Appendix D

Demand Side Management

2018 WA IRP

Appendix Demand Side Management (DSM)

Table of Contents

Ramp Rates

Residential DSM Forecast Highlights

Commercial DSM Forecast Highlights

Industrial DSM Forecast Highlights

Carbon DSM Scenarios

Residential Equipment

Residential Non-Equipment

Commercial Equipment Commercial

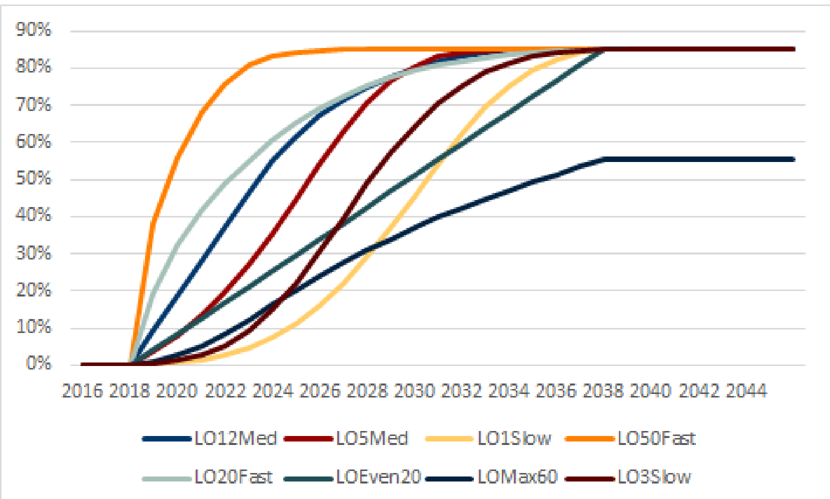
Non-Equipment Industrial Equipment

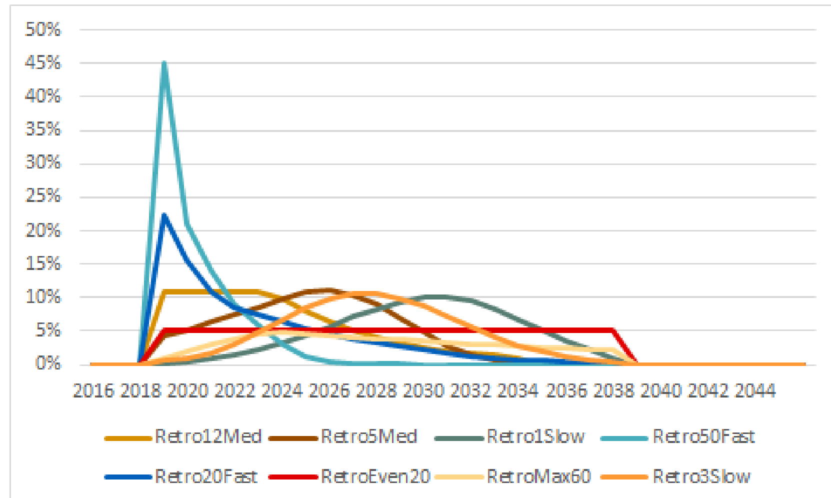
Industrial Non-Equipment

Ramp Rates from the NWPCC's 7th Plan

Key	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
LO12Med	0%	0%	0%	9%	19%	28%	37%	47%	55%	62%	67%	71%	75%	78%	80%	82%
LO5Med	0%	0%	0%	4%	8%	13%	20%	27%	35%	45%	54%	63%	71%	76%	81%	83%
LO1Slow	0%	0%	0%	0%	1%	1%	3%	5%	7%	11%	16%	22%	29%	37%	46%	54%
LO50Fast	0%	0%	0%	38%	56%	68%	76%	81%	83%	84%	85%	85%	85%	85%	85%	85%
LO20Fast	0%	0%	0%	19%	32%	42%	49%	55%	61%	65%	69%	72%	75%	78%	79%	81%
LOEven20	0%	0%	0%	4%	9%	13%	17%	21%	26%	30%	34%	38%	43%	47%	51%	55%
LOMax60	0%	0%	0%	1%	3%	5%	8%	12%	16%	20%	24%	28%	31%	34%	37%	40%
LO3Slow	0%	0%	0%	0%	1%	3%	5%	9%	15%	22%	31%	40%	49%	57%	65%	71%
Retro12Med	0%	0%	0%	11%	11%	11%	11%	11%	10%	8%	6%	5%	4%	3%	3%	2%
Retro5Med	0%	0%	0%	4%	5%	6%	7%	8%	10%	11%	11%	10%	9%	7%	5%	3%
Retro1Slow	0%	0%	0%	0%	1%	1%	1%	2%	3%	4%	6%	7%	8%	9%	10%	10%
Retro50Fast	0%	0%	0%	45%	21%	14%	9%	6%	3%	1%	1%	0%	0%	0%	0%	0%
Retro20Fast	0%	0%	0%	22%	16%	11%	8%	7%	6%	5%	5%	4%	3%	3%	2%	2%
RetroEven20	0%	0%	0%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
RetroMax60	0%	0%	0%	1%	2%	3%	4%	5%	4.9%	4.6%	4.4%	4.1%	3.9%	3.7%	3.5%	3.3%
Retro3Slow	0%	0%	0%	1%	1%	2%	3%	5%	7%	8%	10%	11%	11%	10%	9%	7%

Key	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
LO12Med	83%	84%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
LO5Med	84%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
LO1Slow	62%	69%	75%	79%	82%	84%	85%	85%	85%	85%	85%	85%	85%	85%	85%
LO50Fast	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
LO20Fast	82%	83%	84%	84%	84%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
LOEven20	60%	64%	68%	72%	77%	81%	85%	85%	85%	85%	85%	85%	85%	85%	85%
LOMax60	42%	45%	47%	49%	51%	53%	55%	55%	55%	55%	55%	55%	55%	55%	55%
LO3Slow	75%	79%	81%	83%	84%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
Retro12Med	2%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Retro5Med	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Retro1Slow	9%	8%	7%	5%	3%	2%	1%	0%	0%	0%	0%	0%	0%	0%	0%
Retro50Fast	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Retro20Fast	1%	1%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RetroEven20	5%	5%	5%	5%	5%	5%	5%	0%	0%	0%	0%	0%	0%	0%	0%
RetroMax60	3.1%	2.9%	2.7%	2.6%	2.4%	2.3%	2.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Retro3Slow	6%	4%	3%	2%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%





Residential DSM Highlights

Summary of Energy Savings (therms), Selected Years	2019	2020	2022	2028	2038
Baseline Forecast (therms)	123,231,862	124,383,448	125,348,545	133,277,265	147,015,422
Potential Forecasts (therms)					
UCT Achievable Economic Potential	122,702,298	123,482,919	122,833,755	121,145,865	117,278,046
TRC Achievable Economic Potential	122,241,647	122,832,284	121,847,269	121,390,173	125,753,607
Achievable Technical Potential	121,657,268	121,868,830	119,556,377	112,443,189	104,746,227
Technical Potential	119,993,583	119,572,379	116,038,828	107,647,590	98,623,601
Cumulative Savings (therms)					
UCT Achievable Economic Potential	529,565	900,529	2,514,790	12,131,400	29,737,376
TRC Achievable Economic Potential	990,215	1,551,164	3,501,276	11,887,092	21,261,815
Achievable Technical Potential	1,574,594	2,514,618	5,792,168	20,834,076	42,269,196
Technical Potential	3,238,280	4,811,069	9,309,717	25,629,675	48,391,821
Energy Savings (% of Baseline)					
UCT Achievable Economic Potential	0.4%	0.7%	2.0%	9.1%	20.2%
TRC Achievable Economic Potential	0.8%	1.2%	2.8%	8.9%	14.5%
Achievable Technical Potential	1.3%	2.0%	4.6%	15.6%	28.8%
Technical Potential	2.6%	3.9%	7.4%	19.2%	32.9%
Incremental Savings (therms)					
UCT Achievable Economic Potential	333,424	369,466	1,167,261	2,294,752	1,594,933
TRC Achievable Economic Potential	527,930	559,955	1,352,349	1,973,374	208,493
Achievable Technical Potential	875,986	939,400	2,262,626	3,360,892	1,967,650
Technical Potential	1,809,141	1,567,136	2,988,126	3,824,986	2,157,180

Commercial DSM Highlights

Summary of Energy Savings (therms), Selected Years	2019	2020	2022	2028	2038
Baseline Forecast (therms)	94,398,445	95,540,156	98,107,808	107,060,779	122,968,382
Potential Forecasts (therms)					
UCT Achievable Economic Potential	93,811,369	94,576,969	95,920,877	99,147,639	107,561,211
TRC Achievable Economic Potential	93,947,284	94,812,733	96,446,677	100,944,282	111,241,993
Achievable Technical Potential	92,758,005	93,014,892	93,355,705	94,212,341	101,188,467
Technical Potential	91,515,329	91,171,727	90,368,413	89,081,949	96,803,024
Cumulative Savings (therms)					
UCT Achievable Economic Potential	587,075	963,187	2,186,931	7,913,141	15,407,171
TRC Achievable Economic Potential	451,161	727,423	1,661,131	6,116,498	11,726,388
Achievable Technical Potential	1,640,440	2,525,264	4,752,103	12,848,438	21,779,915
Technical Potential	2,883,115	4,368,429	7,739,395	17,978,831	26,165,358
Energy Savings (% of Baseline)					
UCT Achievable Economic Potential	0.6%	1.0%	2.2%	7.4%	12.5%
TRC Achievable Economic Potential	0.5%	0.8%	1.7%	5.7%	9.5%
Achievable Technical Potential	1.7%	2.6%	4.8%	12.0%	17.7%
Technical Potential	3.1%	4.6%	7.9%	16.8%	21.3%
Incremental Savings (therms)					
UCT Achievable Economic Potential	313,506	375,891	773,942	1,049,624	861,545
TRC Achievable Economic Potential	233,412	276,119	602,559	820,760	650,245
Achievable Technical Potential	833,615	893,323	1,287,975	1,442,143	986,088
Technical Potential	1,452,520	1,493,946	1,857,647	1,726,851	1,190,244

Industrial DSM Highlights

Summary of Energy Savings (therms), Selected Years	2019	2020	2022	2028	2038
Baseline Forecast (therms)	24,778,429	24,988,671	25,279,998	27,322,555	28,202,435
Potential Forecasts (therms)					
UCT Achievable Economic Potential	24,663,998	24,814,702	24,940,709	26,339,005	26,649,309
TRC Achievable Economic Potential	24,658,719	24,809,504	24,921,352	26,342,909	26,706,942
RVT Achievable Economic Potential	24,676,331	24,835,082	24,966,153	26,444,224	26,829,901
Achievable Technical Potential	24,641,897	24,784,516	24,877,752	26,246,272	26,547,546
Technical Potential	24,591,345	24,711,152	24,751,606	25,991,355	26,252,340
Cumulative Savings (therms)					
UCT Achievable Economic Potential	114,431	173,969	339,289	983,551	1,553,126
TRC Achievable Economic Potential	119,710	179,167	358,646	979,647	1,495,493
RVT Achievable Economic Potential	102,098	153,589	313,845	878,332	1,372,534
Achievable Technical Potential	136,532	204,156	402,246	1,076,283	1,654,889
Technical Potential	187,084	277,519	528,392	1,331,200	1,950,095
Energy Savings (% of Baseline)					
UCT Achievable Economic Potential	0.5%	0.7%	1.3%	3.6%	5.5%
TRC Achievable Economic Potential	0.5%	0.7%	1.4%	3.6%	5.3%
RVT Achievable Economic Potential	0.4%	0.6%	1.2%	3.2%	4.9%
Achievable Technical Potential	0.6%	0.8%	1.6%	3.9%	5.9%
Technical Potential	0.8%	1.1%	2.1%	4.9%	6.9%
Incremental Savings (therms)					
UCT Achievable Economic Potential	57,081	61,380	100,644	107,763	23,006
TRC Achievable Economic Potential	59,600	61,407	113,693	99,569	19,153
RVT Achievable Economic Potential	50,922	53,128	102,153	89,266	22,944
Achievable Technical Potential	68,047	69,932	123,855	109,251	23,157
Technical Potential	92,815	93,626	153,801	128,805	27,487

Residential Cumulative Savings (mTherms)
Achievable Economic UCT Potential

	Base Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
ORIGINAL	199,856	529,565	900,529	1,358,618	2,514,790	3,971,553	4,494,103	6,085,454	7,915,828	9,990,652	12,131,400	14,337,529	16,560,699	18,783,285	20,727,722	22,529,619	24,157,655	25,773,217	27,095,797	28,373,916	29,737,376
BALLOT	220,663	563,800	947,561	1,413,129	2,617,510	4,046,061	4,535,479	6,078,736	7,876,345	9,896,468	11,954,911	14,052,052	16,139,250	18,203,608	19,990,301	21,641,549	23,162,657	24,681,920	25,943,630	27,181,194	28,519,732
	9.43%	6.07%	4.96%	3.86%	3.92%	1.84%	0.91%	-0.11%	-0.50%	-0.95%	-1.48%	-2.03%	-2.61%	-3.18%	-3.69%	-4.10%	-4.30%	-4.42%	-4.44%	-4.39%	-4.27%
INSLEE	220,653	563,784	947,467	1,412,921	2,616,313	4,044,784	4,534,096	6,076,629	7,873,521	9,892,962	11,950,919	14,047,832	16,135,116	18,199,859	19,987,596	21,639,516	23,161,250	24,681,210	25,943,085	27,180,466	28,518,881
	9.43%	6.07%	4.95%	3.84%	3.88%	1.81%	0.88%	-0.15%	-0.54%	-0.99%	-1.51%	-2.06%	-2.64%	-3.21%	-3.70%	-4.11%	-4.30%	-4.42%	-4.44%	-4.39%	-4.27%
MKT CHOICE	220,669	563,903	948,632	1,415,112	2,622,514	4,056,352	4,562,657	6,122,218	7,949,460	10,002,691	12,096,994	14,234,509	16,364,984	18,474,605	20,302,512	21,990,479	23,542,681	25,087,711	26,365,263	27,613,157	28,958,707
	9.43%	6.09%	5.07%	3.99%	4.11%	2.09%	1.50%	0.60%	0.42%	0.12%	-0.28%	-0.72%	-1.20%	-1.67%	-2.09%	-2.45%	-2.61%	-2.73%	-2.77%	-2.76%	-2.69%

Commercial Cumulative Savings (mTherms)
Achievable Economic UCT Potential

	Base Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
ORIGINAL	271,701	587,075	963,187	1,411,770	2,186,931	3,030,232	3,916,187	4,862,255	5,856,837	6,901,289	7,913,141	8,918,556	9,887,160	10,893,773	11,787,847	12,578,227	13,299,614	14,008,785	14,549,091	15,013,112	15,407,171
BALLOT	269,724	567,178	920,026	1,352,976	2,115,504	2,945,806	3,819,335	4,754,110	5,738,231	6,772,785	7,776,039	8,773,363	9,736,895	10,735,549	11,622,941	12,406,932	13,121,953	13,825,329	14,362,005	14,822,961	15,213,998
	-0.73%	-3.39%	-4.48%	-4.16%	-3.27%	-2.79%	-2.47%	-2.22%	-2.03%	-1.86%	-1.73%	-1.63%	-1.52%	-1.45%	-1.40%	-1.36%	-1.34%	-1.31%	-1.29%	-1.27%	-1.25%
INSLEE	262,590	551,895	896,670	1,319,039	2,063,492	2,875,035	3,729,633	4,645,441	5,610,280	6,625,018	7,609,892	8,589,532	9,545,279	10,527,895	11,400,920	12,171,054	12,871,790	13,560,184	14,083,471	14,531,236	14,912,741
	-3.35%	-5.99%	-6.91%	-6.57%	-5.64%	-5.12%	-4.76%	-4.46%	-4.21%	-4.00%	-3.83%	-3.69%	-3.46%	-3.36%	-3.28%	-3.24%	-3.22%	-3.20%	-3.20%	-3.21%	-3.21%
MKT CHOICE	279,843	589,930	958,694	1,400,101	2,170,429	3,008,992	3,890,506	4,833,303	5,824,812	6,865,270	7,873,533	8,875,558	9,840,804	10,844,145	11,735,392	12,523,072	13,241,812	13,949,177	14,488,151	14,949,942	15,336,948
	3.00%	0.49%	-0.47%	-0.83%	-0.75%	-0.70%	-0.66%	-0.60%	-0.55%	-0.52%	-0.50%	-0.48%	-0.47%	-0.46%	-0.44%	-0.44%	-0.43%	-0.43%	-0.42%	-0.42%	-0.46%

Industrial Cumulative Savings (mTherms)
Achievable Economic UCT Potential

	Base Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
ORIGINAL	57,693	114,431	173,969	240,809	339,289	439,988	548,573	671,496	783,082	891,794	983,551	1,092,049	1,172,571	1,246,996	1,298,919	1,375,260	1,420,537	1,466,225	1,506,549	1,542,754	1,553,126
BALLOT	0.00%	0.00%	-1.81%	-2.61%	-3.02%	-3.56%	-6.22%	-7.82%	-8.83%	-9.37%	-9.68%	-9.78%	-9.73%	-9.56%	-9.31%	-9.04%	-8.75%	-8.47%	-8.22%	-7.98%	-7.87%
	57,693	114,431	170,813	234,525	329,030	424,330	514,458	619,001	713,957	808,232	888,383	985,240	1,058,510	1,127,810	1,177,967	1,250,999	1,296,212	1,341,966	1,382,768	1,419,681	1,430,891
INSLEE	0.00%	0.00%	-1.81%	-2.61%	-3.02%	-3.56%	-6.22%	-7.82%	-8.83%	-9.37%	-9.68%	-9.78%	-9.73%	-9.56%	-9.31%	-9.04%	-8.75%	-8.47%	-8.22%	-7.98%	-7.87%
	57,693	114,431	170,813	234,525	329,030	424,330	514,458	619,001	713,957	808,232	888,383	985,240	1,058,510	1,127,810	1,177,967	1,250,999	1,296,212	1,341,966	1,382,768	1,419,681	1,430,891
MKT CHOICE	0.00%	0.00%	-1.81%	-2.61%	-3.02%	-3.56%	-6.22%	-7.82%	-8.83%	-9.37%	-9.68%	-9.78%	-9.73%	-9.56%	-9.31%	-9.04%	-8.75%	-8.47%	-8.22%	-7.98%	-8%
	57,693	114,431	170,813	234,525	329,030	424,330	514,458	619,001	713,957	808,232	888,383	985,240	1,058,510	1,127,810	1,177,968	1,250,999	1,296,212	1,341,967	1,382,769	1,419,681	1,430,891

Residential Equipment

Measure					Characteristics									Sources			Measure Assumptions in 2017						
Segment	Vintage	End Use	Measure	Efficient Definition	Replacement Type	Baseline Definition	Measure Description	Measure Ramp Rate Name	Ramp Offset	Input Unit of Measure	UOM Size	Units per Household	Line Loss	Lifetime Source	Costs Source	Savings Source	Measure Lifetime (Years)	Incremental Measure Cost ($)	Incremental Non-Energy Benefits ($)	Cost Scalar	Measure Savings @ generator (therm)	Base Saturation	Applicability
CZ1 - Single Family	Existing	Space Heating	Furnace - Direct Fuel	AFUE 95%	Lost Opportunity	AFUE 80%	AFUE 95%	LO12Med	1	kBTU/hr	60.00	60.00	0.16%	GFURN-Heating-AEO15-178	CNGC Data	BEST	18	$ 1,488.00	$ 7.75	100.0%	88.50	85.1%	100.0%
CZ1 - Single Family	Existing	Space Heating	Boiler - Direct Fuel	AFUE 96%	Lost Opportunity	AFUE 82%	AFUE 96%	LO12Med	0	kBTU/hr	105.00	60.00	0.16%	BLR-Heating-AEO15-126	BLR-Heating-AEO15-126	BEST	20	$ 2,775.00	$ 10.69	104.2%	72.19	1.9%	100.0%
CZ1 - Single Family	Existing	Secondary Heating	Fireplace	Tier 1 (70% FE Rating)	Lost Opportunity	Baseline (50% to 60% FE Rating)	Tier 1 (70% FE Rating)	LO1Slow	3	unit	1.00	1.00	0.16%	CNGC Prior Study Database	CNGC Data	Calculated	20	$ 246.85	$ 0.66	100.0%	23.38	32.9%	100.0%
CZ1 - Single Family	Existing	Water Heating	Water Heater <= 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Baseline (UEF 0.58)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-EIA14-2014 Ref. Case-24	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-20	19	$ 1,724.38	$ -	102.4%	50.36	68.7%	98.0%
CZ1 - Single Family	Existing	Water Heating	Water Heater <= 55 gal.	ENERGY STAR (UEF 0.64)	Lost Opportunity	Baseline (UEF 0.58)	ENERGY STAR (UEF 0.64)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-AEG-v1-6	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-6	13	$ 292.75	$ -	100.0%	14.17	1.4%	2.0%
CZ1 - Single Family	Existing	Water Heating	Water Heater > 55 gal.	Condensing (UEF 0.82)	Lost Opportunity	Standard (UEF 0.76)	Condensing (UEF 0.82)	LO12Med	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	13	$ 445.30	$ -	102.4%	49.34	0.0%	2.0%
CZ1 - Single Family	Existing	Water Heating	Water Heater > 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Standard (UEF 0.76)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	19	$ 1,983.04	$ -	102.4%	57.92	1.6%	98.0%
CZ1 - Single Family	Existing	Appliances	Clothes Dryer	NEEA/ENERGY STAR (CE >60%)	Lost Opportunity	Standard	NEEA/ENERGY STAR (CE >60%)	LOMax60	4	units	1.00	1.00	0.16%	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	16	$ 150.00	$ -	104.2%	2.30	13.1%	100.0%
CZ1 - Single Family	Existing	Appliances	Stove/Oven	EF 0.42	Lost Opportunity	EF 0.399	EF 0.42	LOMax60	4	units	1.00	1.00	0.16%	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	19	$ 50.00	$ -	104.2%	2.67	27.4%	100.0%
CZ1 - Single Family	Existing	Miscellaneous	Pool Heater	Condensing (EF .90)	Lost Opportunity	Standard (EF .82)	Condensing (EF .90)	LOMax60	3	units	1.00	1.00	0.16%	AEG Research	BNNL	Energy.gov	10	$ 675.00	$ -	111.4%	28.60	1.0%	100.0%
CZ1 - Single Family	New	Space Heating	Furnace - Direct Fuel	AFUE 95%	Lost Opportunity	AFUE 80%	AFUE 95%	LO12Med	1	kBTU/hr	60.00	60.00	0.16%	GFURN-Heating-AEO15-178	CNGC Data	BEST	18	$ 1,488.00	$ 5.29	100.0%	58.20	94.2%	100.0%
CZ1 - Single Family	New	Space Heating	Boiler - Direct Fuel	AFUE 96%	Lost Opportunity	AFUE 82%	AFUE 96%	LO12Med	0	kBTU/hr	105.00	60.00	0.16%	BLR-Heating-AEO15-126	BLR-Heating-AEO15-126	BEST	20	$ 2,775.00	$ 9.42	104.2%	61.80	1.5%	100.0%
CZ1 - Single Family	New	Secondary Heating	Fireplace	Tier 1 (70% FE Rating)	Lost Opportunity	Baseline (50% to 60% FE Rating)	Tier 1 (70% FE Rating)	LO1Slow	3	unit	1.00	1.00	0.16%	CNGC Prior Study Database	CNGC Data	Calculated	20	$ 246.85	$ 0.66	100.0%	23.38	65.7%	100.0%
CZ1 - Single Family	New	Water Heating	Water Heater <= 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Baseline (UEF 0.58)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-EIA14-2014 Ref. Case-24	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-20	19	$ 1,724.38	$ -	102.4%	50.36	67.8%	98.0%
CZ1 - Single Family	New	Water Heating	Water Heater <= 55 gal.	ENERGY STAR (UEF 0.64)	Lost Opportunity	Baseline (UEF 0.58)	ENERGY STAR (UEF 0.64)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-AEG-v1-6	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-6	13	$ 292.75	$ -	100.0%	14.17	1.4%	2.0%
CZ1 - Single Family	New	Water Heating	Water Heater > 55 gal.	Condensing (UEF 0.82)	Lost Opportunity	Standard (UEF 0.76)	Condensing (UEF 0.82)	LO12Med	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	13	$ 445.30	$ -	102.4%	49.34	0.0%	2.0%
CZ1 - Single Family	New	Water Heating	Water Heater > 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Standard (UEF 0.76)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	19	$ 1,983.04	$ -	102.4%	57.92	1.6%	98.0%
CZ1 - Single Family	New	Appliances	Clothes Dryer	NEEA/ENERGY STAR (CE >60%)	Lost Opportunity	Standard	NEEA/ENERGY STAR (CE >60%)	LOMax60	4	units	1.00	1.00	0.16%	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	16	$ 150.00	$ -	104.2%	2.30	13.1%	100.0%
CZ1 - Single Family	New	Appliances	Stove/Oven	EF 0.42	Lost Opportunity	EF 0.399	EF 0.42	LOMax60	4	units	1.00	1.00	0.16%	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	19	$ 50.00	$ -	104.2%	2.67	26.2%	100.0%
CZ1 - Single Family	New	Miscellaneous	Pool Heater	Condensing (EF .90)	Lost Opportunity	Standard (EF .82)	Condensing (EF .90)	LOMax60	3	units	1.00	1.00	0.16%	AEG Research	BNNL	Energy.gov	10	$ 675.00	$ -	111.4%	28.60	1.0%	100.0%
CZ1 - Multi Family	Existing	Space Heating	Furnace - Direct Fuel	AFUE 95%	Lost Opportunity	AFUE 80%	AFUE 95%	LO12Med	1	kBTU/hr	60.00	36.00	0.16%	GFURN-Heating-AEO15-178	CNGC Data	BEST	18	$ 1,488.00	$ 7.06	100.0%	17.96	85.1%	100.0%
CZ1 - Multi Family	Existing	Space Heating	Boiler - Direct Fuel	AFUE 96%	Lost Opportunity	AFUE 82%	AFUE 96%	LO12Med	0	kBTU/hr	105.00	45.00	0.16%	BLR-Heating-AEO15-126	BLR-Heating-AEO15-126	BEST	20	$ 2,775.00	$ 11.52	104.2%	17.54	1.9%	100.0%
CZ1 - Multi Family	Existing	Secondary Heating	Fireplace	Tier 1 (70% FE Rating)	Lost Opportunity	Baseline (50% to 60% FE Rating)	Tier 1 (70% FE Rating)	LO1Slow	3	unit	1.00	1.00	0.16%	CNGC Prior Study Database	CNGC Data	Calculated	20	$ 246.85	$ 0.42	100.0%	23.38	32.9%	100.0%
CZ1 - Multi Family	Existing	Water Heating	Water Heater <= 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Baseline (UEF 0.58)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-EIA14-2014 Ref. Case-24	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-20	19	$ 1,724.38	$ -	102.4%	50.36	68.7%	98.0%
CZ1 - Multi Family	Existing	Water Heating	Water Heater <= 55 gal.	ENERGY STAR (UEF 0.64)	Lost Opportunity	Baseline (UEF 0.58)	ENERGY STAR (UEF 0.64)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-AEG-v1-6	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-6	13	$ 292.75	$ -	100.0%	14.17	1.4%	2.0%
CZ1 - Multi Family	Existing	Water Heating	Water Heater > 55 gal.	Condensing (UEF 0.82)	Lost Opportunity	Standard (UEF 0.76)	Condensing (UEF 0.82)	LO12Med	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	13	$ 445.30	$ -	102.4%	49.34	0.0%	2.0%
CZ1 - Multi Family	Existing	Water Heating	Water Heater > 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Standard (UEF 0.76)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	19	$ 1,983.04	$ -	102.4%	57.92	1.6%	98.0%
CZ1 - Multi Family	Existing	Appliances	Clothes Dryer	NEEA/ENERGY STAR (CE >60%)	Lost Opportunity	Standard	NEEA/ENERGY STAR (CE >60%)	LOMax60	4	units	1.00	1.00	0.16%	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	16	$ 150.00	$ -	104.2%	2.30	13.1%	100.0%
CZ1 - Multi Family	Existing	Appliances	Stove/Oven	EF 0.42	Lost Opportunity	EF 0.399	EF 0.42	LOMax60	4	units	1.00	1.00	0.16%	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	19	$ 50.00	$ -	104.2%	2.67	27.4%	100.0%
CZ1 - Multi Family	Existing	Miscellaneous	Pool Heater	Condensing (EF .90)	Lost Opportunity	Standard (EF .82)	Condensing (EF .90)	LOMax60	3	units	1.00	1.00	0.16%	AEG Research	BNNL	Energy.gov	10	$ 675.00	$ -	111.4%	28.60	1.0%	100.0%
CZ1 - Multi Family	New	Space Heating	Furnace - Direct Fuel	AFUE 95%	Lost Opportunity	AFUE 80%	AFUE 95%	LO12Med	1	kBTU/hr	60.00	36.00	0.16%	GFURN-Heating-AEO15-178	CNGC Data	BEST	18	$ 1,488.00	$ 4.79	100.0%	11.75	94.2%	100.0%
CZ1 - Multi Family	New	Space Heating	Boiler - Direct Fuel	AFUE 96%	Lost Opportunity	AFUE 82%	AFUE 96%	LO12Med	0	kBTU/hr	105.00	45.00	0.16%	BLR-Heating-AEO15-126	BLR-Heating-AEO15-126	BEST	20	$ 2,775.00	$ 8.42	104.2%	12.45	1.5%	100.0%
CZ1 - Multi Family	New	Secondary Heating	Fireplace	Tier 1 (70% FE Rating)	Lost Opportunity	Baseline (50% to 60% FE Rating)	Tier 1 (70% FE Rating)	LO1Slow	3	unit	1.00	1.00	0.16%	CNGC Prior Study Database	CNGC Data	Calculated	20	$ 246.85	$ 0.42	100.0%	23.38	65.7%	100.0%
CZ1 - Multi Family	New	Water Heating	Water Heater <= 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Baseline (UEF 0.58)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-EIA14-2014 Ref. Case-24	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-20	19	$ 1,724.38	$ -	102.4%	50.36	67.8%	98.0%
CZ1 - Multi Family	New	Water Heating	Water Heater <= 55 gal.	ENERGY STAR (UEF 0.64)	Lost Opportunity	Baseline (UEF 0.58)	ENERGY STAR (UEF 0.64)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-AEG-v1-6	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-6	13	$ 292.75	$ -	100.0%	14.17	1.4%	2.0%
CZ1 - Multi Family	New	Water Heating	Water Heater > 55 gal.	Condensing (UEF 0.82)	Lost Opportunity	Standard (UEF 0.76)	Condensing (UEF 0.82)	LO12Med	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	13	$ 445.30	$ -	102.4%	49.34	0.0%	2.0%
CZ1 - Multi Family	New	Water Heating	Water Heater > 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Standard (UEF 0.76)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	19	$ 1,983.04	$ -	102.4%	57.92	1.6%	98.0%
CZ1 - Multi Family	New	Appliances	Clothes Dryer	NEEA/ENERGY STAR (CE >60%)	Lost Opportunity	Standard	NEEA/ENERGY STAR (CE >60%)	LOMax60	4	units	1.00	1.00	0.16%	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	16	$ 150.00	$ -	104.2%	2.30	13.1%	100.0%
CZ1 - Multi Family	New	Appliances	Stove/Oven	EF 0.42	Lost Opportunity	EF 0.399	EF 0.42	LOMax60	4	units	1.00	1.00	0.16%	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	19	$ 50.00	$ -	104.2%	2.67	26.2%	100.0%
CZ1 - Multi Family	New	Miscellaneous	Pool Heater	Condensing (EF .90)	Lost Opportunity	Standard (EF .82)	Condensing (EF .90)	LOMax60	3	units	1.00	1.00	0.16%	AEG Research	BNNL	Energy.gov	10	$ 675.00	$ -	111.4%	28.60	1.0%	100.0%
CZ2 - Single Family	Existing	Space Heating	Furnace - Direct Fuel	AFUE 95%	Lost Opportunity	AFUE 80%	AFUE 95%	LO12Med	1	kBTU/hr	60.00	60.00	0.16%	GFURN-Heating-AEO15-178	CNGC Data	BEST	18	$ 1,488.00	$ 6.48	100.0%	76.00	85.1%	100.0%
CZ2 - Single Family	Existing	Space Heating	Boiler - Direct Fuel	AFUE 96%	Lost Opportunity	AFUE 82%	AFUE 96%	LO12Med	0	kBTU/hr	105.00	60.00	0.16%	BLR-Heating-AEO15-126	BLR-Heating-AEO15-126	BEST	20	$ 2,775.00	$ 8.82	104.2%	62.05	1.9%	100.0%
CZ2 - Single Family	Existing	Secondary Heating	Fireplace	Tier 1 (70% FE Rating)	Lost Opportunity	Baseline (50% to 60% FE Rating)	Tier 1 (70% FE Rating)	LO1Slow	3	unit	1.00	1.00	0.16%	CNGC Prior Study Database	CNGC Data	Calculated	20	$ 246.85	$ 0.52	100.0%	23.38	32.9%	100.0%
CZ2 - Single Family	Existing	Water Heating	Water Heater <= 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Baseline (UEF 0.58)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-EIA14-2014 Ref. Case-24	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-20	19	$ 1,724.38	$ -	102.4%	50.36	68.7%	98.0%
CZ2 - Single Family	Existing	Water Heating	Water Heater <= 55 gal.	ENERGY STAR (UEF 0.64)	Lost Opportunity	Baseline (UEF 0.58)	ENERGY STAR (UEF 0.64)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-AEG-v1-6	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-6	13	$ 292.75	$ -	100.0%	14.17	1.4%	2.0%
CZ2 - Single Family	Existing	Water Heating	Water Heater > 55 gal.	Condensing (UEF 0.82)	Lost Opportunity	Standard (UEF 0.76)	Condensing (UEF 0.82)	LO12Med	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	13	$ 445.30	$ -	102.4%	49.34	0.0%	2.0%
CZ2 - Single Family	Existing	Water Heating	Water Heater > 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Standard (UEF 0.76)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	19	$ 1,983.04	$ -	102.4%	57.92	1.6%	98.0%
CZ2 - Single Family	Existing	Appliances	Clothes Dryer	NEEA/ENERGY STAR (CE >60%)	Lost Opportunity	Standard	NEEA/ENERGY STAR (CE >60%)	LOMax60	4	units	1.00	1.00	0.16%	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	16	$ 150.00	$ -	104.2%	2.30	13.1%	100.0%
CZ2 - Single Family	Existing	Appliances	Stove/Oven	EF 0.42	Lost Opportunity	EF 0.399	EF 0.42	LOMax60	4	units	1.00	1.00	0.16%	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	19	$ 50.00	$ -	104.2%	2.67	27.4%	100.0%
CZ2 - Single Family	Existing	Miscellaneous	Pool Heater	Condensing (EF .90)	Lost Opportunity	Standard (EF .82)	Condensing (EF .90)	LOMax60	3	units	1.00	1.00	0.16%	AEG Research	BNNL	Energy.gov	10	$ 675.00	$ -	111.4%	28.60	1.0%	100.0%
CZ2 - Single Family	New	Space Heating	Furnace - Direct Fuel	AFUE 95%	Lost Opportunity	AFUE 80%	AFUE 95%	LO12Med	1	kBTU/hr	60.00	60.00	0.16%	GFURN-Heating-AEO15-178	CNGC Data	BEST	18	$ 1,488.00	$ 4.24	100.0%	48.00	94.2%	100.0%
CZ2 - Single Family	New	Space Heating	Boiler - Direct Fuel	AFUE 96%	Lost Opportunity	AFUE 82%	AFUE 96%	LO12Med	0	kBTU/hr	105.00	60.00	0.16%	BLR-Heating-AEO15-126	BLR-Heating-AEO15-126	BEST	20	$ 2,775.00	$ 7.46	104.2%	51.00	1.5%	100.0%
CZ2 - Single Family	New	Secondary Heating	Fireplace	Tier 1 (70% FE Rating)	Lost Opportunity	Baseline (50% to 60% FE Rating)	Tier 1 (70% FE Rating)	LO1Slow	3	unit	1.00	1.00	0.16%	CNGC Prior Study Database	CNGC Data	Calculated	20	$ 246.85	$ 0.52	100.0%	23.38	65.7%	100.0%
CZ2 - Single Family	New	Water Heating	Water Heater <= 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Baseline (UEF 0.58)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-EIA14-2014 Ref. Case-24	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-20	19	$ 1,724.38	$ -	102.4%	50.36	67.8%	98.0%
CZ2 - Single Family	New	Water Heating	Water Heater <= 55 gal.	ENERGY STAR (UEF 0.64)	Lost Opportunity	Baseline (UEF 0.58)	ENERGY STAR (UEF 0.64)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-AEG-v1-6	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-6	13	$ 292.75	$ -	100.0%	14.17	1.4%	2.0%
CZ2 - Single Family	New	Water Heating	Water Heater > 55 gal.	Condensing (UEF 0.82)	Lost Opportunity	Standard (UEF 0.76)	Condensing (UEF 0.82)	LO12Med	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	13	$ 445.30	$ -	102.4%	49.34	0.0%	2.0%
CZ2 - Single Family	New	Water Heating	Water Heater > 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Standard (UEF 0.76)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	19	$ 1,983.04	$ -	102.4%	57.92	1.6%	98.0%
CZ2 - Single Family	New	Appliances	Clothes Dryer	NEEA/ENERGY STAR (CE >60%)	Lost Opportunity	Standard	NEEA/ENERGY STAR (CE >60%)	LOMax60	4	units	1.00	1.00	0.16%	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	16	$ 150.00	$ -	104.2%	2.30	13.1%	100.0%
CZ2 - Single Family	New	Appliances	Stove/Oven	EF 0.42	Lost Opportunity	EF 0.399	EF 0.42	LOMax60	4	units	1.00	1.00	0.16%	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	19	$ 50.00	$ -	104.2%	2.67	26.2%	100.0%
CZ2 - Single Family	New	Miscellaneous	Pool Heater	Condensing (EF .90)	Lost Opportunity	Standard (EF .82)	Condensing (EF .90)	LOMax60	3	units	1.00	1.00	0.16%	AEG Research	BNNL	Energy.gov	10	$ 675.00	$ -	111.4%	28.60	1.0%	100.0%
CZ2 - Multi Family	Existing	Space Heating	Furnace - Direct Fuel	AFUE 95%	Lost Opportunity	AFUE 80%	AFUE 95%	LO12Med	1	kBTU/hr	60.00	36.00	0.16%	GFURN-Heating-AEO15-178	CNGC Data	BEST	18	$ 1,488.00	$ 5.09	100.0%	14.00	85.1%	100.0%
CZ2 - Multi Family	Existing	Space Heating	Boiler - Direct Fuel	AFUE 96%	Lost Opportunity	AFUE 82%	AFUE 96%	LO12Med	0	kBTU/hr	105.00	45.00	0.16%	BLR-Heating-AEO15-126	BLR-Heating-AEO15-126	BEST	20	$ 2,775.00	$ 10.88	104.2%	13.65	1.9%	100.0%
CZ2 - Multi Family	Existing	Secondary Heating	Fireplace	Tier 1 (70% FE Rating)	Lost Opportunity	Baseline (50% to 60% FE Rating)	Tier 1 (70% FE Rating)	LO1Slow	3	unit	1.00	1.00	0.16%	CNGC Prior Study Database	CNGC Data	Calculated	20	$ 246.85	$ 0.33	100.0%	23.38	32.9%	100.0%
CZ2 - Multi Family	Existing	Water Heating	Water Heater <= 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Baseline (UEF 0.58)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-EIA14-2014 Ref. Case-24	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-20	19	$ 1,724.38	$ -	102.4%	50.36	68.7%	98.0%
CZ2 - Multi Family	Existing	Water Heating	Water Heater <= 55 gal.	ENERGY STAR (UEF 0.64)	Lost Opportunity	Baseline (UEF 0.58)	ENERGY STAR (UEF 0.64)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-AEG-v1-6	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-6	13	$ 292.75	$ -	100.0%	14.17	1.4%	2.0%
CZ2 - Multi Family	Existing	Water Heating	Water Heater > 55 gal.	Condensing (UEF 0.82)	Lost Opportunity	Standard (UEF 0.76)	Condensing (UEF 0.82)	LO12Med	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	13	$ 445.30	$ -	102.4%	49.34	0.0%	2.0%
CZ2 - Multi Family	Existing	Water Heating	Water Heater > 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Standard (UEF 0.76)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	19	$ 1,983.04	$ -	102.4%	57.92	1.6%	98.0%
CZ2 - Multi Family	Existing	Appliances	Clothes Dryer	NEEA/ENERGY STAR (CE >60%)	Lost Opportunity	Standard	NEEA/ENERGY STAR (CE >60%)	LOMax60	4	units	1.00	1.00	0.16%	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	16	$ 150.00	$ -	104.2%	2.30	13.1%	100.0%
CZ2 - Multi Family	Existing	Appliances	Stove/Oven	EF 0.42	Lost Opportunity	EF 0.399	EF 0.42	LOMax60	4	units	1.00	1.00	0.16%	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	19	$ 50.00	$ -	104.2%	2.67	27.4%	100.0%
CZ2 - Multi Family	Existing	Miscellaneous	Pool Heater	Condensing (EF .90)	Lost Opportunity	Standard (EF .82)	Condensing (EF .90)	LOMax60	3	units	1.00	1.00	0.16%	AEG Research	BNNL	Energy.gov	10	$ 675.00	$ -	111.4%	28.60	1.0%	100.0%
CZ2 - Multi Family	New	Space Heating	Furnace - Direct Fuel	AFUE 95%	Lost Opportunity	AFUE 80%	AFUE 95%	LO12Med	1	kBTU/hr	60.00	36.00	0.16%	GFURN-Heating-AEO15-178	CNGC Data	BEST	18	$ 1,488.00	$ 3.11	100.0%	8.25	94.2%	100.0%
CZ2 - Multi Family	New	Space Heating	Boiler - Direct Fuel	AFUE 96%	Lost Opportunity	AFUE 82%	AFUE 96%	LO12Med	0	kBTU/hr	105.00	45.00	0.16%	BLR-Heating-AEO15-126	BLR-Heating-AEO15-126	BEST	20	$ 2,775.00	$ 7.22	104.2%	8.80	1.5%	100.0%
CZ2 - Multi Family	New	Secondary Heating	Fireplace	Tier 1 (70% FE Rating)	Lost Opportunity	Baseline (50% to 60% FE Rating)	Tier 1 (70% FE Rating)	LO1Slow	3	unit	1.00	1.00	0.16%	CNGC Prior Study Database	CNGC Data	Calculated	20	$ 246.85	$ 0.33	100.0%	23.38	65.7%	100.0%
CZ2 - Multi Family	New	Water Heating	Water Heater <= 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Baseline (UEF 0.58)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-EIA14-2014 Ref. Case-24	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-20	19	$ 1,724.38	$ -	102.4%	50.36	67.8%	98.0%
CZ2 - Multi Family	New	Water Heating	Water Heater <= 55 gal.	ENERGY STAR (UEF 0.64)	Lost Opportunity	Baseline (UEF 0.58)	ENERGY STAR (UEF 0.64)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-AEG-v1-6	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-6	13	$ 292.75	$ -	100.0%	14.17	1.4%	2.0%
CZ2 - Multi Family	New	Water Heating	Water Heater > 55 gal.	Condensing (UEF 0.82)	Lost Opportunity	Standard (UEF 0.76)	Condensing (UEF 0.82)	LO12Med	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	13	$ 445.30	$ -	102.4%	49.34	0.0%	2.0%
CZ2 - Multi Family	New	Water Heating	Water Heater > 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Standard (UEF 0.76)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	19	$ 1,983.04	$ -	102.4%	57.92	1.6%	98.0%
CZ2 - Multi Family	New	Appliances	Clothes Dryer	NEEA/ENERGY STAR (CE >60%)	Lost Opportunity	Standard	NEEA/ENERGY STAR (CE >60%)	LOMax60	4	units	1.00	1.00	0.16%	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	16	$ 150.00	$ -	104.2%	2.30	13.1%	100.0%
CZ2 - Multi Family	New	Appliances	Stove/Oven	EF 0.42	Lost Opportunity	EF 0.399	EF 0.42	LOMax60	4	units	1.00	1.00	0.16%	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	19	$ 50.00	$ -	104.2%	2.67	26.2%	100.0%
CZ2 - Multi Family	New	Miscellaneous	Pool Heater	Condensing (EF .90)	Lost Opportunity	Standard (EF .82)	Condensing (EF .90)	LOMax60	3	units	1.00	1.00	0.16%	AEG Research	BNNL	Energy.gov	10	$ 675.00	$ -	111.4%	28.60	1.0%	100.0%
CZ3 - Single Family	Existing	Space Heating	Furnace - Direct Fuel	AFUE 95%	Lost Opportunity	AFUE 80%	AFUE 95%	LO12Med	1	kBTU/hr	60.00	60.00	0.16%	GFURN-Heating-AEO15-178	CNGC Data	BEST	18	$ 1,488.00	$ 5.08	100.0%	103.50	85.1%	100.0%
CZ3 - Single Family	Existing	Space Heating	Boiler - Direct Fuel	AFUE 96%	Lost Opportunity	AFUE 82%	AFUE 96%	LO12Med	0	kBTU/hr	105.00	60.00	0.16%	BLR-Heating-AEO15-126	BLR-Heating-AEO15-126	BEST	20	$ 2,775.00	$ 7.01	104.2%	83.27	1.9%	100.0%
CZ3 - Single Family	Existing	Secondary Heating	Fireplace	Tier 1 (70% FE Rating)	Lost Opportunity	Baseline (50% to 60% FE Rating)	Tier 1 (70% FE Rating)	LO1Slow	3	unit	1.00	1.00	0.16%	CNGC Prior Study Database	CNGC Data	Calculated	20	$ 246.85	$ 0.52	100.0%	23.38	32.9%	100.0%
CZ3 - Single Family	Existing	Water Heating	Water Heater <= 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Baseline (UEF 0.58)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-EIA14-2014 Ref. Case-24	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-20	19	$ 1,724.38	$ -	102.4%	50.36	68.7%	98.0%
CZ3 - Single Family	Existing	Water Heating	Water Heater <= 55 gal.	ENERGY STAR (UEF 0.64)	Lost Opportunity	Baseline (UEF 0.58)	ENERGY STAR (UEF 0.64)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-AEG-v1-6	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-6	13	$ 292.75	$ -	100.0%	14.17	1.4%	2.0%
CZ3 - Single Family	Existing	Water Heating	Water Heater > 55 gal.	Condensing (UEF 0.82)	Lost Opportunity	Standard (UEF 0.76)	Condensing (UEF 0.82)	LO12Med	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	13	$ 445.30	$ -	102.4%	49.34	0.0%	2.0%
CZ3 - Single Family	Existing	Water Heating	Water Heater > 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Standard (UEF 0.76)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	19	$ 1,983.04	$ -	102.4%	57.92	1.6%	98.0%
CZ3 - Single Family	Existing	Appliances	Clothes Dryer	NEEA/ENERGY STAR (CE >60%)	Lost Opportunity	Standard	NEEA/ENERGY STAR (CE >60%)	LOMax60	4	units	1.00	1.00	0.16%	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	16	$ 150.00	$ -	104.2%	2.30	13.1%	100.0%
CZ3 - Single Family	Existing	Appliances	Stove/Oven	EF 0.42	Lost Opportunity	EF 0.399	EF 0.42	LOMax60	4	units	1.00	1.00	0.16%	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	19	$ 50.00	$ -	104.2%	2.67	27.4%	100.0%
CZ3 - Single Family	Existing	Miscellaneous	Pool Heater	Condensing (EF .90)	Lost Opportunity	Standard (EF .82)	Condensing (EF .90)	LOMax60	3	units	1.00	1.00	0.16%	AEG Research	BNNL	Energy.gov	10	$ 675.00	$ -	111.4%	28.60	1.0%	100.0%
CZ3 - Single Family	New	Space Heating	Furnace - Direct Fuel	AFUE 95%	Lost Opportunity	AFUE 80%	AFUE 95%	LO12Med	1	kBTU/hr	60.00	60.00	0.16%	GFURN-Heating-AEO15-178	CNGC Data	BEST	18	$ 1,488.00	$ 3.48	100.0%	68.40	94.2%	100.0%
CZ3 - Single Family	New	Space Heating	Boiler - Direct Fuel	AFUE 96%	Lost Opportunity	AFUE 82%	AFUE 96%	LO12Med	0	kBTU/hr	105.00	60.00	0.16%	BLR-Heating-AEO15-126	BLR-Heating-AEO15-126	BEST	20	$ 2,775.00	$ 6.29	104.2%	72.60	1.5%	100.0%
CZ3 - Single Family	New	Secondary Heating	Fireplace	Tier 1 (70% FE Rating)	Lost Opportunity	Baseline (50% to 60% FE Rating)	Tier 1 (70% FE Rating)	LO1Slow	3	unit	1.00	1.00	0.16%	CNGC Prior Study Database	CNGC Data	Calculated	20	$ 246.85	$ 0.52	100.0%	23.38	65.7%	100.0%
CZ3 - Single Family	New	Water Heating	Water Heater <= 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Baseline (UEF 0.58)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-EIA14-2014 Ref. Case-24	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-20	19	$ 1,724.38	$ -	102.4%	50.36	67.8%	98.0%
CZ3 - Single Family	New	Water Heating	Water Heater <= 55 gal.	ENERGY STAR (UEF 0.64)	Lost Opportunity	Baseline (UEF 0.58)	ENERGY STAR (UEF 0.64)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-AEG-v1-6	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-6	13	$ 292.75	$ -	100.0%	14.17	1.4%	2.0%
CZ3 - Single Family	New	Water Heating	Water Heater > 55 gal.	Condensing (UEF 0.82)	Lost Opportunity	Standard (UEF 0.76)	Condensing (UEF 0.82)	LO12Med	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	13	$ 445.30	$ -	102.4%	49.34	0.0%	2.0%
CZ3 - Single Family	New	Water Heating	Water Heater > 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Standard (UEF 0.76)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	19	$ 1,983.04	$ -	102.4%	57.92	1.6%	98.0%
CZ3 - Single Family	New	Appliances	Clothes Dryer	NEEA/ENERGY STAR (CE >60%)	Lost Opportunity	Standard	NEEA/ENERGY STAR (CE >60%)	LOMax60	4	units	1.00	1.00	0.16%	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	16	$ 150.00	$ -	104.2%	2.30	13.1%	100.0%
CZ3 - Single Family	New	Appliances	Stove/Oven	EF 0.42	Lost Opportunity	EF 0.399	EF 0.42	LOMax60	4	units	1.00	1.00	0.16%	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	19	$ 50.00	$ -	104.2%	2.67	26.2%	100.0%
CZ3 - Single Family	New	Miscellaneous	Pool Heater	Condensing (EF .90)	Lost Opportunity	Standard (EF .82)	Condensing (EF .90)	LOMax60	3	units	1.00	1.00	0.16%	AEG Research	BNNL	Energy.gov	10	$ 675.00	$ -	111.4%	28.60	1.0%	100.0%
CZ3 - Multi Family	Existing	Space Heating	Furnace - Direct Fuel	AFUE 95%	Lost Opportunity	AFUE 80%	AFUE 95%	LO12Med	1	kBTU/hr	60.00	36.00	0.16%	GFURN-Heating-AEO15-178	CNGC Data	BEST	18	$ 1,488.00	$ 4.83	100.0%	20.46	85.1%	100.0%
CZ3 - Multi Family	Existing	Space Heating	Boiler - Direct Fuel	AFUE 96%	Lost Opportunity	AFUE 82%	AFUE 96%	LO12Med	0	kBTU/hr	105.00	45.00	0.16%	BLR-Heating-AEO15-126	BLR-Heating-AEO15-126	BEST	20	$ 2,775.00	$ 3.84	104.2%	19.96	1.9%	100.0%
CZ3 - Multi Family	Existing	Secondary Heating	Fireplace	Tier 1 (70% FE Rating)	Lost Opportunity	Baseline (50% to 60% FE Rating)	Tier 1 (70% FE Rating)	LO1Slow	3	unit	1.00	1.00	0.16%	CNGC Prior Study Database	CNGC Data	Calculated	20	$ 246.85	$ 0.33	100.0%	23.38	32.9%	100.0%
CZ3 - Multi Family	Existing	Water Heating	Water Heater <= 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Baseline (UEF 0.58)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-EIA14-2014 Ref. Case-24	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-20	19	$ 1,724.38	$ -	102.4%	50.36	68.7%	98.0%
CZ3 - Multi Family	Existing	Water Heating	Water Heater <= 55 gal.	ENERGY STAR (UEF 0.64)	Lost Opportunity	Baseline (UEF 0.58)	ENERGY STAR (UEF 0.64)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-AEG-v1-6	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-6	13	$ 292.75	$ -	100.0%	14.17	1.4%	2.0%
CZ3 - Multi Family	Existing	Water Heating	Water Heater > 55 gal.	Condensing (UEF 0.82)	Lost Opportunity	Standard (UEF 0.76)	Condensing (UEF 0.82)	LO12Med	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	13	$ 445.30	$ -	102.4%	49.34	0.0%	2.0%
CZ3 - Multi Family	Existing	Water Heating	Water Heater > 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Standard (UEF 0.76)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	19	$ 1,983.04	$ -	102.4%	57.92	1.6%	98.0%
CZ3 - Multi Family	Existing	Appliances	Clothes Dryer	NEEA/ENERGY STAR (CE >60%)	Lost Opportunity	Standard	NEEA/ENERGY STAR (CE >60%)	LOMax60	4	units	1.00	1.00	0.16%	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	16	$ 150.00	$ -	104.2%	2.30	13.1%	100.0%
CZ3 - Multi Family	Existing	Appliances	Stove/Oven	EF 0.42	Lost Opportunity	EF 0.399	EF 0.42	LOMax60	4	units	1.00	1.00	0.16%	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	19	$ 50.00	$ -	104.2%	2.67	27.4%	100.0%
CZ3 - Multi Family	Existing	Miscellaneous	Pool Heater	Condensing (EF .90)	Lost Opportunity	Standard (EF .82)	Condensing (EF .90)	LOMax60	3	units	1.00	1.00	0.16%	AEG Research	BNNL	Energy.gov	10	$ 675.00	$ -	111.4%	28.60	1.0%	100.0%
CZ3 - Multi Family	New	Space Heating	Furnace - Direct Fuel	AFUE 95%	Lost Opportunity	AFUE 80%	AFUE 95%	LO12Med	1	kBTU/hr	60.00	36.00	0.16%	GFURN-Heating-AEO15-178	CNGC Data	BEST	18	$ 1,488.00	$ 3.37	100.0%	13.75	94.2%	100.0%
CZ3 - Multi Family	New	Space Heating	Boiler - Direct Fuel	AFUE 96%	Lost Opportunity	AFUE 82%	AFUE 96%	LO12Med	0	kBTU/hr	105.00	45.00	0.16%	BLR-Heating-AEO15-126	BLR-Heating-AEO15-126	BEST	20	$ 2,775.00	$ 2.89	104.2%	14.60	1.5%	100.0%
CZ3 - Multi Family	New	Secondary Heating	Fireplace	Tier 1 (70% FE Rating)	Lost Opportunity	Baseline (50% to 60% FE Rating)	Tier 1 (70% FE Rating)	LO1Slow	3	unit	1.00	1.00	0.16%	CNGC Prior Study Database	CNGC Data	Calculated	20	$ 246.85	$ 0.33	100.0%	23.38	65.7%	100.0%
CZ3 - Multi Family	New	Water Heating	Water Heater <= 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Baseline (UEF 0.58)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-EIA14-2014 Ref. Case-24	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-20	19	$ 1,724.38	$ -	102.4%	50.36	67.8%	98.0%
CZ3 - Multi Family	New	Water Heating	Water Heater <= 55 gal.	ENERGY STAR (UEF 0.64)	Lost Opportunity	Baseline (UEF 0.58)	ENERGY STAR (UEF 0.64)	LO20Fast	4	unit	1.00	1.00	0.16%	DHW_WHsm-Water Heating-AEG-v1-6	CNGC Program Data	DHW_WHsm-Water Heating-AEG-v1-6	13	$ 292.75	$ -	100.0%	14.17	1.4%	2.0%
CZ3 - Multi Family	New	Water Heating	Water Heater > 55 gal.	Condensing (UEF 0.82)	Lost Opportunity	Standard (UEF 0.76)	Condensing (UEF 0.82)	LO12Med	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	13	$ 445.30	$ -	102.4%	49.34	0.0%	2.0%
CZ3 - Multi Family	New	Water Heating	Water Heater > 55 gal.	Instantaneous - ENERGY STAR (UEF 0.87)	Lost Opportunity	Standard (UEF 0.76)	Instantaneous - ENERGY STAR (UEF 0.87)	LO20Fast	4	unit	1.00	1.00	0.16%	Scaled from small	Scaled from small	Scaled from small	19	$ 1,983.04	$ -	102.4%	57.92	1.6%	98.0%
CZ3 - Multi Family	New	Appliances	Clothes Dryer	NEEA/ENERGY STAR (CE >60%)	Lost Opportunity	Standard	NEEA/ENERGY STAR (CE >60%)	LOMax60	4	units	1.00	1.00	0.16%	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	CDR-Appliances-AEO17-286	16	$ 150.00	$ -	104.2%	2.30	13.1%	100.0%

Residential Equipment

Measure					Characteristics									Sources			Measure Assumptions in 2017						
Segment	Vintage	End Use	Measure	Efficient Definition	Replacement Type	Baseline Definition	Measure Description	Measure Ramp Rate Name	Ramp Offset	Input Unit of Measure	UOM Size	Units per Household	Line Loss	Lifetime Source	Costs Source	Savings Source	Measure Lifetime (Years)	Incremental Measure Cost ($)	Incremental Non-Energy Benefits ($)	Cost Scalar	Measure Savings @ generator (therm)	Base Saturation	Applicability
CZ3 - Multi Family	New	Appliances	Stove/Oven	EF 0.42	Lost Opportunity	EF 0.399	EF 0.42	LOMax60	4	units	1.00	1.00	0.16%	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	STV-Appliances-AEO17-58	19	$ 50.00	$ -	104.2%	2.67	26.2%	100.0%
CZ3 - Multi Family	New	Miscellaneous	Pool Heater	Condensing (EF .90)	Lost Opportunity	Standard (EF .82)	Condensing (EF .90)	LOMax60	3	units	1.00	1.00	0.16%	AEG Research	BNNL	Energy.gov	10	$ 675.00	$ -	111.4%	28.60	1.0%	100.0%

Residential Non Equipment

Measure					Characteristics									Sources			Measure Assumptions in 2017					
Segment	Vintage	End Use	Measure	Efficient Definition	Replacement Type	Baseline Definition	Measure Description	Measure Ramp Rate Name	Ramp Offset	Input Unit of Measure	Input Units	Units per Household	Line Loss	Lifetime Source	Costs Source	Savings Source	Measure Lifetime (Years)	Incremental Measure Cost ($)	Incremental Non-Energy Benefits ($)	Measure Savings @ generator (therm) (NEM Only)	Base Saturation	Applicability
CZ1 - Single Family	Existing	Space Heating	Insulation - Ceiling, Installation	R-38 (Retro only)	Retrofit	R-0	R-38 (Retro only)	RetroEven20	4	sqft roof	1.00	1,082.85	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data CZ1	BEST	45	$ 1.61	$ 17.26	0.14	0.0%	6.1%
CZ1 - Single Family	Existing	Space Heating	Insulation - Ceiling, Upgrade	R-49	Retrofit	R11+, up to R40	R-49	RetroEven20	4	sqft roof	1.00	1,082.85	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data CZ1	BEST	45	$ 1.61	$ 4.38	0.04	19.7%	87.5%
CZ1 - Single Family	Existing	Space Heating	Insulation - Slab Foundation	R-11 (NC Only)	Retrofit	R-0	R-11 (NC Only)	Retro3Slow	4	sqft floor	1.00	1,082.85	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	N/A	70	$ 0.95	$ -	-	5.2%	5.2%
CZ1 - Single Family	Existing	Space Heating	Insulation - Basement Sidewall	R-15	Retrofit	R-0	R-15	Retro1Slow	0	sqft floor	1.00	1,082.85	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	BEST	70	$ 0.95	$ 4.51	0.04	6.0%	32.8%
CZ1 - Single Family	Existing	Space Heating	Insulation - Ducting	duct thermal losses reduced 50%	Retrofit	2° F duct loss	duct thermal losses reduced 50%	Retro1Slow	-1	sqft home	1.00	2,165.69	0.16%	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	20	$ 0.29	$ 6.70	0.03	6.9%	25.0%
CZ1 - Single Family	Existing	Space Heating	Insulation - Infiltration Control (Air Sealing)	20% reduction in ACH50	Retrofit	ACH50 >= 5	20% reduction in ACH50	RetroEven20	4	sqft home	1.00	2,165.69	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	NWPCC 7th Plan: Res-SF Wx-7P v7	BEST	15	$ 0.70	$ 2.36	0.01	11.0%	80.0%
CZ1 - Single Family	Existing	Space Heating	Insulation - Floor/Crawlspace	R-30	Retrofit	R-0	R-30	Retro1Slow	1	sqft floor	1.00	1,082.85	0.16%	ResSFWx v3 7	ResSFWx v3 7	ResSFWx v3 7	45	$ 1.39	$ 6.28	0.05	5.1%	52.8%
CZ1 - Single Family	Existing	Space Heating	Insulation - Wall Cavity, Upgrade	R-21	Retrofit	R-11+, up to R-20	R-21	Retro1Slow	0	sqft wall	1.00	1,706.92	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	ORNL ZIP Code Insulation Program	BEST	45	$ 2.01	$ 3.46	0.02	32.2%	79.9%
CZ1 - Single Family	Existing	Space Heating	Insulation - Wall Cavity, Installation	R-11	Retrofit	R-0	R-11	Retro1Slow	0	sqft wall	1.00	1,706.92	0.16%	ResSFWx v3 7	ResSFWx v3 7	NWPCC 7th Plan: Res-SF Wx-7P v7	45	$ 1.47	$ 12.96	0.07	0.0%	15.1%
CZ1 - Single Family	Existing	Space Heating	Insulation - Wall Sheathing	R-5 (NC Only)	Retrofit	R-0	R-5 (NC Only)	Retro1Slow	0	sqft wall	1.00	1,706.92	0.16%	ResSFWx v3 7	ORNL Zip Code Insulation Program	BEST	45	$ 0.89	$ 2.55	0.01	0.0%	0.0%
CZ1 - Single Family	Existing	Space Heating	Ducting - Repair and Sealing	50% reduction in duct leakage	Retrofit	10% air leak to outside	50% reduction in duct leakage	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res-Duct Seal-7P v4	NWPCC 7th Plan: Res-Duct Seal-7P v4	BEST	20	$ 793.95	$ 3.19	27.72	15.0%	50.0%
CZ1 - Single Family	Existing	Space Heating	Doors - Storm and Thermal	R-5 door	Retrofit	R-2.5 door	R-5 door	Retro12Med	5	sqft door	1.00	21.00	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	BEST	45	$ 18.64	$ 0.58	0.24	55.0%	100.0%
CZ1 - Single Family	Existing	Space Heating	Windows - High Efficiency	Double Pane LowE CL22	Retrofit	Single pane	Double Pane LowE CL22	Retro3Slow	-1	sqft window	1.00	203.03	0.16%	ResSFWx v3 7	ResSFWx v3 7	BEST	45	$ 23.09	$ 14.60	0.63	89.3%	100.0%
CZ1 - Single Family	Existing	Space Heating	Thermostat - Programmable	Programmed thermostat	Retrofit	Manual/no control	Programmed thermostat	Retro3Slow	3	household	1.00	1.00	0.16%	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	15	$ 61.59	$ 2.89	25.14	16.5%	25.0%
CZ1 - Single Family	Existing	Space Heating	Thermostat - Wi-Fi/Interactive	Interactive/learning thermostat (ie, NEST)	Retrofit	Manual/no control	Interactive/learning thermostat (ie, NEST)	Retro3Slow	-1	household	1.00	1.00	0.16%	ResConnectedTstats v1.2	CNGC Program Data	ResConnectedTstats v1.2	5	$ 254.58	$ 3.47	30.17	10.0%	75.0%
CZ1 - Single Family	Existing	Space Heating	Gas Furnace - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	BEST	2	$ 114.20	$ -	14.28	35.0%	90.0%
CZ1 - Single Family	Existing	Space Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No reset controls	Reset control installed	Retro5Med	0	household	1.00	1.00	0.16%	IL TRM 5.3.14	IL TRM 5.3.14	IL TRM 5.3.14	20	$ 626.72	$ -	22.39	10.0%	100.0%
CZ1 - Single Family	Existing	Space Heating	Gas Boiler - Steam Trap Maintenance	Cleaned and restored	Retrofit	Degraded system	Cleaned and restored	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 4.4.16 (pp226-231)	IL TRM 4.4.16 (pp226-231)	IL TRM 4.4.16 (pp226-231)	6	$ 81.56	$ -	44.77	0.0%	0.0%
CZ1 - Single Family	Existing	Space Heating	Gas Boiler - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	BEST	2	$ 114.20	$ -	12.69	35.0%	90.0%
CZ1 - Single Family	Existing	Space Heating	Gas Boiler - Pipe Insulation	Pipe insulated throughout home	Retrofit	No insulation	Pipe insulated throughout home	Retro12Med	-1	boil pipe	1.00	85.35	0.16%	IL TRM 5.3.2	DEER	IL TRM 5.3.2	15	$ 5.82	$ -	0.30	6.9%	100.0%
CZ1 - Single Family	Existing	Water Heating	Water Heater - Drainwater Heat Recovery	Drain equipped with heat recovery system	Retrofit	None	Drain equipped with heat recovery system	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	40	$ 855.55	$ -	10.87	0.0%	0.0%
CZ1 - Single Family	Existing	Water Heating	Water Heater - Faucet Aerators	1.5 GPM faucet	Retrofit	2.5 GPM faucet	1.5 GPM faucet	Retro1Slow	0	aerators	1.00	3.00	0.16%	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	15	$ 5.30	$ 66.61	5.11	40.0%	100.0%
CZ1 - Single Family	Existing	Water Heating	Water Heater - Low Flow Showerhead (2.0 GPM)	2.0 GPM showerhead	Retrofit	3.5 GPM showerhead	2.0 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.80	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	$ 18.22	$ 15.39	6.44	20.0%	50.0%
CZ1 - Single Family	Existing	Water Heating	Water Heater - Low Flow Showerhead (1.5 GPM)	1.5 GPM showerhead	Retrofit	3.5 GPM showerhead	1.5 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.80	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	$ 18.22	$ 38.77	11.21	20.0%	50.0%
CZ1 - Single Family	Existing	Water Heating	Water Heater - Temperature Setback	Setback to 120° F	Retrofit	135° F set point	Setback to 120° F	Retro3Slow	0	household	1.00	1.00	0.16%	IL TRM 5.4.6	IL TRM 5.4.6	IL TRM 5.4.6	2	$ 5.30	$ -	3.24	10.0%	100.0%
CZ1 - Single Family	Existing	Water Heating	Water Heater - Thermostatic Shower Restriction Valve	Restrictor installed, shutting off water when it is warm	Retrofit	No control	Restrictor installed, shutting off water when it is warm	Retro1Slow	0	showerheads	1.00	1.80	0.16%	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	10	$ 15.28	$ 9.07	2.39	10.0%	100.0%
CZ1 - Single Family	Existing	Water Heating	Water Heater - Pipe Insulation	Insulated 5' of pipe between unit and conditioned space	Retrofit	No insulation of water pipe in unconditioned space	Insulated 5' of pipe between unit and conditioned space	Retro3Slow	-1	feet pipe	1.00	5.00	0.16%	IL TRM 5.3.2	DEER	BEST	15	$ 5.86	$ -	1.80	6.9%	100.0%
CZ1 - Single Family	Existing	Water Heating	Water Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard tank water heater, baseline	40 sq ft supplemental solar system installed	RetroMax60	-1	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	$ 4,690.72	$ -	95.00	2.0%	30.0%
CZ1 - Single Family	Existing	Miscellaneous	Pool Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard baseline pool heater	40 sq ft supplemental solar system installed	RetroEven20	0	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	$ 4,690.72	$ -	199.55	2.0%	30.0%
CZ1 - Single Family	Existing	Water Heating	ENERGY STAR Dishwashers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	15	$ 76.22	$ 941.40	3.70	87.0%	100.0%
CZ1 - Single Family	Existing	Water Heating	ENERGY STAR Clothes Washers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	ResClothesWashers v6 0	ResClothesWashers v6 0	ResClothesWashers v6 0	14	$ 63.06	$ 18.08	6.03	41.0%	100.0%
CZ1 - Single Family	Existing	Space Heating	ENERGY STAR Homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO50Fast	6	household	1.00	1.00	0.16%	CNGC Program Data	N/A	N/A	30	$ 1.00	$ -	-	0.0%	0.0%
CZ1 - Single Family	Existing	Space Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	CNGC Program Data	N/A	N/A	30	$ 1.00	$ -	-	0.0%	0.0%
CZ1 - Single Family	Existing	Water Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	CNGC Program Data	N/A	N/A	30	$ 1.00	$ -	-	0.0%	0.0%
CZ1 - Single Family	Existing	Space Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	$ 4,997.55	$ 9.52	88.03	1.0%	50.0%
CZ1 - Single Family	Existing	Water Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	$ 4,997.55	$ 9.52	60.94	1.0%	50.0%
CZ1 - Single Family	Existing	Space Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	$ 4,997.55	$ 9.52	88.03	1.0%	50.0%
CZ1 - Single Family	Existing	Water Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	$ 4,997.55	$ 9.52	60.94	1.0%	50.0%
CZ1 - Single Family	New	Space Heating	Insulation - Ceiling, Installation	R-38 (Retro only)	Retrofit	R-0	R-38 (Retro only)	RetroEven20	4	sqft roof	1.00	1,082.85	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data CZ1	N/A	45	$ 1.61	$ -	-	0.0%	0.0%
CZ1 - Single Family	New	Space Heating	Insulation - Ceiling, Upgrade	R-49	Retrofit	R11+, up to R40	R-49	RetroEven20	4	sqft roof	1.00	1,082.85	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data CZ1	BEST	45	$ 1.61	$ -	-	0.0%	0.0%
CZ1 - Single Family	New	Space Heating	Insulation - Slab Foundation	R-11 (NC Only)	Retrofit	R-0	R-11 (NC Only)	Retro3Slow	4	sqft floor	1.00	1,082.85	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	BEST	70	$ 0.95	$ 5.51	0.04	5.2%	8.9%
CZ1 - Single Family	New	Space Heating	Insulation - Basement Sidewall	R-15	Retrofit	R-0	R-15	Retro1Slow	0	sqft floor	1.00	1,082.85	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	BEST	70	$ 0.95	$ 0.53	0.00	0.0%	5.0%
CZ1 - Single Family	New	Space Heating	Insulation - Ducting	duct thermal losses reduced 50%	Retrofit	2° F duct loss	duct thermal losses reduced 50%	Retro1Slow	-1	sqft home	1.00	2,165.69	0.16%	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	20	$ 0.29	$ 4.41	0.02	17.7%	25.0%
CZ1 - Single Family	New	Space Heating	Insulation - Infiltration Control (Air Sealing)	20% reduction in ACH50	Retrofit	ACH50 >= 5	20% reduction in ACH50	RetroEven20	4	sqft home	1.00	2,165.69	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	NWPCC 7th Plan: Res-SF Wx-7P v7	BEST	15	$ 0.70	$ 3.97	0.02	23.4%	80.0%
CZ1 - Single Family	New	Space Heating	Insulation - Floor/Crawlspace	R-30	Retrofit	R-0	R-30	Retro1Slow	1	sqft floor	1.00	1,082.85	0.16%	ResSFWx v3 7	ResSFWx v3 7	ResSFWx v3 7	45	$ 1.39	$ 5.28	0.04	72.2%	72.2%
CZ1 - Single Family	New	Space Heating	Insulation - Wall Cavity, Upgrade	R-21	Retrofit	R-11+, up to R-20	R-21	Retro1Slow	0	sqft wall	1.00	1,706.92	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	ORNL ZIP Code Insulation Program	BEST	45	$ 2.01	$ -	-	100.0%	100.0%
CZ1 - Single Family	New	Space Heating	Insulation - Wall Cavity, Installation	R-11	Retrofit	R-0	R-11	Retro1Slow	0	sqft wall	1.00	1,706.92	0.16%	ResSFWx v3 7	ResSFWx v3 7	NWPCC 7th Plan: Res-SF Wx-7P v7	45	$ 0.00	$ -	-	0.0%	0.0%
CZ1 - Single Family	New	Space Heating	Insulation - Wall Sheathing	R-5 (NC Only)	Retrofit	R-0	R-5 (NC Only)	Retro1Slow	0	sqft wall	1.00	1,706.92	0.16%	ResSFWx v3 7	ORNL Zip Code Insulation Program	BEST	45	$ 0.89	$ 2.22	0.01	65.0%	85.0%
CZ1 - Single Family	New	Space Heating	Ducting - Repair and Sealing	50% reduction in duct leakage	Retrofit	10% air leak to outside	50% reduction in duct leakage	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res-Duct Seal-7P v4	NWPCC 7th Plan: Res-Duct Seal-7P v4	BEST	20	$ 793.95	$ 1.08	9.07	50.0%	50.0%
CZ1 - Single Family	New	Space Heating	Doors - Storm and Thermal	R-5 door	Retrofit	R-2.5 door	R-5 door	Retro12Med	5	sqft door	1.00	21.00	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	BEST	45	$ 0.89	$ 0.02	0.20	60.0%	100.0%
CZ1 - Single Family	New	Space Heating	Windows - High Efficiency	Double Pane LowE CL22	Retrofit	Single pane	Double Pane LowE CL22	Retro3Slow	-1	sqft window	1.00	203.03	0.16%	ResSFWx v3 7	ResSFWx v3 7	BEST	45	$ 23.09	$ 12.28	0.52	100.0%	100.0%
CZ1 - Single Family	New	Space Heating	Thermostat - Programmable	Programmed thermostat	Retrofit	Manual/no control	Programmed thermostat	Retro3Slow	3	household	1.00	1.00	0.16%	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	15	$ 61.59	$ 2.43	20.89	19.4%	25.0%
CZ1 - Single Family	New	Space Heating	Thermostat - Wi-Fi/Interactive	Interactive/learning thermostat (ie, NEST)	Retrofit	Manual/no control	Interactive/learning thermostat (ie, NEST)	Retro3Slow	-1	household	1.00	1.00	0.16%	ResConnectedTstats v1.2	CNGC Program Data	ResConnectedTstats v1.2	5	$ 254.58	$ 2.92	25.06	10.0%	75.0%
CZ1 - Single Family	New	Space Heating	Gas Furnace - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	N/A	2	$ 114.20	$ -	-	0.0%	0.0%
CZ1 - Single Family	New	Space Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No reset controls	Reset control installed	Retro5Med	0	household	1.00	1.00	0.16%	IL TRM 5.3.14	IL TRM 5.3.14	IL TRM 5.3.14	20	$ 626.72	$ -	16.03	10.0%	100.0%
CZ1 - Single Family	New	Space Heating	Gas Boiler - Steam Trap Maintenance	Cleaned and restored	Retrofit	Degraded system	Cleaned and restored	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 4.4.16 (pp226-231)	IL TRM 4.4.16 (pp226-231)	N/A	6	$ 81.56	$ -	-	0.0%	0.0%
CZ1 - Single Family	New	Space Heating	Gas Boiler - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	N/A	2	$ 114.20	$ -	-	0.0%	0.0%
CZ1 - Single Family	New	Space Heating	Gas Boiler - Pipe Insulation	Pipe insulated throughout home	Retrofit	No insulation	Pipe insulated throughout home	Retro12Med	-1	boil pipe	1.00	85.35	0.16%	IL TRM 5.3.2	DEER	IL TRM 5.3.2	15	$ 5.82	$ -	0.30	17.7%	100.0%
CZ1 - Single Family	New	Water Heating	Water Heater - Drainwater Heat Recovery	Drain equipped with heat recovery system	Retrofit	None	Drain equipped with heat recovery system	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	40	$ 855.55	$ -	10.87	0.0%	10.0%
CZ1 - Single Family	New	Water Heating	Water Heater - Faucet Aerators	1.5 GPM faucet	Retrofit	2.5 GPM faucet	1.5 GPM faucet	Retro1Slow	0	aerators	1.00	3.00	0.16%	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	15	$ 5.30	$ 66.61	5.11	35.0%	100.0%
CZ1 - Single Family	New	Water Heating	Water Heater - Low Flow Showerhead (2.0 GPM)	2.0 GPM showerhead	Retrofit	3.5 GPM showerhead	2.0 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.80	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	$ 18.22	$ 15.39	6.44	18.0%	50.0%
CZ1 - Single Family	New	Water Heating	Water Heater - Low Flow Showerhead (1.5 GPM)	1.5 GPM showerhead	Retrofit	3.5 GPM showerhead	1.5 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.80	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	$ 18.22	$ 38.77	11.21	18.0%	50.0%
CZ1 - Single Family	New	Water Heating	Water Heater - Temperature Setback	Setback to 120° F	Retrofit	135° F set point	Setback to 120° F	Retro3Slow	0	household	1.00	1.00	0.16%	IL TRM 5.4.6	IL TRM 5.4.6	IL TRM 5.4.6	2	$ 5.30	$ -	3.24	15.0%	100.0%
CZ1 - Single Family	New	Water Heating	Water Heater - Thermostatic Shower Restriction Valve	Restrictor installed, shutting off water when it is warm	Retrofit	No control	Restrictor installed, shutting off water when it is warm	Retro1Slow	0	showerheads	1.00	1.80	0.16%	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	10	$ 15.28	$ 9.07	2.39	0.0%	100.0%
CZ1 - Single Family	New	Water Heating	Water Heater - Pipe Insulation	Insulated 5' of pipe between unit and conditioned space	Retrofit	No insulation of water pipe in unconditioned space	Insulated 5' of pipe between unit and conditioned space	Retro3Slow	-1	feet pipe	1.00	5.00	0.16%	IL TRM 5.3.2	DEER	BEST	15	$ 5.86	$ -	1.44	17.7%	100.0%
CZ1 - Single Family	New	Water Heating	Water Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard tank water heater, baseline	40 sq ft supplemental solar system installed	RetroMax60	-1	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	$ 4,690.72	$ -	95.00	2.0%	30.0%
CZ1 - Single Family	New	Miscellaneous	Pool Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard baseline pool heater	40 sq ft supplemental solar system installed	RetroEven20	0	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	$ 4,690.72	$ -	229.28	2.0%	30.0%
CZ1 - Single Family	New	Water Heating	ENERGY STAR Dishwashers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	15	$ 76.22	$ 941.40	3.70	77.1%	88.6%
CZ1 - Single Family	New	Water Heating	ENERGY STAR Clothes Washers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	ResClothesWashers v6 0	ResClothesWashers v6 0	ResClothesWashers v6 0	14	$ 63.06	$ 18.08	6.03	40.5%	98.7%
CZ1 - Single Family	New	Space Heating	ENERGY STAR Homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO50Fast	6	household	1.00	1.00	0.16%	CNGC Program Data	ENERGY STAR Certified Homes, Version 3 (Rev. 08)	CNGC Program Data 2015, scaled by UEC	30	$ 2,117.00	$ -	171.16	0.0%	0.0%
CZ1 - Single Family	New	Space Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	CNGC Program Data	ENERGY STAR Certified Homes, Version 3 (Rev. 08)	CNGC Program Data 2015	30	$ 2,117.00	$ -	83.60	0.0%	20.0%
CZ1 - Single Family	New	Water Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	CNGC Program Data	ENERGY STAR Certified Homes, Version 3 (Rev. 08)	CNGC Program Data 2015	30	$ 2,117.00	$ -	108.38	0.0%	20.0%
CZ1 - Single Family	New	Space Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	$ 4,997.55	$ 9.52	88.03	0.0%	50.0%
CZ1 - Single Family	New	Water Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	$ 4,997.55	$ 9.52	60.94	0.0%	50.0%
CZ1 - Single Family	New	Space Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	$ 4,997.55	$ 9.52	88.03	0.0%	50.0%
CZ1 - Single Family	New	Water Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	$ 4,997.55	$ 9.52	60.94	0.0%	50.0%
CZ1 - Multi Family	Existing	Space Heating	Insulation - Ceiling, Installation	R-38 (Retro only)	Retrofit	R-0	R-38 (Retro only)	RetroEven20	4	sqft roof - mf	1.00	541.42	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data CZ1	BEST	45	$ 1.61	$ 9.18	0.15	0.0%	6.1%
CZ1 - Multi Family	Existing	Space Heating	Insulation - Ceiling, Upgrade	R-49	Retrofit	R11+, up to R40	R-49	RetroEven20	4	sqft roof - mf	1.00	541.42	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data CZ1	BEST	45	$ 1.61	$ 2.33	0.04	19.7%	87.5%
CZ1 - Multi Family	Existing	Space Heating	Insulation - Slab Foundation	R-11 (NC Only)	Retrofit	R-0	R-11 (NC Only)	Retro3Slow	4	sqft floor	1.00	1,082.85	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	N/A	70	$ 0.95	$ -	-	0.0%	0.0%
CZ1 - Multi Family	Existing	Space Heating	Insulation - Basement Sidewall	R-15	Retrofit	R-0	R-15	Retro1Slow	0	sqft floor	1.00	1,082.85	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	N/A	70	$ 0.95	$ -	-	0.0%	0.0%
CZ1 - Multi Family	Existing	Space Heating	Insulation - Ducting	duct thermal losses reduced 50%	Retrofit	2° F duct loss	duct thermal losses reduced 50%	Retro1Slow	-1	sqft home	1.00	1,082.85	0.16%	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	20	$ 0.29	$ 3.54	0.03	6.9%	25.0%
CZ1 - Multi Family	Existing	Space Heating	Insulation - Infiltration Control (Air Sealing)	20% reduction in ACH50	Retrofit	ACH50 >= 5	20% reduction in ACH50	RetroEven20	4	sqft home	1.00	1,082.85	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	NWPCC 7th Plan: Res-SF Wx-7P v7	BEST	15	$ 0.70	$ 1.26	0.01	11.0%	80.0%
CZ1 - Multi Family	Existing	Space Heating	Insulation - Floor/Crawlspace	R-30	Retrofit	R-0	R-30	Retro1Slow	1	sqft floor	1.00	1,082.85	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	ResSFWx v3 7	45	$ 1.04	$ 3.34	0.03	5.1%	52.8%
CZ1 - Multi Family	Existing	Space Heating	Insulation - Wall Cavity, Upgrade	R-21	Retrofit	R-11+, up to R-20	R-21	Retro1Slow	0	sqft wall	1.00	1,122.45	0.16%	NWPCC 7th Plan: Res-MF Wx-7P v7	ORNL ZIP Code Insulation Program	BEST	45	$ 2.01	$ 1.84	0.01	32.2%	79.9%
CZ1 - Multi Family	Existing	Space Heating	Insulation - Wall Cavity, Installation	R-11	Retrofit	R-0	R-11	Retro1Slow	0	sqft wall	1.00	1,122.45	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	NWPCC 7th Plan: Res-MF Wx-7P v7	45	$ 1.10	$ 6.90	0.06	0.0%	15.1%
CZ1 - Multi Family	Existing	Space Heating	Insulation - Wall Sheathing	R-5 (NC Only)	Retrofit	R-0	R-5 (NC Only)	Retro1Slow	0	sqft wall	1.00	1,122.45	0.16%	ResMFWeatherization v3 4	ORNL Zip Code Insulation Program	BEST	45	$ 0.89	$ 3.65	0.03	0.0%	0.0%
CZ1 - Multi Family	Existing	Space Heating	Ducting - Repair and Sealing	50% reduction in duct leakage	Retrofit	10% air leak to outside	50% reduction in duct leakage	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res-Duct Seal-7P v4	NWPCC 7th Plan: Res-Duct Seal-7P v4	BEST	20	$ 793.95	$ 1.68	15.13	15.0%	50.0%
CZ1 - Multi Family	Existing	Space Heating	Doors - Storm and Thermal	R-5 door	Retrofit	R-2.5 door	R-5 door	Retro12Med	5	sqft door	1.00	21.00	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	BEST	45	$ 18.64	$ 0.31	0.13	55.0%	100.0%
CZ1 - Multi Family	Existing	Space Heating	Windows - High Efficiency	Double Pane LowE CL22	Retrofit	Single pane	Double Pane LowE CL22	Retro3Slow	-1	sqft window	1.00	115.86	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	BEST	45	$ 21.05	$ 7.77	0.60	89.3%	100.0%
CZ1 - Multi Family	Existing	Space Heating	Thermostat - Programmable	Programmed thermostat	Retrofit	Manual/no control	Programmed thermostat	Retro3Slow	3	household	1.00	1.00	0.16%	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	15	$ 61.59	$ 1.54	13.85	16.5%	25.0%
CZ1 - Multi Family	Existing	Space Heating	Thermostat - Wi-Fi/Interactive	Interactive/learning thermostat (ie, NEST)	Retrofit	Manual/no control	Interactive/learning thermostat (ie, NEST)	Retro3Slow	-1	household	1.00	1.00	0.16%	ResConnectedTstats v1.2	CNGC Program Data	ResConnectedTstats v1.2	5	$ 254.58	$ 1.85	16.62	10.0%	75.0%
CZ1 - Multi Family	Existing	Space Heating	Gas Furnace - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	BEST	2	$ 114.20	$ -	8.00	35.0%	90.0%
CZ1 - Multi Family	Existing	Space Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No reset controls	Reset control installed	Retro5Med	0	household	1.00	1.00	0.16%	IL TRM 5.3.14	IL TRM 5.3.14	IL TRM 5.3.14	20	$ 626.72	$ -	18.09	10.0%	100.0%
CZ1 - Multi Family	Existing	Space Heating	Gas Boiler - Steam Trap Maintenance	Cleaned and restored	Retrofit	Degraded system	Cleaned and restored	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 4.4.16 (pp226-231)	IL TRM 4.4.16 (pp226-231)	IL TRM 4.4.16 (pp226-231)	6	$ 81.56	$ -	36.19	0.0%	0.0%
CZ1 - Multi Family	Existing	Space Heating	Gas Boiler - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	BEST	2	$ 114.20	$ -	10.53	35.0%	90.0%
CZ1 - Multi Family	Existing	Space Heating	Gas Boiler - Pipe Insulation	Pipe insulated throughout home	Retrofit	No insulation	Pipe insulated throughout home	Retro12Med	-1	boil pipe	1.00	56.12	0.16%	IL TRM 5.3.2	DEER	IL TRM 5.3.2	15	$ 5.82	$ -	0.30	6.9%	100.0%
CZ1 - Multi Family	Existing	Water Heating	Water Heater - Drainwater Heat Recovery	Drain equipped with heat recovery system	Retrofit	None	Drain equipped with heat recovery system	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	40	$ 682.79	$ -	10.87	0.0%	0.0%
CZ1 - Multi Family	Existing	Water Heating	Water Heater - Faucet Aerators	1.5 GPM faucet	Retrofit	2.5 GPM faucet	1.5 GPM faucet	Retro1Slow	0	aerators	1.00	2.00	0.16%	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	15	$ 5.30	$ 31.35	3.61	40.0%	100.0%
CZ1 - Multi Family	Existing	Water Heating	Water Heater - Low Flow Showerhead (2.0 GPM)	2.0 GPM showerhead	Retrofit	3.5 GPM showerhead	2.0 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.30	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	$ 18.22	$ 11.12	6.44	20.0%	50.0%
CZ1 - Multi Family	Existing	Water Heating	Water Heater - Low Flow Showerhead (1.5 GPM)	1.5 GPM showerhead	Retrofit	3.5 GPM showerhead	1.5 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.30	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	$ 18.22	$ 28.00	11.21	20.0%	50.0%
CZ1 - Multi Family	Existing	Water Heating	Water Heater - Temperature Setback	Setback to 120° F	Retrofit	135° F set point	Setback to 120° F	Retro3Slow	0	household	1.00	1.00	0.16%	IL TRM 5.4.6	IL TRM 5.4.6	IL TRM 5.4.6	2	$ 5.30	$ -	3.24	10.0%	100.0%
CZ1 - Multi Family	Existing	Water Heating	Water Heater - Thermostatic Shower Restriction Valve	Restrictor installed, shutting off water when it is warm	Retrofit	No control	Restrictor installed, shutting off water when it is warm	Retro1Slow	0	showerheads	1.00	1.30	0.16%	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	10	$ 15.28	$ 6.55	2.39	10.0%	100.0%
CZ1 - Multi Family	Existing	Water Heating	Water Heater - Pipe Insulation	Insulated 5' of pipe between unit and conditioned space	Retrofit	No insulation of water pipe in unconditioned space	Insulated 5' of pipe between unit and conditioned space	Retro3Slow	-1	feet pipe	1.00	5.00	0.16%	IL TRM 5.3.2	DEER	BEST	15	$ 5.86	$ -	1.08	6.9%	100.0%
CZ1 - Multi Family	Existing	Water Heating	Water Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard tank water heater, baseline	40 sq ft supplemental solar system installed	RetroMax60	-1	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	$ 4,690.72	$ -	59.14	2.0%	30.0%
CZ1 - Multi Family	Existing	Miscellaneous	Pool Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard baseline pool heater	40 sq ft supplemental solar system installed	RetroEven20	0	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	$ 4,690.72	$ -	199.55	2.0%	30.0%
CZ1 - Multi Family	Existing	Water Heating	ENERGY STAR Dishwashers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	15	$ 76.22	$ 941.40	3.70	87.0%	100.0%
CZ1 - Multi Family	Existing	Water Heating	ENERGY STAR Clothes Washers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	ResClothesWashers v6 0	ResClothesWashers v6 0	ResClothesWashers v6 0	14	$ 63.06	$ 18.08	6.03	41.0%	100.0%
CZ1 - Multi Family	Existing	Space Heating	ENERGY STAR Homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO50Fast	6	household	1.00	1.00	0.16%	ResMFEstarHomes2012	N/A	N/A	70	$ 1.00	$ -	-	0.0%	0.0%
CZ1 - Multi Family	Existing	Space Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	ResMFEstarHomes2012	N/A	N/A	70	$ 1.00	$ -	-	0.0%	0.0%
CZ1 - Multi Family	Existing	Water Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	ResMFEstarHomes2012	N/A	N/A	70	$ 1.00	$ -	-	0.0%	0.0%
CZ1 - Multi Family	Existing	Space Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	$ 4,997.55	$ 5.20	48.08	1.0%	50.0%
CZ1 - Multi Family	Existing	Water Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	$ 4,997.55	$ 5.20	37.94	1.0%	50.0%
CZ1 - Multi Family	Existing	Space Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	$ 4,997.55	$ 5.20	48.08	1.0%	50.0%
CZ1 - Multi Family	Existing	Water Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	$ 4,997.55	$ 5.20	37.94	1.0%	50.0%
CZ1 - Multi Family	New	Space Heating	Insulation - Ceiling, Installation	R-38 (Retro only)	Retrofit	R-0	R-38 (Retro only)	RetroEven20	4	sqft roof - mf	1.00	541.42	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data CZ1	N/A	45	$ 1.61	$ -	-	0.0%	0.0%
CZ1 - Multi Family	New	Space Heating	Insulation - Ceiling, Upgrade	R-49	Retrofit	R11+, up to R40	R-49	RetroEven20	4	sqft roof - mf	1.00	541.42	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data CZ1	BEST	45	$ 1.61	$ -	-	0.0%	0.0%
CZ1 - Multi Family	New	Space Heating	Insulation - Slab Foundation	R-11 (NC Only)	Retrofit	R-0	R-11 (NC Only)	Retro3Slow	4	sqft floor	1.00	1,082.85	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	N/A	70	$ 0.95	$ -	-	0.0%	0.0%
CZ1 - Multi Family	New	Space Heating	Insulation - Basement Sidewall	R-15	Retrofit	R-0	R-15	Retro1Slow	0	sqft floor	1.00	1,082.85	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	N/A	70	$ 0.95	$ -	-	0.0%	0.0%
CZ1 - Multi Family	New	Space Heating	Insulation - Ducting	duct thermal losses reduced 50%	Retrofit	2° F duct loss	duct thermal losses reduced 50%	Retro1Slow	-1	sqft home	1.00	1,082.85	0.16%	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	20	$ 0.29	$ 2.26	0.02	17.7%	25.0%
CZ1 - Multi Family	New	Space Heating	Insulation - Infiltration Control (Air Sealing)	20% reduction in ACH50	Retrofit	ACH50 >= 5	20% reduction in ACH50	RetroEven20	4	sqft home	1.00	1,082.85	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	NWPCC 7th Plan: Res-SF Wx-7P v7	BEST	15	$ 0.70	$ 2.07	0.02	23.4%	80.0%
CZ1 - Multi Family	New	Space Heating	Insulation - Floor/Crawlspace	R-30	Retrofit	R-0	R-30	Retro1Slow	1	sqft floor	1.00	1,082.85	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	ResSFWx v3 7	45	$ 1.04	$ 2.75	0.02	72.2%	72.2%
CZ1 - Multi Family	New	Space Heating	Insulation - Wall Cavity, Upgrade	R-21	Retrofit	R-11+, up to R-20	R-21	Retro1Slow	0	sqft wall	1.00	1,122.45	0.16%	NWPCC 7th Plan: Res-MF Wx-7P v7	ORNL ZIP Code Insulation Program	BEST	45	$ 2.01	$ -	-	100.0%	100.0%
CZ1 - Multi Family	New	Space Heating	Insulation - Wall Cavity, Installation	R-11	Retrofit	R-0	R-11	Retro1Slow	0	sqft wall	1.00	1,122.45	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	NWPCC 7th Plan: Res-MF Wx-7P v7	45	$ 0.00	$ -	-	0.0%	0.0%
CZ1 - Multi Family	New	Space Heating	Insulation - Wall Sheathing	R-5 (NC Only)	Retrofit	R-0	R-5 (NC Only)	Retro1Slow	0	sqft wall	1.00	1,122.45	0.16%	ResMFWeatherization v3 4	ORNL Zip Code Insulation Program	BEST	45	$ 0.89	$ 2.56	0.02	65.0%	85.0%
CZ1 - Multi Family	New	Space Heating	Ducting - Repair and Sealing	50% reduction in duct leakage	Retrofit	10% air leak to outside	50% reduction in duct leakage	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res-Duct Seal-7P v4	NWPCC 7th Plan: Res-Duct Seal-7P v4	BEST	20	$ 793.95	$ 0.55	4.91	50.0%	50.0%
CZ1 - Multi Family	New	Space Heating	Doors - Storm and Thermal	R-5 door	Retrofit	R-2.5 door	R-5 door	Retro12Med	5	sqft door	1.00	21.00	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	BEST	45	$ 0.89	$ 0.01	0.11	60.0%	100.0%
CZ1 - Multi Family	New	Space Heating	Windows - High Efficiency	Double Pane LowE CL22	Retrofit	Single pane	Double Pane LowE CL22	Retro3Slow	-1	sqft window	1.00	115.86	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	BEST	45	$ 21.05	$ 6.40	0.49	100.0%	100.0%
CZ1 - Multi Family	New	Space Heating	Thermostat - Programmable	Programmed thermostat	Retrofit	Manual/no control	Programmed thermostat	Retro3Slow	3	household	1.00	1.00	0.16%	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	15	$ 61.59	$ 1.27	11.34	19.4%	25.0%
CZ1 - Multi Family	New	Space Heating	Thermostat - Wi-Fi/Interactive	Interactive/learning thermostat (ie, NEST)	Retrofit	Manual/no control	Interactive/learning thermostat (ie, NEST)	Retro3Slow	-1	household	1.00	1.00	0.16%	ResConnectedTstats v1.2	CNGC Program Data	ResConnectedTstats v1.2	5	$ 254.58	$ 1.52	13.61	10.0%	75.0%
CZ1 - Multi Family	New	Space Heating	Gas Furnace - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	N/A	2	$ 114.20	$ -	-	0.0%	0.0%
CZ1 - Multi Family	New	Space Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No reset controls	Reset control installed	Retro5Med	0	household	1.00	1.00	0.16%	IL TRM 5.3.14	IL TRM 5.3.14	IL TRM 5.3.14	20	$ 626.72	$ -	10.71	10.0%	100.0%
CZ1 - Multi Family	New	Space Heating	Gas Boiler - Steam Trap Maintenance	Cleaned and restored	Retrofit	Degraded system	Cleaned and restored	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 4.4.16 (pp226-231)	IL TRM 4.4.16 (pp226-231)	N/A	6	$ 81.56	$ -	-	0.0%	0.0%
CZ1 - Multi Family	New	Space Heating	Gas Boiler - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	N/A	2	$ 114.20	$ -	-	0.0%	0.0%
CZ1 - Multi Family	New	Space Heating	Gas Boiler - Pipe Insulation	Pipe insulated throughout home	Retrofit	No insulation	Pipe insulated throughout home	Retro12Med	-1	boil pipe	1.00	56.12	0.16%	IL TRM 5.3.2	DEER	IL TRM 5.3.2	15	$ 5.82	$ -	0.30	17.7%	100.0%
CZ1 - Multi Family	New	Water Heating	Water Heater - Drainwater Heat Recovery	Drain equipped with heat recovery system	Retrofit	None	Drain equipped with heat recovery system	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	40	$ 682.79	$ -	10.87	0.0%	10.0%
CZ1 - Multi Family	New	Water Heating	Water Heater - Faucet Aerators	1.5 GPM faucet	Retrofit	2.5 GPM faucet	1.5 GPM faucet	Retro1Slow	0	aerators	1.00	2.00	0.16%	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	15	$ 5.30	$ 31.35	3.61	35.0%	100.0%
CZ1 - Multi Family	New	Water Heating	Water Heater - Low Flow Showerhead (2.0 GPM)	2.0 GPM showerhead	Retrofit	3.5 GPM showerhead	2.0 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.30	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	$ 18.22	$ 11.12	6.44	18.0%	50.0%
CZ1 - Multi Family	New	Water Heating	Water Heater - Low Flow Showerhead (1.5 GPM)	1.5 GPM showerhead	Retrofit	3.5 GPM showerhead	1.5 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.30	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	$ 18.22	$ 28.00	11.21	18.0%	50.0%
CZ1 - Multi Family	New	Water Heating	Water Heater - Temperature Setback	Setback to 120° F	Retrofit	135° F set point	Setback to 120° F	Retro3Slow	0	household	1.00	1.00	0.16%	IL TRM 5.4.6	IL TRM 5.4.6	IL TRM 5.4.6	2	$ 5.30	$ -	3.24	15.0%	100.0%
CZ1 - Multi Family	New	Water Heating	Water Heater - Thermostatic Shower Restriction Valve	Restrictor installed, shutting off water when it is warm	Retrofit	No control	Restrictor installed, shutting off water when it is warm	Retro1Slow	0	showerheads	1.00	1.30	0.16%	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	10	$ 15.28	$ 6.55	2.39	0.0%	100.0%
CZ1 - Multi Family	New	Water Heating	Water Heater - Pipe Insulation	Insulated 5' of pipe between unit and conditioned space	Retrofit	No insulation of water pipe in unconditioned space	Insulated 5' of pipe between unit and conditioned space	Retro3Slow	-1	feet pipe	1.00	5.00	0.16%	IL TRM 5.3.2	DEER	BEST	15	$ 5.86	$ -	0.93	17.7%	100.0%
CZ1 - Multi Family	New	Water Heating	Water Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard tank water heater, baseline	40 sq ft supplemental solar system installed	RetroMax60	-1	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	$ 4,690.72	$ -	59.11	2.0%	30.0%
CZ1 - Multi Family	New	Miscellaneous	Pool Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard baseline pool heater	40 sq ft supplemental solar system installed	RetroEven20	0	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	$ 4,690.72	$ -	229.28	2.0%	30.0%
CZ1 - Multi Family	New	Water Heating	ENERGY STAR Dishwashers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	15	$ 76.22	$ 941.40	3.70	67.9%	78.0%
CZ1 - Multi Family	New	Water Heating	ENERGY STAR Clothes Washers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	ResClothesWashers v6 0	ResClothesWashers v6 0	ResClothesWashers v6 0	14	$ 63.06	$ 18.08	6.03	19.3%	47.0%
CZ1 - Multi Family	New	Space Heating	ENERGY STAR Homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO50Fast	6	household	1.00	1.00	0.16%	ResMFEstarHomes2012	ResMFEstarHomes2012	ResMFEstarHomes2012	70	$ 2,457.20	$ -	18.94	0.0%	0.0%
CZ1 - Multi Family	New	Space Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	ResMFEstarHomes2012	ResMFEstarHomes2012	ResMFEstarHomes2012	70	$ 2,457.20	$ -	9.12	0.0%	0.0%
CZ1 - Multi Family	New	Water Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	ResMFEstarHomes2012	ResMFEstarHomes2012	ResMFEstarHomes2012	70	$ 2,457.20	$ -	9.82	0.0%	0.0%
CZ1 - Multi Family	New	Space Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	$ 4,997.55	$ 5.20	48.08	0.0%	50.0%
CZ1 - Multi Family	New	Water Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	$ 4,997.55	$ 5.20	37.94	0.0%	50.0%
CZ1 - Multi Family	New	Space Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	$ 4,997.55	$ 5.20	48.08	0.0%	50.0%
CZ1 - Multi Family	New	Water Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	$ 4,997.55	$ 5.20	37.94	0.0%	50.0%
CZ2 - Single Family	Existing	Space Heating	Insulation - Ceiling, Installation	R-38 (Retro only)	Retrofit	R-0	R-38 (Retro only)	RetroEven20	4	sqft roof	1.00	1,009.71	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data CZ2	BEST	45	$ 1.12	$ 15.20	0.16	0.0%	6.1%
CZ2 - Single Family	Existing	Space Heating	Insulation - Ceiling, Upgrade	R-49	Retrofit	R11+, up to R40	R-49	RetroEven20	4	sqft roof	1.00	1,009.71	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data CZ2	BEST	45	$ 1.12	$ 3.97	0.04	19.7%	87.5%
CZ2 - Single Family	Existing	Space Heating	Insulation - Slab Foundation	R-11 (NC Only)	Retrofit	R-0	R-11 (NC Only)	Retro3Slow	4	sqft floor	1.00	1,009.71	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	N/A	70	$ 0.95	$ -	-	5.2%	5.2%
CZ2 - Single Family	Existing	Space Heating	Insulation - Basement Sidewall	R-15	Retrofit	R-0	R-15	Retro1Slow	0	sqft floor	1.00	1,009.71	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	BEST	70	$ 0.95	$ 4.20	0.05	6.0%	32.8%
CZ2 - Single Family	Existing	Space Heating	Insulation - Ducting	duct thermal losses reduced 50%	Retrofit	2° F duct loss	duct thermal losses reduced 50%	Retro1Slow	-1	sqft home	1.00	2,019.42	0.16%	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	20	$ 0.29	$ 5.67	0.03	6.9%	25.0%
CZ2 - Single Family	Existing	Space Heating	Insulation - Infiltration Control (Air Sealing)	20% reduction in ACH50	Retrofit	ACH50 >= 5	20% reduction in ACH50	RetroEven20	4	sqft home	1.00	2,019.42	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	NWPCC 7th Plan: Res-SF Wx-7P v7	BEST	15	$ 0.70	$ 1.51	0.01	11.0%	80.0%
CZ2 - Single Family	Existing	Space Heating	Insulation - Floor/Crawlspace	R-30	Retrofit	R-0	R-30	Retro1Slow	1	sqft floor	1.00	1,009.71	0.16%	RTFSFWx v3 7	RTFSFWx v3 7	ResSFWx v3 7	45	$ 1.39	$ 4.68	0.05	5.1%	52.8%
CZ2 - Single Family	Existing	Space Heating	Insulation - Wall Cavity, Upgrade	R-21	Retrofit	R-11+, up to R-20	R-21	Retro1Slow	0	sqft wall	1.00	1,655.00	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	ORNL ZIP Code Insulation Program	BEST	45	$ 2.01	$ 3.10	0.02	32.2%	79.9%
CZ2 - Single Family	Existing	Space Heating	Insulation - Wall Cavity, Installation	R-11	Retrofit	R-0	R-11	Retro1Slow	0	sqft wall	1.00	1,655.00	0.16%	RTFSFWx v3 7	RTFSFWx v3 7	NWPCC 7th Plan: Res-SF Wx-7P v7	45	$ 1.47	$ 11.64	0.08	0.0%	15.1%
CZ2 - Single Family	Existing	Space Heating	Insulation - Wall Sheathing	R-5 (NC Only)	Retrofit	R-0	R-5 (NC Only)	Retro1Slow	0	sqft wall	1.00	1,655.00	0.16%	RTFSFWx v3 7	ORNL Zip Code Insulation Program	BEST	45	$ 0.89	$ 2.41	0.02	0.0%	0.0%
CZ2 - Single Family	Existing	Space Heating	Ducting - Repair and Sealing	50% reduction in duct leakage	Retrofit	10% air leak to outside	50% reduction in duct leakage	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res-Duct Seal-7P v4	NWPCC 7th Plan: Res-Duct Seal-7P v4	BEST	20	$ 793.95	$ 2.80	30.48	15.0%	50.0%

Residential Non Equipment

Measure					Characteristics									Sources			Measure Assumptions in 2017					
Segment	Vintage	End Use	Measure	Efficient Definition	Replacement Type	Baseline Definition	Measure Description	Measure Ramp Rate Name	Ramp Offset	Input Unit of Measure	Input Units	Units per Household	Line Loss	Lifetime Source	Costs Source	Savings Source	Measure Lifetime (Years)	Incremental Measure Cost ($)	Incremental Non-Energy Benefits ($)	Measure Savings @ generator (therm) (NEM Only)	Base Saturation	Applicability
CZ2 - Single Family	Existing	Space Heating	Doors - Storm and Thermal	R-5 door	Retrofit	R-2.5 door	R-5 door	Retro12Med	5	sqft door	1.00	21.00	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	BEST	45	18.64	0.48	0.25	55.0%	100.0%
CZ2 - Single Family	Existing	Space Heating	Windows - High Efficiency	Double Pane LowE CL22	Retrofit	Single pane	Double Pane LowE CL22	Retro3Slow	-1	sqft window	1.00	189.32	0.16%	RTFSFWx v3 7	RTFSFWx v3 7	BEST	45	23.09	12.42	0.71	89.3%	100.0%
CZ2 - Single Family	Existing	Space Heating	Thermostat - Programmable	Programmed thermostat	Retrofit	Manual/no control	Programmed thermostat	Retro3Slow	3	household	1.00	1.00	0.16%	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	15	61.59	2.44	26.51	16.5%	25.0%
CZ2 - Single Family	Existing	Space Heating	Thermostat - Wi-Fi/Interactive	Interactive/learning thermostat (ie, NEST)	Retrofit	Manual/no control	Interactive/learning thermostat (ie, NEST)	Retro3Slow	-1	household	1.00	1.00	0.16%	ResConnectedTstats v1.2	CNGC Program Data	ResConnectedTstats v1.2	5	254.58	2.93	31.81	10.0%	75.0%
CZ2 - Single Family	Existing	Space Heating	Gas Furnace - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	BEST	2	114.20	-	15.51	35.0%	90.0%
CZ2 - Single Family	Existing	Space Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No reset controls	Reset control installed	Retro5Med	0	household	1.00	1.00	0.16%	IL TRM 5.3.14	IL TRM 5.3.14	IL TRM 5.3.14	20	626.72	-	23.37	10.0%	100.0%
CZ2 - Single Family	Existing	Space Heating	Gas Boiler - Steam Trap Maintenance	Cleaned and restored	Retrofit	Degraded system	Cleaned and restored	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 4.4.16 (pp226-231)	IL TRM 4.4.16 (pp226-231)	IL TRM 4.4.16 (pp226-231)	6	81.56	-	46.74	0.0%	0.0%
CZ2 - Single Family	Existing	Space Heating	Gas Boiler - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	BEST	2	114.20	-	13.60	35.0%	90.0%
CZ2 - Single Family	Existing	Space Heating	Gas Boiler - Pipe Insulation	Pipe insulated throughout home	Retrofit	No insulation	Pipe insulated throughout home	Retro12Med	-1	boil pipe	1.00	82.75	0.16%	IL TRM 5.3.2	DEER	IL TRM 5.3.2	15	5.82	-	0.30	6.9%	100.0%
CZ2 - Single Family	Existing	Water Heating	Water Heater - Drainwater Heat Recovery	Drain equipped with heat recovery system	Retrofit	None	Drain equipped with heat recovery system	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	40	855.55	-	10.87	0.0%	0.0%
CZ2 - Single Family	Existing	Water Heating	Water Heater - Faucet Aerators	1.5 GPM faucet	Retrofit	2.5 GPM faucet	1.5 GPM faucet	Retro1Slow	0	aerators	1.00	3.00	0.16%	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	15	5.30	66.61	5.11	40.0%	100.0%
CZ2 - Single Family	Existing	Water Heating	Water Heater - Low Flow Showerhead (2.0 GPM)	2.0 GPM showerhead	Retrofit	3.5 GPM showerhead	2.0 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.80	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	18.22	15.39	6.44	20.0%	50.0%
CZ2 - Single Family	Existing	Water Heating	Water Heater - Low Flow Showerhead (1.5 GPM)	1.5 GPM showerhead	Retrofit	3.5 GPM showerhead	1.5 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.80	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	18.22	38.77	11.21	20.0%	50.0%
CZ2 - Single Family	Existing	Water Heating	Water Heater - Temperature Setback	Setback to 120°F	Retrofit	135°F set point	Setback to 120°F	Retro3Slow	0	household	1.00	1.00	0.16%	IL TRM 5.4.6	IL TRM 5.4.6	IL TRM 5.4.6	2	5.30	-	3.24	10.0%	100.0%
CZ2 - Single Family	Existing	Water Heating	Water Heater - Thermostatic Shower Restriction Valve	Restrictor installed, shutting off water when it is warm	Retrofit	No control	Restrictor installed, shutting off water when it is warm	Retro1Slow	0	showerheads	1.00	1.80	0.16%	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	10	15.28	9.07	2.39	10.0%	100.0%
CZ2 - Single Family	Existing	Water Heating	Water Heater - Pipe Insulation	Insulated 5' of pipe between unit and conditioned space	Retrofit	No insulation of water pipe in unconditioned space	Insulated 5' of pipe between unit and conditioned space	Retro3Slow	-1	feet pipe	1.00	5.00	0.16%	IL TRM 5.3.2	DEER	BEST	15	5.86	-	1.62	6.9%	100.0%
CZ2 - Single Family	Existing	Water Heating	Water Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard tank water heater, baseline	40 sq ft supplemental solar system installed	RetroMax60	-1	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	4,690.72	-	95.00	2.0%	30.0%
CZ2 - Single Family	Existing	Miscellaneous	Pool Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard baseline pool heater	40 sq ft supplemental solar system installed	RetroEven20	0	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	4,690.72	-	200.66	2.0%	30.0%
CZ2 - Single Family	Existing	Water Heating	ENERGY STAR Dishwashers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	15	76.22	941.40	3.70	87.0%	100.0%
CZ2 - Single Family	Existing	Water Heating	ENERGY STAR Clothes Washers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	ResClothesWashers v6 0	ResClothesWashers v6 0	ResClothesWashers v6 0	14	63.06	18.08	6.03	41.0%	100.0%
CZ2 - Single Family	Existing	Space Heating	ENERGY STAR Homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO50Fast	6	household	1.00	1.00	0.16%	CNGC Program Data	N/A	N/A	30	1.00	-	-	0.0%	0.0%
CZ2 - Single Family	Existing	Space Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	CNGC Program Data	N/A	N/A	30	1.00	-	-	0.0%	0.0%
CZ2 - Single Family	Existing	Water Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	CNGC Program Data	N/A	N/A	30	1.00	-	-	0.0%	0.0%
CZ2 - Single Family	Existing	Space Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	4,997.55	7.30	85.44	1.0%	50.0%
CZ2 - Single Family	Existing	Water Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	4,997.55	7.30	60.60	1.0%	50.0%
CZ2 - Single Family	Existing	Space Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	4,997.55	7.30	85.44	1.0%	50.0%
CZ2 - Single Family	Existing	Water Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	4,997.55	7.30	60.60	1.0%	50.0%
CZ2 - Single Family	New	Space Heating	Insulation - Ceiling, Installation	R-38 (Retro only)	Retrofit	R-0	R-38 (Retro only)	RetroEven20	4	sqft roof	1.00	1,009.71	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data CZ2	N/A	45	1.12	-	-	0.0%	0.0%
CZ2 - Single Family	New	Space Heating	Insulation - Ceiling, Upgrade	R-49	Retrofit	R11+, up to R40	R-49	RetroEven20	4	sqft roof	1.00	1,009.71	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data CZ2	BEST	45	1.12	-	-	0.0%	0.0%
CZ2 - Single Family	New	Space Heating	Insulation - Slab Foundation	R-11 (NC Only)	Retrofit	R-0	R-11 (NC Only)	Retro3Slow	4	sqft floor	1.00	1,009.71	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	BEST	70	0.95	4.82	0.05	5.2%	8.9%
CZ2 - Single Family	New	Space Heating	Insulation - Basement Sidewall	R-15	Retrofit	R-0	R-15	Retro1Slow	0	sqft floor	1.00	1,009.71	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	BEST	70	0.95	0.44	0.00	0.0%	5.0%
CZ2 - Single Family	New	Space Heating	Insulation - Ducting	duct thermal losses reduced 50%	Retrofit	2°F duct loss	duct thermal losses reduced 50%	Retro1Slow	-1	sqft home	1.00	2,019.42	0.16%	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	20	0.29	3.63	0.02	17.7%	25.0%
CZ2 - Single Family	New	Space Heating	Insulation - Infiltration Control (Air Sealing)	20% reduction in ACH50	Retrofit	ACH50 >= 5	20% reduction in ACH50	RetroEven20	4	sqft home	1.00	2,019.42	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	NWPCC 7th Plan: Res-SF Wx-7P v7	BEST	15	0.70	2.52	0.01	23.4%	80.0%
CZ2 - Single Family	New	Space Heating	Insulation - Floor/Crawlspace	R-30	Retrofit	R-0	R-30	Retro1Slow	1	sqft floor	1.00	1,009.71	0.16%	RTFSFWx v3 7	RTFSFWx v3 7	ResSFWx v3 7	45	1.39	3.74	0.04	72.2%	72.2%
CZ2 - Single Family	New	Space Heating	Insulation - Wall Cavity, Upgrade	R-21	Retrofit	R-11+, up to R-20	R-21	Retro1Slow	0	sqft wall	1.00	1,655.00	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	ORNL ZIP Code Insulation Program	BEST	45	2.01	-	-	100.0%	100.0%
CZ2 - Single Family	New	Space Heating	Insulation - Wall Cavity, Installation	R-11	Retrofit	R-0	R-11	Retro1Slow	0	sqft wall	1.00	1,655.00	0.16%	RTFSFWx v3 7	RTFSFWx v3 7	NWPCC 7th Plan: Res-SF Wx-7P v7	45	0.00	-	-	0.0%	0.0%
CZ2 - Single Family	New	Space Heating	Insulation - Wall Sheathing	R-5 (NC Only)	Retrofit	R-0	R-5 (NC Only)	Retro1Slow	0	sqft wall	1.00	1,655.00	0.16%	RTFSFWx v3 7	ORNL Zip Code Insulation Program	BEST	45	0.89	2.07	0.01	65.0%	85.0%
CZ2 - Single Family	New	Space Heating	Ducting - Repair and Sealing	50% reduction in duct leakage	Retrofit	10% air leak to outside	50% reduction in duct leakage	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res-Duct Seal-7P v4	NWPCC 7th Plan: Res-Duct Seal-7P v4	BEST	20	793.95	0.89	9.31	50.0%	50.0%
CZ2 - Single Family	New	Space Heating	Doors - Storm and Thermal	R-5 door	Retrofit	R-2.5 door	R-5 door	Retro12Med	5	sqft door	1.00	21.00	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	BEST	45	0.89	0.02	0.19	60.0%	100.0%
CZ2 - Single Family	New	Space Heating	Windows - High Efficiency	Double Pane LowE CL22	Retrofit	Single pane	Double Pane LowE CL22	Retro3Slow	-1	sqft window	1.00	189.32	0.16%	RTFSFWx v3 7	RTFSFWx v3 7	BEST	45	23.09	9.92	0.56	100.0%	100.0%
CZ2 - Single Family	New	Space Heating	Thermostat - Programmable	Programmed thermostat	Retrofit	Manual/no control	Programmed thermostat	Retro3Slow	3	household	1.00	1.00	0.16%	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	15	61.59	1.95	20.77	19.4%	25.0%
CZ2 - Single Family	New	Space Heating	Thermostat - Wi-Fi/Interactive	Interactive/learning thermostat (ie, NEST)	Retrofit	Manual/no control	Interactive/learning thermostat (ie, NEST)	Retro3Slow	-1	household	1.00	1.00	0.16%	ResConnectedTstats v1.2	CNGC Program Data	ResConnectedTstats v1.2	5	254.58	2.34	24.93	10.0%	75.0%
CZ2 - Single Family	New	Space Heating	Gas Furnace - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	N/A	2	114.20	-	-	0.0%	0.0%
CZ2 - Single Family	New	Space Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No reset controls	Reset control installed	Retro5Med	0	household	1.00	1.00	0.16%	IL TRM 5.3.14	IL TRM 5.3.14	IL TRM 5.3.14	20	626.72	-	16.09	10.0%	100.0%
CZ2 - Single Family	New	Space Heating	Gas Boiler - Steam Trap Maintenance	Cleaned and restored	Retrofit	Degraded system	Cleaned and restored	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 4.4.16 (pp226-231)	IL TRM 4.4.16 (pp226-231)	N/A	6	81.56	-	-	0.0%	0.0%
CZ2 - Single Family	New	Space Heating	Gas Boiler - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	N/A	2	114.20	-	-	0.0%	0.0%
CZ2 - Single Family	New	Space Heating	Gas Boiler - Pipe Insulation	Pipe insulated throughout home	Retrofit	No insulation	Pipe insulated throughout home	Retro12Med	-1	boil pipe	1.00	82.75	0.16%	IL TRM 5.3.2	DEER	IL TRM 5.3.2	15	5.82	-	0.30	17.7%	100.0%
CZ2 - Single Family	New	Water Heating	Water Heater - Drainwater Heat Recovery	Drain equipped with heat recovery system	Retrofit	None	Drain equipped with heat recovery system	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	40	855.55	-	10.87	0.0%	10.0%
CZ2 - Single Family	New	Water Heating	Water Heater - Faucet Aerators	1.5 GPM faucet	Retrofit	2.5 GPM faucet	1.5 GPM faucet	Retro1Slow	0	aerators	1.00	3.00	0.16%	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	15	5.30	66.61	5.11	35.0%	100.0%
CZ2 - Single Family	New	Water Heating	Water Heater - Low Flow Showerhead (2.0 GPM)	2.0 GPM showerhead	Retrofit	3.5 GPM showerhead	2.0 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.80	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	18.22	15.39	6.44	18.0%	50.0%
CZ2 - Single Family	New	Water Heating	Water Heater - Low Flow Showerhead (1.5 GPM)	1.5 GPM showerhead	Retrofit	3.5 GPM showerhead	1.5 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.80	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	18.22	38.77	11.21	18.0%	50.0%
CZ2 - Single Family	New	Water Heating	Water Heater - Temperature Setback	Setback to 120°F	Retrofit	135°F set point	Setback to 120°F	Retro3Slow	0	household	1.00	1.00	0.16%	IL TRM 5.4.6	IL TRM 5.4.6	IL TRM 5.4.6	2	5.30	-	3.24	15.0%	100.0%
CZ2 - Single Family	New	Water Heating	Water Heater - Thermostatic Shower Restriction Valve	Restrictor installed, shutting off water when it is warm	Retrofit	No control	Restrictor installed, shutting off water when it is warm	Retro1Slow	0	showerheads	1.00	1.80	0.16%	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	10	15.28	9.07	2.39	0.0%	100.0%
CZ2 - Single Family	New	Water Heating	Water Heater - Pipe Insulation	Insulated 5' of pipe between unit and conditioned space	Retrofit	No insulation of water pipe in unconditioned space	Insulated 5' of pipe between unit and conditioned space	Retro3Slow	-1	feet pipe	1.00	5.00	0.16%	IL TRM 5.3.2	DEER	BEST	15	5.86	-	1.45	17.7%	100.0%
CZ2 - Single Family	New	Water Heating	Water Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard tank water heater, baseline	40 sq ft supplemental solar system installed	RetroMax60	-1	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	4,690.72	-	95.00	2.0%	30.0%
CZ2 - Single Family	New	Miscellaneous	Pool Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard baseline pool heater	40 sq ft supplemental solar system installed	RetroEven20	0	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	4,690.72	-	230.56	2.0%	30.0%
CZ2 - Single Family	New	Water Heating	ENERGY STAR Dishwashers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	15	76.22	941.40	3.70	77.1%	88.6%
CZ2 - Single Family	New	Water Heating	ENERGY STAR Clothes Washers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	ResClothesWashers v6 0	ResClothesWashers v6 0	ResClothesWashers v6 0	14	63.06	18.08	6.03	40.5%	98.7%
CZ2 - Single Family	New	Space Heating	ENERGY STAR Homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO50Fast	6	household	1.00	1.00	0.16%	CNGC Program Data	ENERGY STAR Certified Homes, Version 3 (Rev. 08)	CNGC Program Data 2015, scaled by UEC	30	2,117.00	-	156.71	0.0%	20.0%
CZ2 - Single Family	New	Space Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	CNGC Program Data	ENERGY STAR Certified Homes, Version 3 (Rev. 08)	CNGC Program Data 2015	30	2,117.00	-	76.58	0.0%	20.0%
CZ2 - Single Family	New	Water Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	CNGC Program Data	ENERGY STAR Certified Homes, Version 3 (Rev. 08)	CNGC Program Data 2015	30	2,117.00	-	105.27	0.0%	20.0%
CZ2 - Single Family	New	Space Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	4,997.55	7.30	85.44	0.0%	50.0%
CZ2 - Single Family	New	Water Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	4,997.55	7.30	60.60	0.0%	50.0%
CZ2 - Single Family	New	Space Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	4,997.55	7.30	85.44	0.0%	50.0%
CZ2 - Single Family	New	Water Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	4,997.55	7.30	60.60	0.0%	50.0%
CZ2 - Multi Family	Existing	Space Heating	Insulation - Ceiling, Installation	R-38 (Retro only)	Retrofit	R-0	R-38 (Retro only)	RetroEven20	4	sqft roof - mf	1.00	504.85	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data CZ2	BEST	45	1.12	7.15	0.16	0.0%	6.1%
CZ2 - Multi Family	Existing	Space Heating	Insulation - Ceiling, Upgrade	R-49	Retrofit	R11+, up to R40	R-49	RetroEven20	4	sqft roof - mf	1.00	504.85	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data CZ2	BEST	45	1.12	1.87	0.04	19.7%	87.5%
CZ2 - Multi Family	Existing	Space Heating	Insulation - Slab Foundation	R-11 (NC Only)	Retrofit	R-0	R-11 (NC Only)	Retro3Slow	4	sqft floor	1.00	1,009.71	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	N/A	70	0.95	-	-	0.0%	0.0%
CZ2 - Multi Family	Existing	Space Heating	Insulation - Basement Sidewall	R-15	Retrofit	R-0	R-15	Retro1Slow	0	sqft floor	1.00	1,009.71	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	N/A	70	0.95	-	-	0.0%	0.0%
CZ2 - Multi Family	Existing	Space Heating	Insulation - Ducting	duct thermal losses reduced 50%	Retrofit	2°F duct loss	duct thermal losses reduced 50%	Retro1Slow	-1	sqft home	1.00	1,009.71	0.16%	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	20	0.29	2.57	0.03	6.9%	25.0%
CZ2 - Multi Family	Existing	Space Heating	Insulation - Infiltration Control (Air Sealing)	20% reduction in ACH50	Retrofit	ACH50 >= 5	20% reduction in ACH50	RetroEven20	4	sqft home	1.00	1,009.71	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	NWPCC 7th Plan: Res-SF Wx-7P v7	BEST	15	0.70	0.71	0.01	11.0%	80.0%
CZ2 - Multi Family	Existing	Space Heating	Insulation - Floor/Crawlspace	R-30	Retrofit	R-0	R-30	Retro1Slow	1	sqft floor	1.00	1,009.71	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	ResSFWx v3 7	45	1.04	2.20	0.02	5.1%	52.8%
CZ2 - Multi Family	Existing	Space Heating	Insulation - Wall Cavity, Upgrade	R-21	Retrofit	R-11+, up to R-20	R-21	Retro1Slow	0	sqft wall	1.00	1,087.72	0.16%	NWPCC 7th Plan: Res-MF Wx-7P v7	ORNL ZIP Code Insulation Program	BEST	45	2.01	1.46	0.02	32.2%	79.9%
CZ2 - Multi Family	Existing	Space Heating	Insulation - Wall Cavity, Installation	R-11	Retrofit	R-0	R-11	Retro1Slow	0	sqft wall	1.00	1,087.72	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	NWPCC 7th Plan: Res-MF Wx-7P v7	45	1.10	5.47	0.06	0.0%	15.1%
CZ2 - Multi Family	Existing	Space Heating	Insulation - Wall Sheathing	R-5 (NC Only)	Retrofit	R-0	R-5 (NC Only)	Retro1Slow	0	sqft wall	1.00	1,087.72	0.16%	ResMFWeatherization v3 4	ORNL Zip Code Insulation Program	BEST	45	0.89	3.24	0.03	0.0%	0.0%
CZ2 - Multi Family	Existing	Space Heating	Ducting - Repair and Sealing	50% reduction in duct leakage	Retrofit	10% air leak to outside	50% reduction in duct leakage	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res-Duct Seal-7P v4	NWPCC 7th Plan: Res-Duct Seal-7P v4	BEST	20	793.95	1.27	14.33	15.0%	50.0%
CZ2 - Multi Family	Existing	Space Heating	Doors - Storm and Thermal	R-5 door	Retrofit	R-2.5 door	R-5 door	Retro12Med	5	sqft door	1.00	21.00	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	BEST	45	18.64	0.22	0.12	55.0%	100.0%
CZ2 - Multi Family	Existing	Space Heating	Windows - High Efficiency	Double Pane LowE CL22	Retrofit	Single pane	Double Pane LowE CL22	Retro3Slow	-1	sqft window	1.00	108.04	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	BEST	45	21.05	5.84	0.61	89.3%	100.0%
CZ2 - Multi Family	Existing	Space Heating	Thermostat - Programmable	Programmed thermostat	Retrofit	Manual/no control	Programmed thermostat	Retro3Slow	3	household	1.00	1.00	0.16%	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	15	61.59	1.15	12.94	16.5%	25.0%
CZ2 - Multi Family	Existing	Space Heating	Thermostat - Wi-Fi/Interactive	Interactive/learning thermostat (ie, NEST)	Retrofit	Manual/no control	Interactive/learning thermostat (ie, NEST)	Retro3Slow	-1	household	1.00	1.00	0.16%	ResConnectedTstats v1.2	CNGC Program Data	ResConnectedTstats v1.2	5	254.58	1.38	15.53	10.0%	75.0%
CZ2 - Multi Family	Existing	Space Heating	Gas Furnace - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	BEST	2	114.20	-	7.17	35.0%	90.0%
CZ2 - Multi Family	Existing	Space Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No reset controls	Reset control installed	Retro5Med	0	household	1.00	1.00	0.16%	IL TRM 5.3.14	IL TRM 5.3.14	IL TRM 5.3.14	20	626.72	-	21.63	10.0%	100.0%
CZ2 - Multi Family	Existing	Space Heating	Gas Boiler - Steam Trap Maintenance	Cleaned and restored	Retrofit	Degraded system	Cleaned and restored	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 4.4.16 (pp226-231)	IL TRM 4.4.16 (pp226-231)	IL TRM 4.4.16 (pp226-231)	6	81.56	-	43.25	0.0%	0.0%
CZ2 - Multi Family	Existing	Space Heating	Gas Boiler - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	BEST	2	114.20	-	12.37	35.0%	90.0%
CZ2 - Multi Family	Existing	Space Heating	Gas Boiler - Pipe Insulation	Pipe insulated throughout home	Retrofit	No insulation	Pipe insulated throughout home	Retro12Med	-1	boil pipe	1.00	54.39	0.16%	IL TRM 5.3.2	DEER	IL TRM 5.3.2	15	5.82	-	0.30	6.9%	100.0%
CZ2 - Multi Family	Existing	Water Heating	Water Heater - Drainwater Heat Recovery	Drain equipped with heat recovery system	Retrofit	None	Drain equipped with heat recovery system	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	40	682.79	-	10.87	0.0%	0.0%
CZ2 - Multi Family	Existing	Water Heating	Water Heater - Faucet Aerators	1.5 GPM faucet	Retrofit	2.5 GPM faucet	1.5 GPM faucet	Retro1Slow	0	aerators	1.00	2.00	0.16%	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	15	5.30	31.35	3.61	40.0%	100.0%
CZ2 - Multi Family	Existing	Water Heating	Water Heater - Low Flow Showerhead (2.0 GPM)	2.0 GPM showerhead	Retrofit	3.5 GPM showerhead	2.0 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.30	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	18.22	11.12	6.44	20.0%	50.0%
CZ2 - Multi Family	Existing	Water Heating	Water Heater - Low Flow Showerhead (1.5 GPM)	1.5 GPM showerhead	Retrofit	3.5 GPM showerhead	1.5 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.30	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	18.22	28.00	11.21	20.0%	50.0%
CZ2 - Multi Family	Existing	Water Heating	Water Heater - Temperature Setback	Setback to 120°F	Retrofit	135°F set point	Setback to 120°F	Retro3Slow	0	household	1.00	1.00	0.16%	IL TRM 5.4.6	IL TRM 5.4.6	IL TRM 5.4.6	2	5.30	-	3.24	10.0%	100.0%
CZ2 - Multi Family	Existing	Water Heating	Water Heater - Thermostatic Shower Restriction Valve	Restrictor installed, shutting off water when it is warm	Retrofit	No control	Restrictor installed, shutting off water when it is warm	Retro1Slow	0	showerheads	1.00	1.30	0.16%	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	10	15.28	6.55	2.39	10.0%	100.0%
CZ2 - Multi Family	Existing	Water Heating	Water Heater - Pipe Insulation	Insulated 5' of pipe between unit and conditioned space	Retrofit	No insulation of water pipe in unconditioned space	Insulated 5' of pipe between unit and conditioned space	Retro3Slow	-1	feet pipe	1.00	5.00	0.16%	IL TRM 5.3.2	DEER	BEST	15	5.86	-	1.07	6.9%	100.0%
CZ2 - Multi Family	Existing	Water Heating	Water Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard tank water heater, baseline	40 sq ft supplemental solar system installed	RetroMax60	-1	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	4,690.72	-	59.23	2.0%	30.0%
CZ2 - Multi Family	Existing	Miscellaneous	Pool Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard baseline pool heater	40 sq ft supplemental solar system installed	RetroEven20	0	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	4,690.72	-	200.66	2.0%	30.0%
CZ2 - Multi Family	Existing	Water Heating	ENERGY STAR Dishwashers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	15	76.22	941.40	3.70	87.0%	100.0%
CZ2 - Multi Family	Existing	Water Heating	ENERGY STAR Clothes Washers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	ResClothesWashers v6 0	ResClothesWashers v6 0	ResClothesWashers v6 0	14	63.06	18.08	6.03	41.0%	100.0%
CZ2 - Multi Family	Existing	Space Heating	ENERGY STAR Homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO50Fast	6	household	1.00	1.00	0.16%	ResMFEstarHomes2012	N/A	N/A	70	1.00	-	-	0.0%	0.0%
CZ2 - Multi Family	Existing	Space Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	ResMFEstarHomes2012	N/A	N/A	70	1.00	-	-	0.0%	0.0%
CZ2 - Multi Family	Existing	Water Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	ResMFEstarHomes2012	N/A	N/A	70	1.00	-	-	0.0%	0.0%
CZ2 - Multi Family	Existing	Space Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	4,997.55	3.62	42.38	1.0%	50.0%
CZ2 - Multi Family	Existing	Water Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	4,997.55	3.62	37.78	1.0%	50.0%
CZ2 - Multi Family	Existing	Space Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	4,997.55	3.62	42.38	1.0%	50.0%
CZ2 - Multi Family	Existing	Water Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	4,997.55	3.62	37.78	1.0%	50.0%
CZ2 - Multi Family	New	Space Heating	Insulation - Ceiling, Installation	R-38 (Retro only)	Retrofit	R-0	R-38 (Retro only)	RetroEven20	4	sqft roof - mf	1.00	504.85	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data CZ2	N/A	45	1.12	-	-	0.0%	0.0%
CZ2 - Multi Family	New	Space Heating	Insulation - Ceiling, Upgrade	R-49	Retrofit	R11+, up to R40	R-49	RetroEven20	4	sqft roof - mf	1.00	504.85	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data CZ2	BEST	45	1.12	-	-	0.0%	0.0%
CZ2 - Multi Family	New	Space Heating	Insulation - Slab Foundation	R-11 (NC Only)	Retrofit	R-0	R-11 (NC Only)	Retro3Slow	4	sqft floor	1.00	1,009.71	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	N/A	70	0.95	-	-	0.0%	0.0%
CZ2 - Multi Family	New	Space Heating	Insulation - Basement Sidewall	R-15	Retrofit	R-0	R-15	Retro1Slow	0	sqft floor	1.00	1,009.71	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	N/A	70	0.95	-	-	0.0%	0.0%
CZ2 - Multi Family	New	Space Heating	Insulation - Ducting	duct thermal losses reduced 50%	Retrofit	2°F duct loss	duct thermal losses reduced 50%	Retro1Slow	-1	sqft home	1.00	1,009.71	0.16%	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	20	0.29	1.51	0.02	17.7%	25.0%
CZ2 - Multi Family	New	Space Heating	Insulation - Infiltration Control (Air Sealing)	20% reduction in ACH50	Retrofit	ACH50 >= 5	20% reduction in ACH50	RetroEven20	4	sqft home	1.00	1,009.71	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	NWPCC 7th Plan: Res-SF Wx-7P v7	BEST	15	0.70	1.08	0.01	23.4%	80.0%
CZ2 - Multi Family	New	Space Heating	Insulation - Floor/Crawlspace	R-30	Retrofit	R-0	R-30	Retro1Slow	1	sqft floor	1.00	1,009.71	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	ResSFWx v3 7	45	1.04	1.60	0.02	72.2%	72.2%
CZ2 - Multi Family	New	Space Heating	Insulation - Wall Cavity, Upgrade	R-21	Retrofit	R-11+, up to R-20	R-21	Retro1Slow	0	sqft wall	1.00	1,087.72	0.16%	NWPCC 7th Plan: Res-MF Wx-7P v7	ORNL ZIP Code Insulation Program	BEST	45	2.01	-	-	100.0%	100.0%
CZ2 - Multi Family	New	Space Heating	Insulation - Wall Cavity, Installation	R-11	Retrofit	R-0	R-11	Retro1Slow	0	sqft wall	1.00	1,087.72	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	NWPCC 7th Plan: Res-MF Wx-7P v7	45	0.00	-	-	0.0%	0.0%
CZ2 - Multi Family	New	Space Heating	Insulation - Wall Sheathing	R-5 (NC Only)	Retrofit	R-0	R-5 (NC Only)	Retro1Slow	0	sqft wall	1.00	1,087.72	0.16%	ResMFWeatherization v3 4	ORNL Zip Code Insulation Program	BEST	45	0.89	2.16	0.02	65.0%	85.0%
CZ2 - Multi Family	New	Space Heating	Ducting - Repair and Sealing	50% reduction in duct leakage	Retrofit	10% air leak to outside	50% reduction in duct leakage	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res-Duct Seal-7P v4	NWPCC 7th Plan: Res-Duct Seal-7P v4	BEST	20	793.95	0.37	4.08	50.0%	50.0%
CZ2 - Multi Family	New	Space Heating	Doors - Storm and Thermal	R-5 door	Retrofit	R-2.5 door	R-5 door	Retro12Med	5	sqft door	1.00	21.00	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	BEST	45	0.89	0.01	0.09	60.0%	100.0%
CZ2 - Multi Family	New	Space Heating	Windows - High Efficiency	Double Pane LowE CL22	Retrofit	Single pane	Double Pane LowE CL22	Retro3Slow	-1	sqft window	1.00	108.04	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	BEST	45	21.05	4.25	0.44	100.0%	100.0%
CZ2 - Multi Family	New	Space Heating	Thermostat - Programmable	Programmed thermostat	Retrofit	Manual/no control	Programmed thermostat	Retro3Slow	3	household	1.00	1.00	0.16%	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	15	61.59	0.83	9.29	19.4%	25.0%
CZ2 - Multi Family	New	Space Heating	Thermostat - Wi-Fi/Interactive	Interactive/learning thermostat (ie, NEST)	Retrofit	Manual/no control	Interactive/learning thermostat (ie, NEST)	Retro3Slow	-1	household	1.00	1.00	0.16%	ResConnectedTstats v1.2	CNGC Program Data	ResConnectedTstats v1.2	5	254.58	1.00	11.15	10.0%	75.0%
CZ2 - Multi Family	New	Space Heating	Gas Furnace - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	N/A	2	114.20	-	-	0.0%	0.0%
CZ2 - Multi Family	New	Space Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No reset controls	Reset control installed	Retro5Med	0	household	1.00	1.00	0.16%	IL TRM 5.3.14	IL TRM 5.3.14	IL TRM 5.3.14	20	626.72	-	11.59	10.0%	100.0%
CZ2 - Multi Family	New	Space Heating	Gas Boiler - Steam Trap Maintenance	Cleaned and restored	Retrofit	Degraded system	Cleaned and restored	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 4.4.16 (pp226-231)	IL TRM 4.4.16 (pp226-231)	N/A	6	81.56	-	-	0.0%	0.0%
CZ2 - Multi Family	New	Space Heating	Gas Boiler - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	N/A	2	114.20	-	-	0.0%	0.0%
CZ2 - Multi Family	New	Space Heating	Gas Boiler - Pipe Insulation	Pipe insulated throughout home	Retrofit	No insulation	Pipe insulated throughout home	Retro12Med	-1	boil pipe	1.00	54.39	0.16%	IL TRM 5.3.2	DEER	IL TRM 5.3.2	15	5.82	-	0.30	17.7%	100.0%
CZ2 - Multi Family	New	Water Heating	Water Heater - Drainwater Heat Recovery	Drain equipped with heat recovery system	Retrofit	None	Drain equipped with heat recovery system	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	40	682.79	-	10.87	0.0%	10.0%
CZ2 - Multi Family	New	Water Heating	Water Heater - Faucet Aerators	1.5 GPM faucet	Retrofit	2.5 GPM faucet	1.5 GPM faucet	Retro1Slow	0	aerators	1.00	2.00	0.16%	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	15	5.30	31.35	3.61	35.0%	100.0%
CZ2 - Multi Family	New	Water Heating	Water Heater - Low Flow Showerhead (2.0 GPM)	2.0 GPM showerhead	Retrofit	3.5 GPM showerhead	2.0 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.30	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	18.22	11.12	6.44	18.0%	50.0%
CZ2 - Multi Family	New	Water Heating	Water Heater - Low Flow Showerhead (1.5 GPM)	1.5 GPM showerhead	Retrofit	3.5 GPM showerhead	1.5 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.30	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	18.22	28.00	11.21	18.0%	50.0%
CZ2 - Multi Family	New	Water Heating	Water Heater - Temperature Setback	Setback to 120°F	Retrofit	135°F set point	Setback to 120°F	Retro3Slow	0	household	1.00	1.00	0.16%	IL TRM 5.4.6	IL TRM 5.4.6	IL TRM 5.4.6	2	5.30	-	3.24	15.0%	100.0%
CZ2 - Multi Family	New	Water Heating	Water Heater - Thermostatic Shower Restriction Valve	Restrictor installed, shutting off water when it is warm	Retrofit	No control	Restrictor installed, shutting off water when it is warm	Retro1Slow	0	showerheads	1.00	1.30	0.16%	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	10	15.28	6.55	2.39	0.0%	100.0%
CZ2 - Multi Family	New	Water Heating	Water Heater - Pipe Insulation	Insulated 5' of pipe between unit and conditioned space	Retrofit	No insulation of water pipe in unconditioned space	Insulated 5' of pipe between unit and conditioned space	Retro3Slow	-1	feet pipe	1.00	5.00	0.16%	IL TRM 5.3.2	DEER	BEST	15	5.86	-	0.93	17.7%	100.0%
CZ2 - Multi Family	New	Water Heating	Water Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard tank water heater, baseline	40 sq ft supplemental solar system installed	RetroMax60	-1	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	4,690.72	-	59.20	2.0%	30.0%
CZ2 - Multi Family	New	Miscellaneous	Pool Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard baseline pool heater	40 sq ft supplemental solar system installed	RetroEven20	0	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	4,690.72	-	230.56	2.0%	30.0%
CZ2 - Multi Family	New	Water Heating	ENERGY STAR Dishwashers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	15	76.22	941.40	3.70	67.9%	78.0%
CZ2 - Multi Family	New	Water Heating	ENERGY STAR Clothes Washers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	ResClothesWashers v6 0	ResClothesWashers v6 0	ResClothesWashers v6 0	14	63.06	18.08	6.03	19.3%	47.0%
CZ2 - Multi Family	New	Space Heating	ENERGY STAR Homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO50Fast	6	household	1.00	1.00	0.16%	ResMFEstarHomes2012	ResMFEstarHomes2012	ResMFEstarHomes2012	70	2,457.20	-	18.94	0.0%	0.0%
CZ2 - Multi Family	New	Space Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	ResMFEstarHomes2012	ResMFEstarHomes2012	ResMFEstarHomes2012	70	2,457.20	-	9.12	0.0%	0.0%
CZ2 - Multi Family	New	Water Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	ResMFEstarHomes2012	ResMFEstarHomes2012	ResMFEstarHomes2012	70	2,457.20	-	9.82	0.0%	0.0%
CZ2 - Multi Family	New	Space Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	4,997.55	3.62	42.38	0.0%	50.0%
CZ2 - Multi Family	New	Water Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	4,997.55	3.62	37.78	0.0%	50.0%
CZ2 - Multi Family	New	Space Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	4,997.55	3.62	42.38	0.0%	50.0%
CZ2 - Multi Family	New	Water Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	4,997.55	3.62	37.78	0.0%	50.0%
CZ3 - Single Family	Existing	Space Heating	Insulation - Ceiling, Installation	R-38 (Retro only)	Retrofit	R-0	R-38 (Retro only)	RetroEven20	4	sqft roof	1.00	1,232.43	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data Average	BEST	45	1.29	20.31	0.10	0.0%	6.1%
CZ3 - Single Family	Existing	Space Heating	Insulation - Ceiling, Upgrade	R-49	Retrofit	R11+, up to R40	R-49	RetroEven20	4	sqft roof	1.00	1,232.43	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data Average	BEST	45	1.29	5.17	0.03	19.7%	87.5%
CZ3 - Single Family	Existing	Space Heating	Insulation - Slab Foundation	R-11 (NC Only)	Retrofit	R-0	R-11 (NC Only)	Retro3Slow	4	sqft floor	1.00	1,232.43	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	N/A	70	0.95	-	-	5.2%	5.2%
CZ3 - Single Family	Existing	Space Heating	Insulation - Basement Sidewall	R-15	Retrofit	R-0	R-15	Retro1Slow	0	sqft floor	1.00	1,232.43	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	BEST	70	0.95	5.70	0.03	6.0%	32.8%
CZ3 - Single Family	Existing	Space Heating	Insulation - Ducting	duct thermal losses reduced 50%	Retrofit	2°F duct loss	duct thermal losses reduced 50%	Retro1Slow	-1	sqft home	1.00	2,464.87	0.16%	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	20	0.29	8.07	0.02	6.9%	25.0%
CZ3 - Single Family	Existing	Space Heating	Insulation - Infiltration Control (Air Sealing)	20% reduction in ACH50	Retrofit	ACH50 >= 5	20% reduction in ACH50	RetroEven20	4	sqft home	1.00	2,464.87	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	NWPCC 7th Plan: Res-SF Wx-7P v7	BEST	15	0.70	2.63	0.01	11.0%	80.0%
CZ3 - Single Family	Existing	Space Heating	Insulation - Floor/Crawlspace	R-30	Retrofit	R-0	R-30	Retro1Slow	1	sqft floor	1.00	1,232.43	0.16%	RTFSFWx v3 7	RTFSFWx v3 7	ResSFWx v3 7	45	1.39	12.15	0.06	5.1%	52.8%
CZ3 - Single Family	Existing	Space Heating	Insulation - Wall Cavity, Upgrade	R-21	Retrofit	R-11+, up to R-20	R-21	Retro1Slow	0	sqft wall	1.00	1,806.53	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	ORNL ZIP Code Insulation Program	BEST	45	2.01	4.30	0.01	32.2%	79.9%
CZ3 - Single Family	Existing	Space Heating	Insulation - Wall Cavity, Installation	R-11	Retrofit	R-0	R-11	Retro1Slow	0	sqft wall	1.00	1,806.53	0.16%	RTFSFWx v3 7	RTFSFWx v3 7	NWPCC 7th Plan: Res-SF Wx-7P v7	45	1.47	16.11	0.05	0.0%	15.1%
CZ3 - Single Family	Existing	Space Heating	Insulation - Wall Sheathing	R-5 (NC Only)	Retrofit	R-0	R-5 (NC Only)	Retro1Slow	0	sqft wall	1.00	1,806.53	0.16%	RTFSFWx v3 7	ORNL Zip Code Insulation Program	BEST	45	0.89	3.28	0.01	0.0%	0.0%
CZ3 - Single Family	Existing	Space Heating	Ducting - Repair and Sealing	50% reduction in duct leakage	Retrofit	10% air leak to outside	50% reduction in duct leakage	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res-Duct Seal-7P v4	NWPCC 7th Plan: Res-Duct Seal-7P v4	BEST	20	793.95	3.89	23.30	15.0%	50.0%
CZ3 - Single Family	Existing	Space Heating	Doors - Storm and Thermal	R-5 door	Retrofit	R-2.5 door	R-5 door	Retro12Med	5	sqft door	1.00	21.00	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	BEST	45	18.64	0.70	0.20	55.0%	100.0%
CZ3 - Single Family	Existing	Space Heating	Windows - High Efficiency	Double Pane LowE CL22	Retrofit	Single pane	Double Pane LowE CL22	Retro3Slow	-1	sqft window	1.00	231.08	0.16%	RTFSFWx v3 7	RTFSFWx v3 7	BEST	45	23.09	18.32	0.47	89.3%	100.0%
CZ3 - Single Family	Existing	Space Heating	Thermostat - Programmable	Programmed thermostat	Retrofit	Manual/no control	Programmed thermostat	Retro3Slow	3	household	1.00	1.00	0.16%	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	15	61.59	3.48	20.88	16.5%	25.0%
CZ3 - Single Family	Existing	Space Heating	Thermostat - Wi-Fi/Interactive	Interactive/learning thermostat (ie, NEST)	Retrofit	Manual/no control	Interactive/learning thermostat (ie, NEST)	Retro3Slow	-1	household	1.00	1.00	0.16%	ResConnectedTstats v1.2	CNGC Program Data	ResConnectedTstats v1.2	5	254.58	4.18	25.05	10.0%	75.0%
CZ3 - Single Family	Existing	Space Heating	Gas Furnace - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	BEST	2	114.20	-	11.90	35.0%	90.0%
CZ3 - Single Family	Existing	Space Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No reset controls	Reset control installed	Retro5Med	0	household	1.00	1.00	0.16%	IL TRM 5.3.14	IL TRM 5.3.14	IL TRM 5.3.14	20	626.72	-	18.57	10.0%	100.0%
CZ3 - Single Family	Existing	Space Heating	Gas Boiler - Steam Trap Maintenance	Cleaned and restored	Retrofit	Degraded system	Cleaned and restored	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 4.4.16 (pp226-231)	IL TRM 4.4.16 (pp226-231)	IL TRM 4.4.16 (pp226-231)	6	81.56	-	37.14	0.0%	0.0%
CZ3 - Single Family	Existing	Space Heating	Gas Boiler - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	BEST	2	114.20	-	10.59	35.0%	90.0%
CZ3 - Single Family	Existing	Space Heating	Gas Boiler - Pipe Insulation	Pipe insulated throughout home	Retrofit	No insulation	Pipe insulated throughout home	Retro12Med	-1	boil pipe	1.00	90.33	0.16%	IL TRM 5.3.2	DEER	IL TRM 5.3.2	15	5.82	-	0.30	6.9%	100.0%
CZ3 - Single Family	Existing	Water Heating	Water Heater - Drainwater Heat Recovery	Drain equipped with heat recovery system	Retrofit	None	Drain equipped with heat recovery system	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	40	855.55	-	10.87	0.0%	0.0%
CZ3 - Single Family	Existing	Water Heating	Water Heater - Faucet Aerators	1.5 GPM faucet	Retrofit	2.5 GPM faucet	1.5 GPM faucet	Retro1Slow	0	aerators	1.00	3.00	0.16%	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	15	5.30	66.61	5.11	40.0%	100.0%

Residential Non Equipment

Measure					Characteristics									Sources			Measure Assumptions in 2017					
Segment	Vintage	End Use	Measure	Efficient Definition	Replacement Type	Baseline Definition	Measure Description	Measure Ramp Rate Name	Ramp Offset	Input Unit of Measure	Input Units	Units per Household	Line Loss	Lifetime Source	Costs Source	Savings Source	Measure Lifetime (Years)	Incremental Measure Cost ($)	Incremental Non-Energy Benefits ($)	Measure Savings @ generator (therm) (NEM Only)	Base Saturation	Applicability
CZ3 - Single Family	Existing	Water Heating	Water Heater - Low Flow Showerhead (2.0 GPM)	2.0 GPM showerhead	Retrofit	3.5 GPM showerhead	2.0 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.80	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	$ 18.22	$ 15.39	6.44	20.0%	50.0%
CZ3 - Single Family	Existing	Water Heating	Water Heater - Low Flow Showerhead (1.5 GPM)	1.5 GPM showerhead	Retrofit	3.5 GPM showerhead	1.5 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.80	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	$ 18.22	$ 38.77	11.21	20.0%	50.0%
CZ3 - Single Family	Existing	Water Heating	Water Heater - Temperature Setback	Setback to 120° F	Retrofit	135° F set point	Setback to 120° F	Retro3Slow	0	household	1.00	1.00	0.16%	IL TRM 5.4.6	IL TRM 5.4.6	IL TRM 5.4.6	2	$ 5.30	$ -	3.24	10.0%	100.0%
CZ3 - Single Family	Existing	Water Heating	Water Heater - Thermostatic Shower Restriction Valve	Restrictor installed, shutting off water when it is warm	Retrofit	No control	Restrictor installed, shutting off water when it is warm	Retro1Slow	0	showerheads	1.00	1.80	0.16%	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	10	$ 15.28	$ 9.07	2.39	10.0%	100.0%
CZ3 - Single Family	Existing	Water Heating	Water Heater - Pipe Insulation	Insulated 5' of pipe between unit and conditioned space	Retrofit	No insulation of water pipe in unconditioned space	Insulated 5' of pipe between unit and conditioned space	Retro3Slow	-1	feet pipe	1.00	5.00	0.16%	IL TRM 5.3.2	DEER	BEST	15	$ 5.86	$ -	1.69	6.9%	100.0%
CZ3 - Single Family	Existing	Water Heating	Water Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard tank water heater, baseline	40 sq ft supplemental solar system installed	RetroMax60	-1	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	$ 4,690.72	$ -	95.00	2.0%	30.0%
CZ3 - Single Family	Existing	Miscellaneous	Pool Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard baseline pool heater	40 sq ft supplemental solar system installed	RetroEven20	0	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	$ 4,690.72	$ -	202.35	2.0%	30.0%
CZ3 - Single Family	Existing	Water Heating	ENERGY STAR Dishwashers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	15	$ 76.22	$ 941.40	3.70	87.0%	100.0%
CZ3 - Single Family	Existing	Water Heating	ENERGY STAR Clothes Washers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	ResClothesWashers v6 0	ResClothesWashers v6 0	ResClothesWashers v6 0	14	$ 63.06	$ 18.08	6.03	41.0%	100.0%
CZ3 - Single Family	Existing	Space Heating	ENERGY STAR Homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO50Fast	6	household	1.00	1.00	0.16%	CNGC Program Data	N/A	N/A	30	$ 1.00	$ -	-	0.0%	0.0%
CZ3 - Single Family	Existing	Space Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	CNGC Program Data	N/A	N/A	30	$ 1.00	$ -	-	0.0%	0.0%
CZ3 - Single Family	Existing	Water Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	CNGC Program Data	N/A	N/A	30	$ 1.00	$ -	-	0.0%	0.0%
CZ3 - Single Family	Existing	Space Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	$ 4,997.55	$ 6.50	76.08	1.0%	50.0%
CZ3 - Single Family	Existing	Water Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	$ 4,997.55	$ 6.50	60.09	1.0%	50.0%
CZ3 - Single Family	Existing	Space Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	$ 4,997.55	$ 6.50	76.08	1.0%	50.0%
CZ3 - Single Family	Existing	Water Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	$ 4,997.55	$ 6.50	60.09	1.0%	50.0%
CZ3 - Single Family	New	Space Heating	Insulation - Ceiling, Installation	R-38 (Retro only)	Retrofit	R-0	R-38 (Retro only)	RetroEven20	4	sqft roof	1.00	1,232.43	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data Average	N/A	45	$ 1.29	$ -	-	0.0%	0.0%
CZ3 - Single Family	New	Space Heating	Insulation - Ceiling, Upgrade	R-49	Retrofit	R11+, up to R40	R-49	RetroEven20	4	sqft roof	1.00	1,232.43	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data Average	BEST	45	$ 1.29	$ -	-	0.0%	0.0%
CZ3 - Single Family	New	Space Heating	Insulation - Slab Foundation	R-11 (NC Only)	Retrofit	R-0	R-11 (NC Only)	Retro3Slow	4	sqft floor	1.00	1,232.43	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	BEST	70	$ 0.95	$ 7.39	0.03	5.2%	8.9%
CZ3 - Single Family	New	Space Heating	Insulation - Basement Sidewall	R-15	Retrofit	R-0	R-15	Retro1Slow	0	sqft floor	1.00	1,232.43	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	BEST	70	$ 0.95	$ 0.60	0.00	0.0%	5.0%
CZ3 - Single Family	New	Space Heating	Insulation - Ducting	duct thermal losses reduced 50%	Retrofit	2° F duct loss	duct thermal losses reduced 50%	Retro1Slow	-1	sqft home	1.00	2,464.87	0.16%	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	20	$ 0.29	$ 6.56	0.01	17.7%	25.0%
CZ3 - Single Family	New	Space Heating	Insulation - Infiltration Control (Air Sealing)	20% reduction in ACH50	Retrofit	ACH50 >= 5	20% reduction in ACH50	RetroEven20	4	sqft home	1.00	2,464.87	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	NWPCC 7th Plan: Res-SF Wx-7P v7	BEST	15	$ 0.70	$ 4.82	0.01	23.4%	80.0%
CZ3 - Single Family	New	Space Heating	Insulation - Floor/Crawlspace	R-30	Retrofit	R-0	R-30	Retro1Slow	1	sqft floor	1.00	1,232.43	0.16%	RTFSFWx v3 7	RTFSFWx v3 7	ResSFWx v3 7	45	$ 1.39	$ 11.16	0.05	72.2%	72.2%
CZ3 - Single Family	New	Space Heating	Insulation - Wall Cavity, Upgrade	R-21	Retrofit	R-11+, up to R-20	R-21	Retro1Slow	0	sqft wall	1.00	1,806.53	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	ORNL ZIP Code Insulation Program	BEST	45	$ 2.01	$ -	-	100.0%	100.0%
CZ3 - Single Family	New	Space Heating	Insulation - Wall Cavity, Installation	R-11	Retrofit	R-0	R-11	Retro1Slow	0	sqft wall	1.00	1,806.53	0.16%	RTFSFWx v3 7	RTFSFWx v3 7	NWPCC 7th Plan: Res-SF Wx-7P v7	45	$ 0.00	$ -	-	0.0%	0.0%
CZ3 - Single Family	New	Space Heating	Insulation - Wall Sheathing	R-5 (NC Only)	Retrofit	R-0	R-5 (NC Only)	Retro1Slow	0	sqft wall	1.00	1,806.53	0.16%	RTFSFWx v3 7	ORNL Zip Code Insulation Program	BEST	45	$ 0.89	$ 3.10	0.01	65.0%	85.0%
CZ3 - Single Family	New	Space Heating	Ducting - Repair and Sealing	50% reduction in duct leakage	Retrofit	10% air leak to outside	50% reduction in duct leakage	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res-Duct Seal-7P v4	NWPCC 7th Plan: Res-Duct Seal-7P v4	BEST	20	$ 793.95	$ 1.61	7.56	50.0%	50.0%
CZ3 - Single Family	New	Space Heating	Doors - Storm and Thermal	R-5 door	Retrofit	R-2.5 door	R-5 door	Retro12Med	5	sqft door	1.00	21.00	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	BEST	45	$ 0.89	$ 0.03	0.17	60.0%	100.0%
CZ3 - Single Family	New	Space Heating	Windows - High Efficiency	Double Pane LowE CL22	Retrofit	Single pane	Double Pane LowE CL22	Retro3Slow	-1	sqft window	1.00	231.08	0.16%	RTFSFWx v3 7	RTFSFWx v3 7	BEST	45	$ 23.09	$ 16.82	0.40	100.0%	100.0%
CZ3 - Single Family	New	Space Heating	Thermostat - Programmable	Programmed thermostat	Retrofit	Manual/no control	Programmed thermostat	Retro3Slow	3	household	1.00	1.00	0.16%	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	15	$ 61.59	$ 3.20	17.55	19.4%	25.0%
CZ3 - Single Family	New	Space Heating	Thermostat - Wi-Fi/Interactive	Interactive/learning thermostat (ie, NEST)	Retrofit	Manual/no control	Interactive/learning thermostat (ie, NEST)	Retro3Slow	-1	household	1.00	1.00	0.16%	ResConnectedTstats v1.2	CNGC Program Data	ResConnectedTstats v1.2	5	$ 254.58	$ 3.84	21.06	10.0%	75.0%
CZ3 - Single Family	New	Space Heating	Gas Furnace - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	N/A	2	$ 114.20	$ -	-	0.0%	0.0%
CZ3 - Single Family	New	Space Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No reset controls	Reset control installed	Retro5Med	0	household	1.00	1.00	0.16%	IL TRM 5.3.14	IL TRM 5.3.14	IL TRM 5.3.14	20	$ 626.72	$ -	13.48	10.0%	100.0%
CZ3 - Single Family	New	Space Heating	Gas Boiler - Steam Trap Maintenance	Cleaned and restored	Retrofit	Degraded system	Cleaned and restored	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 4.4.16 (pp226-231)	IL TRM 4.4.16 (pp226-231)	N/A	6	$ 81.56	$ -	-	0.0%	0.0%
CZ3 - Single Family	New	Space Heating	Gas Boiler - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	N/A	2	$ 114.20	$ -	-	0.0%	0.0%
CZ3 - Single Family	New	Space Heating	Gas Boiler - Pipe Insulation	Pipe insulated throughout home	Retrofit	No insulation	Pipe insulated throughout home	Retro12Med	-1	boil pipe	1.00	90.33	0.16%	IL TRM 5.3.2	DEER	IL TRM 5.3.2	15	$ 5.82	$ -	0.30	17.7%	100.0%
CZ3 - Single Family	New	Water Heating	Water Heater - Drainwater Heat Recovery	Drain equipped with heat recovery system	Retrofit	None	Drain equipped with heat recovery system	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	40	$ 855.55	$ -	10.87	0.0%	10.0%
CZ3 - Single Family	New	Water Heating	Water Heater - Faucet Aerators	1.5 GPM faucet	Retrofit	2.5 GPM faucet	1.5 GPM faucet	Retro1Slow	0	aerators	1.00	3.00	0.16%	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	15	$ 5.30	$ 66.61	5.11	35.0%	100.0%
CZ3 - Single Family	New	Water Heating	Water Heater - Low Flow Showerhead (2.0 GPM)	2.0 GPM showerhead	Retrofit	3.5 GPM showerhead	2.0 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.80	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	$ 18.22	$ 15.39	6.44	18.0%	50.0%
CZ3 - Single Family	New	Water Heating	Water Heater - Low Flow Showerhead (1.5 GPM)	1.5 GPM showerhead	Retrofit	3.5 GPM showerhead	1.5 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.80	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	$ 18.22	$ 38.77	11.21	18.0%	50.0%
CZ3 - Single Family	New	Water Heating	Water Heater - Temperature Setback	Setback to 120° F	Retrofit	135° F set point	Setback to 120° F	Retro3Slow	0	household	1.00	1.00	0.16%	IL TRM 5.4.6	IL TRM 5.4.6	IL TRM 5.4.6	2	$ 5.30	$ -	3.24	15.0%	100.0%
CZ3 - Single Family	New	Water Heating	Water Heater - Thermostatic Shower Restriction Valve	Restrictor installed, shutting off water when it is warm	Retrofit	No control	Restrictor installed, shutting off water when it is warm	Retro1Slow	0	showerheads	1.00	1.80	0.16%	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	10	$ 15.28	$ 9.07	2.39	0.0%	100.0%
CZ3 - Single Family	New	Water Heating	Water Heater - Pipe Insulation	Insulated 5' of pipe between unit and conditioned space	Retrofit	No insulation of water pipe in unconditioned space	Insulated 5' of pipe between unit and conditioned space	Retro3Slow	-1	feet pipe	1.00	5.00	0.16%	IL TRM 5.3.2	DEER	BEST	15	$ 5.86	$ -	1.51	17.7%	100.0%
CZ3 - Single Family	New	Water Heating	Water Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard tank water heater, baseline	40 sq ft supplemental solar system installed	RetroMax60	-1	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	$ 4,690.72	$ -	95.00	2.0%	30.0%
CZ3 - Single Family	New	Miscellaneous	Pool Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard baseline pool heater	40 sq ft supplemental solar system installed	RetroEven20	0	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	$ 4,690.72	$ -	232.50	2.0%	30.0%
CZ3 - Single Family	New	Water Heating	ENERGY STAR Dishwashers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	15	$ 76.22	$ 941.40	3.70	77.1%	88.6%
CZ3 - Single Family	New	Water Heating	ENERGY STAR Clothes Washers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	ResClothesWashers v6 0	ResClothesWashers v6 0	ResClothesWashers v6 0	14	$ 63.06	$ 18.08	6.03	40.5%	98.7%
CZ3 - Single Family	New	Space Heating	ENERGY STAR Homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO50Fast	6	household	1.00	1.00	0.16%	CNGC Program Data	ENERGY STAR Certified Homes, Version 3 (Rev. 08)	CNGC Program Data 2016, scaled by UEC	30	$ 2,117.00	$ -	174.04	0.0%	0.0%
CZ3 - Single Family	New	Space Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	CNGC Program Data	ENERGY STAR Certified Homes, Version 3 (Rev. 08)	CNGC Program Data 2016	30	$ 2,117.00	$ -	85.00	3.0%	20.0%
CZ3 - Single Family	New	Water Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	CNGC Program Data	ENERGY STAR Certified Homes, Version 3 (Rev. 08)	CNGC Program Data 2016	30	$ 2,117.00	$ -	108.90	3.0%	20.0%
CZ3 - Single Family	New	Space Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	$ 4,997.55	$ 6.50	76.08	0.0%	50.0%
CZ3 - Single Family	New	Water Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	$ 4,997.55	$ 6.50	60.09	0.0%	50.0%
CZ3 - Single Family	New	Space Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	$ 4,997.55	$ 6.50	76.08	0.0%	50.0%
CZ3 - Single Family	New	Water Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	$ 4,997.55	$ 6.50	60.09	0.0%	50.0%
CZ3 - Multi Family	Existing	Space Heating	Insulation - Ceiling, Installation	R-38 (Retro only)	Retrofit	R-0	R-38 (Retro only)	RetroEven20	4	sqft roof - mf	1.00	616.22	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data Average	BEST	45	$ 1.29	$ 9.43	0.11	0.0%	6.1%
CZ3 - Multi Family	Existing	Space Heating	Insulation - Ceiling, Upgrade	R-49	Retrofit	R11+, up to R40	R-49	RetroEven20	4	sqft roof - mf	1.00	616.22	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data Average	BEST	45	$ 1.29	$ 2.40	0.03	19.7%	87.5%
CZ3 - Multi Family	Existing	Space Heating	Insulation - Slab Foundation	R-11 (NC Only)	Retrofit	R-0	R-11 (NC Only)	Retro3Slow	4	sqft floor	1.00	1,232.43	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	N/A	70	$ 0.95	$ -	-	0.0%	0.0%
CZ3 - Multi Family	Existing	Space Heating	Insulation - Basement Sidewall	R-15	Retrofit	R-0	R-15	Retro1Slow	0	sqft floor	1.00	1,232.43	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	N/A	70	$ 0.95	$ -	-	0.0%	0.0%
CZ3 - Multi Family	Existing	Space Heating	Insulation - Ducting	duct thermal losses reduced 50%	Retrofit	2° F duct loss	duct thermal losses reduced 50%	Retro1Slow	-1	sqft home	1.00	1,232.43	0.16%	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	20	$ 0.29	$ 3.75	0.02	6.9%	25.0%
CZ3 - Multi Family	Existing	Space Heating	Insulation - Infiltration Control (Air Sealing)	20% reduction in ACH50	Retrofit	ACH50 >= 5	20% reduction in ACH50	RetroEven20	4	sqft home	1.00	1,232.43	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	NWPCC 7th Plan: Res-SF Wx-7P v7	BEST	15	$ 0.70	$ 1.22	0.01	11.0%	80.0%
CZ3 - Multi Family	Existing	Space Heating	Insulation - Floor/Crawlspace	R-30	Retrofit	R-0	R-30	Retro1Slow	1	sqft floor	1.00	1,232.43	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	ResSFWx v3 7	45	$ 1.04	$ 5.64	0.03	5.1%	52.8%
CZ3 - Multi Family	Existing	Space Heating	Insulation - Wall Cavity, Upgrade	R-21	Retrofit	R-11+, up to R-20	R-21	Retro1Slow	0	sqft wall	1.00	1,189.21	0.16%	NWPCC 7th Plan: Res-MF Wx-7P v7	ORNL ZIP Code Insulation Program	BEST	45	$ 2.01	$ 1.99	0.01	32.2%	79.9%
CZ3 - Multi Family	Existing	Space Heating	Insulation - Wall Cavity, Installation	R-11	Retrofit	R-0	R-11	Retro1Slow	0	sqft wall	1.00	1,189.21	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	NWPCC 7th Plan: Res-MF Wx-7P v7	45	$ 1.10	$ 7.48	0.05	0.0%	15.1%
CZ3 - Multi Family	Existing	Space Heating	Insulation - Wall Sheathing	R-5 (NC Only)	Retrofit	R-0	R-5 (NC Only)	Retro1Slow	0	sqft wall	1.00	1,189.21	0.16%	ResMFWeatherization v3 4	ORNL Zip Code Insulation Program	BEST	45	$ 0.89	$ 4.12	0.03	0.0%	0.0%
CZ3 - Multi Family	Existing	Space Heating	Ducting - Repair and Sealing	50% reduction in duct leakage	Retrofit	10% air leak to outside	50% reduction in duct leakage	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res-Duct Seal-7P v4	NWPCC 7th Plan: Res-Duct Seal-7P v4	BEST	20	$ 793.95	$ 1.81	13.29	15.0%	50.0%
CZ3 - Multi Family	Existing	Space Heating	Doors - Storm and Thermal	R-5 door	Retrofit	R-2.5 door	R-5 door	Retro12Med	5	sqft door	1.00	21.00	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	BEST	45	$ 18.64	$ 0.32	0.11	55.0%	100.0%
CZ3 - Multi Family	Existing	Space Heating	Windows - High Efficiency	Double Pane LowE CL22	Retrofit	Single pane	Double Pane LowE CL22	Retro3Slow	-1	sqft window	1.00	131.87	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	BEST	45	$ 21.05	$ 8.50	0.47	89.3%	100.0%
CZ3 - Multi Family	Existing	Space Heating	Thermostat - Programmable	Programmed thermostat	Retrofit	Manual/no control	Programmed thermostat	Retro3Slow	3	household	1.00	1.00	0.16%	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	15	$ 61.59	$ 1.62	11.90	16.5%	25.0%
CZ3 - Multi Family	Existing	Space Heating	Thermostat - Wi-Fi/Interactive	Interactive/learning thermostat (ie, NEST)	Retrofit	Manual/no control	Interactive/learning thermostat (ie, NEST)	Retro3Slow	-1	household	1.00	1.00	0.16%	ResConnectedTstats v1.2	CNGC Program Data	ResConnectedTstats v1.2	5	$ 254.58	$ 1.94	14.28	10.0%	75.0%
CZ3 - Multi Family	Existing	Space Heating	Gas Furnace - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	BEST	2	$ 114.20	$ -	6.87	35.0%	90.0%
CZ3 - Multi Family	Existing	Space Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No reset controls	Reset control installed	Retro5Med	0	household	1.00	1.00	0.16%	IL TRM 5.3.14	IL TRM 5.3.14	IL TRM 5.3.14	20	$ 626.72	$ -	7.63	10.0%	100.0%
CZ3 - Multi Family	Existing	Space Heating	Gas Boiler - Steam Trap Maintenance	Cleaned and restored	Retrofit	Degraded system	Cleaned and restored	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 4.4.16 (pp226-231)	IL TRM 4.4.16 (pp226-231)	IL TRM 4.4.16 (pp226-231)	6	$ 81.56	$ -	15.27	0.0%	0.0%
CZ3 - Multi Family	Existing	Space Heating	Gas Boiler - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	BEST	2	$ 114.20	$ -	4.41	35.0%	90.0%
CZ3 - Multi Family	Existing	Space Heating	Gas Boiler - Pipe Insulation	Pipe insulated throughout home	Retrofit	No insulation	Pipe insulated throughout home	Retro12Med	-1	boil pipe	1.00	59.46	0.16%	IL TRM 5.3.2	DEER	IL TRM 5.3.2	15	$ 5.82	$ -	0.30	6.9%	100.0%
CZ3 - Multi Family	Existing	Water Heating	Water Heater - Drainwater Heat Recovery	Drain equipped with heat recovery system	Retrofit	None	Drain equipped with heat recovery system	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	40	$ 682.79	$ -	10.87	0.0%	0.0%
CZ3 - Multi Family	Existing	Water Heating	Water Heater - Faucet Aerators	1.5 GPM faucet	Retrofit	2.5 GPM faucet	1.5 GPM faucet	Retro1Slow	0	aerators	1.00	2.00	0.16%	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	15	$ 5.30	$ 31.35	3.61	40.0%	100.0%
CZ3 - Multi Family	Existing	Water Heating	Water Heater - Low Flow Showerhead (2.0 GPM)	2.0 GPM showerhead	Retrofit	3.5 GPM showerhead	2.0 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.30	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	$ 18.22	$ 11.12	6.44	20.0%	50.0%
CZ3 - Multi Family	Existing	Water Heating	Water Heater - Low Flow Showerhead (1.5 GPM)	1.5 GPM showerhead	Retrofit	3.5 GPM showerhead	1.5 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.30	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	$ 18.22	$ 28.00	11.21	20.0%	50.0%
CZ3 - Multi Family	Existing	Water Heating	Water Heater - Temperature Setback	Setback to 120° F	Retrofit	135° F set point	Setback to 120° F	Retro3Slow	0	household	1.00	1.00	0.16%	IL TRM 5.4.6	IL TRM 5.4.6	IL TRM 5.4.6	2	$ 5.30	$ -	3.24	10.0%	100.0%
CZ3 - Multi Family	Existing	Water Heating	Water Heater - Thermostatic Shower Restriction Valve	Restrictor installed, shutting off water when it is warm	Retrofit	No control	Restrictor installed, shutting off water when it is warm	Retro1Slow	0	showerheads	1.00	1.30	0.16%	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	10	$ 15.28	$ 6.55	2.39	10.0%	100.0%
CZ3 - Multi Family	Existing	Water Heating	Water Heater - Pipe Insulation	Insulated 5' of pipe between unit and conditioned space	Retrofit	No insulation of water pipe in unconditioned space	Insulated 5' of pipe between unit and conditioned space	Retro3Slow	-1	feet pipe	1.00	5.00	0.16%	IL TRM 5.3.2	DEER	BEST	15	$ 5.86	$ -	1.06	6.9%	100.0%
CZ3 - Multi Family	Existing	Water Heating	Water Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard tank water heater, baseline	40 sq ft supplemental solar system installed	RetroMax60	-1	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	$ 4,690.72	$ -	59.28	2.0%	30.0%
CZ3 - Multi Family	Existing	Miscellaneous	Pool Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard baseline pool heater	40 sq ft supplemental solar system installed	RetroEven20	0	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	$ 4,690.72	$ -	202.35	2.0%	30.0%
CZ3 - Multi Family	Existing	Water Heating	ENERGY STAR Dishwashers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	15	$ 76.22	$ 941.40	3.70	87.0%	100.0%
CZ3 - Multi Family	Existing	Water Heating	ENERGY STAR Clothes Washers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	ResClothesWashers v6 0	ResClothesWashers v6 0	ResClothesWashers v6 0	14	$ 63.06	$ 18.08	6.03	41.0%	100.0%
CZ3 - Multi Family	Existing	Space Heating	ENERGY STAR Homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO50Fast	6	household	1.00	1.00	0.16%	ResMFEstarHomes2012	N/A	N/A	70	$ 1.00	$ -	-	0.0%	0.0%
CZ3 - Multi Family	Existing	Space Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	ResMFEstarHomes2012	N/A	N/A	70	$ 1.00	$ -	-	0.0%	0.0%
CZ3 - Multi Family	Existing	Water Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	ResMFEstarHomes2012	N/A	N/A	70	$ 1.00	$ -	-	0.0%	0.0%
CZ3 - Multi Family	Existing	Space Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	$ 4,997.55	$ 3.70	43.34	1.0%	50.0%
CZ3 - Multi Family	Existing	Water Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	$ 4,997.55	$ 3.70	37.50	1.0%	50.0%
CZ3 - Multi Family	Existing	Space Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	$ 4,997.55	$ 3.70	43.34	1.0%	50.0%
CZ3 - Multi Family	Existing	Water Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	$ 4,997.55	$ 3.70	37.50	1.0%	50.0%
CZ3 - Multi Family	New	Space Heating	Insulation - Ceiling, Installation	R-38 (Retro only)	Retrofit	R-0	R-38 (Retro only)	RetroEven20	4	sqft roof - mf	1.00	616.22	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data Average	N/A	45	$ 1.29	$ -	-	0.0%	0.0%
CZ3 - Multi Family	New	Space Heating	Insulation - Ceiling, Upgrade	R-49	Retrofit	R11+, up to R40	R-49	RetroEven20	4	sqft roof - mf	1.00	616.22	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	CNGC Program Data Average	BEST	45	$ 1.29	$ -	-	0.0%	0.0%
CZ3 - Multi Family	New	Space Heating	Insulation - Slab Foundation	R-11 (NC Only)	Retrofit	R-0	R-11 (NC Only)	Retro3Slow	4	sqft floor	1.00	1,232.43	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	N/A	70	$ 0.95	$ -	-	0.0%	0.0%
CZ3 - Multi Family	New	Space Heating	Insulation - Basement Sidewall	R-15	Retrofit	R-0	R-15	Retro1Slow	0	sqft floor	1.00	1,232.43	0.16%	ResNewSFSlabInsulation v3.1	ResNewSFSlabInsulation v3.1	N/A	70	$ 0.95	$ -	-	0.0%	0.0%
CZ3 - Multi Family	New	Space Heating	Insulation - Ducting	duct thermal losses reduced 50%	Retrofit	2° F duct loss	duct thermal losses reduced 50%	Retro1Slow	-1	sqft home	1.00	1,232.43	0.16%	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	ResSFDuctSealing v4 4	20	$ 0.29	$ 2.92	0.01	17.7%	25.0%
CZ3 - Multi Family	New	Space Heating	Insulation - Infiltration Control (Air Sealing)	20% reduction in ACH50	Retrofit	ACH50 >= 5	20% reduction in ACH50	RetroEven20	4	sqft home	1.00	1,232.43	0.16%	NWPCC 7th Plan: Res-SF Wx-7P v7	NWPCC 7th Plan: Res-SF Wx-7P v7	BEST	15	$ 0.70	$ 2.21	0.01	23.4%	80.0%
CZ3 - Multi Family	New	Space Heating	Insulation - Floor/Crawlspace	R-30	Retrofit	R-0	R-30	Retro1Slow	1	sqft floor	1.00	1,232.43	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	ResSFWx v3 7	45	$ 1.04	$ 5.13	0.03	72.2%	72.2%
CZ3 - Multi Family	New	Space Heating	Insulation - Wall Cavity, Upgrade	R-21	Retrofit	R-11+, up to R-20	R-21	Retro1Slow	0	sqft wall	1.00	1,189.21	0.16%	NWPCC 7th Plan: Res-MF Wx-7P v7	ORNL ZIP Code Insulation Program	BEST	45	$ 2.01	$ -	-	100.0%	100.0%
CZ3 - Multi Family	New	Space Heating	Insulation - Wall Cavity, Installation	R-11	Retrofit	R-0	R-11	Retro1Slow	0	sqft wall	1.00	1,189.21	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	NWPCC 7th Plan: Res-MF Wx-7P v7	45	$ 0.00	$ -	-	0.0%	0.0%
CZ3 - Multi Family	New	Space Heating	Insulation - Wall Sheathing	R-5 (NC Only)	Retrofit	R-0	R-5 (NC Only)	Retro1Slow	0	sqft wall	1.00	1,189.21	0.16%	ResMFWeatherization v3 4	ORNL Zip Code Insulation Program	BEST	45	$ 0.89	$ 2.92	0.02	65.0%	85.0%
CZ3 - Multi Family	New	Space Heating	Ducting - Repair and Sealing	50% reduction in duct leakage	Retrofit	10% air leak to outside	50% reduction in duct leakage	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res-Duct Seal-7P v4	NWPCC 7th Plan: Res-Duct Seal-7P v4	BEST	20	$ 793.95	$ 0.72	4.39	50.0%	50.0%
CZ3 - Multi Family	New	Space Heating	Doors - Storm and Thermal	R-5 door	Retrofit	R-2.5 door	R-5 door	Retro12Med	5	sqft door	1.00	21.00	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	BEST	45	$ 0.89	$ 0.01	0.10	60.0%	100.0%
CZ3 - Multi Family	New	Space Heating	Windows - High Efficiency	Double Pane LowE CL22	Retrofit	Single pane	Double Pane LowE CL22	Retro3Slow	-1	sqft window	1.00	131.87	0.16%	ResMFWeatherization v3 4	ResMFWeatherization v3 4	BEST	45	$ 21.05	$ 7.73	0.41	100.0%	100.0%
CZ3 - Multi Family	New	Space Heating	Thermostat - Programmable	Programmed thermostat	Retrofit	Manual/no control	Programmed thermostat	Retro3Slow	3	household	1.00	1.00	0.16%	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	RTF: ResSFElectronicTStats v3.1	15	$ 61.59	$ 1.47	10.18	19.4%	25.0%
CZ3 - Multi Family	New	Space Heating	Thermostat - Wi-Fi/Interactive	Interactive/learning thermostat (ie, NEST)	Retrofit	Manual/no control	Interactive/learning thermostat (ie, NEST)	Retro3Slow	-1	household	1.00	1.00	0.16%	ResConnectedTstats v1.2	CNGC Program Data	ResConnectedTstats v1.2	5	$ 254.58	$ 1.76	12.22	10.0%	75.0%
CZ3 - Multi Family	New	Space Heating	Gas Furnace - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	N/A	2	$ 114.20	$ -	-	0.0%	0.0%
CZ3 - Multi Family	New	Space Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No reset controls	Reset control installed	Retro5Med	0	household	1.00	1.00	0.16%	IL TRM 5.3.14	IL TRM 5.3.14	IL TRM 5.3.14	20	$ 626.72	$ -	4.64	10.0%	100.0%
CZ3 - Multi Family	New	Space Heating	Gas Boiler - Steam Trap Maintenance	Cleaned and restored	Retrofit	Degraded system	Cleaned and restored	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 4.4.16 (pp226-231)	IL TRM 4.4.16 (pp226-231)	N/A	6	$ 81.56	$ -	-	0.0%	0.0%
CZ3 - Multi Family	New	Space Heating	Gas Boiler - Maintenance	Restored to nameplate 80% AFUE	Retrofit	Degraded efficiency 10% below nameplate	Restored to nameplate 80% AFUE	RetroEven20	0	household	1.00	1.00	0.16%	IL TRM 5.3.13	RSMeans 2015	N/A	2	$ 114.20	$ -	-	0.0%	0.0%
CZ3 - Multi Family	New	Space Heating	Gas Boiler - Pipe Insulation	Pipe insulated throughout home	Retrofit	No insulation	Pipe insulated throughout home	Retro12Med	-1	boil pipe	1.00	59.46	0.16%	IL TRM 5.3.2	DEER	IL TRM 5.3.2	15	$ 5.82	$ -	0.30	17.7%	100.0%
CZ3 - Multi Family	New	Water Heating	Water Heater - Drainwater Heat Recovery	Drain equipped with heat recovery system	Retrofit	None	Drain equipped with heat recovery system	Retro1Slow	-1	household	1.00	1.00	0.16%	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	NWPCC 7th Plan: Res: Res-GFX-7P v3	40	$ 682.79	$ -	10.87	0.0%	10.0%
CZ3 - Multi Family	New	Water Heating	Water Heater - Faucet Aerators	1.5 GPM faucet	Retrofit	2.5 GPM faucet	1.5 GPM faucet	Retro1Slow	0	aerators	1.00	2.00	0.16%	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	NWPCC Seventh Plan: Res: Res-Aerator-7P v5	15	$ 5.30	$ 31.35	3.61	35.0%	100.0%
CZ3 - Multi Family	New	Water Heating	Water Heater - Low Flow Showerhead (2.0 GPM)	2.0 GPM showerhead	Retrofit	3.5 GPM showerhead	2.0 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.30	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	$ 18.22	$ 11.12	6.44	18.0%	50.0%
CZ3 - Multi Family	New	Water Heating	Water Heater - Low Flow Showerhead (1.5 GPM)	1.5 GPM showerhead	Retrofit	3.5 GPM showerhead	1.5 GPM showerhead	Retro1Slow	0	showerheads	1.00	1.30	0.16%	RTF: Showerheads v3.1	RTF: Showerheads v3.1	RTF: Showerheads v3.1	10	$ 18.22	$ 28.00	11.21	18.0%	50.0%
CZ3 - Multi Family	New	Water Heating	Water Heater - Temperature Setback	Setback to 120° F	Retrofit	135° F set point	Setback to 120° F	Retro3Slow	0	household	1.00	1.00	0.16%	IL TRM 5.4.6	IL TRM 5.4.6	IL TRM 5.4.6	2	$ 5.30	$ -	3.24	15.0%	100.0%
CZ3 - Multi Family	New	Water Heating	Water Heater - Thermostatic Shower Restriction Valve	Restrictor installed, shutting off water when it is warm	Retrofit	No control	Restrictor installed, shutting off water when it is warm	Retro1Slow	0	showerheads	1.00	1.30	0.16%	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	RTF: ThermostaticShowerRestrictionValve v1 3	10	$ 15.28	$ 6.55	2.39	0.0%	100.0%
CZ3 - Multi Family	New	Water Heating	Water Heater - Pipe Insulation	Insulated 5' of pipe between unit and conditioned space	Retrofit	No insulation of water pipe in unconditioned space	Insulated 5' of pipe between unit and conditioned space	Retro3Slow	-1	feet pipe	1.00	5.00	0.16%	IL TRM 5.3.2	DEER	BEST	15	$ 5.86	$ -	0.92	17.7%	100.0%
CZ3 - Multi Family	New	Water Heating	Water Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard tank water heater, baseline	40 sq ft supplemental solar system installed	RetroMax60	-1	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	$ 4,690.72	$ -	59.25	2.0%	30.0%
CZ3 - Multi Family	New	Miscellaneous	Pool Heater - Solar System	40 sq ft supplemental solar system installed	Retrofit	Standard baseline pool heater	40 sq ft supplemental solar system installed	RetroEven20	0	household	1.00	1.00	0.16%	Michigan Energy Measure Database	Michigan Energy Measure Database	Michigan Energy Measure Database	20	$ 4,690.72	$ -	232.50	2.0%	30.0%
CZ3 - Multi Family	New	Water Heating	ENERGY STAR Dishwashers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	DOE Dishwasher Res Technical Support Document	15	$ 76.22	$ 941.40	3.70	67.9%	78.0%
CZ3 - Multi Family	New	Water Heating	ENERGY STAR Clothes Washers	ENERGY STAR unit	Lost Opportunity	Minimum standard unit	ENERGY STAR unit	RetroEven20	1	household	1.00	1.00	0.16%	ResClothesWashers v6 0	ResClothesWashers v6 0	ResClothesWashers v6 0	14	$ 63.06	$ 18.08	6.03	19.3%	47.0%
CZ3 - Multi Family	New	Space Heating	ENERGY STAR Homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO50Fast	6	household	1.00	1.00	0.16%	ResMFEstarHomes2012	ResMFEstarHomes2012	ResMFEstarHomes2012	70	$ 2,457.20	$ -	18.94	0.0%	0.0%
CZ3 - Multi Family	New	Space Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	ResMFEstarHomes2012	ResMFEstarHomes2012	ResMFEstarHomes2012	70	$ 2,457.20	$ -	9.12	0.0%	0.0%
CZ3 - Multi Family	New	Water Heating	Built Green homes	Built Green spec (NC Only)	Retrofit	WA Building Code	Built Green spec (NC Only)	LO1Slow	2	household	1.00	1.00	0.16%	ResMFEstarHomes2012	ResMFEstarHomes2012	ResMFEstarHomes2012	70	$ 2,457.20	$ -	9.82	0.0%	0.0%
CZ3 - Multi Family	New	Space Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	$ 4,997.55	$ 3.70	43.34	0.0%	50.0%
CZ3 - Multi Family	New	Water Heating	Combined Boiler + DHW System (Storage Tank)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and water heating baseline storage tank 40 gal	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC Program Data	Calculated	21	$ 4,997.55	$ 3.70	37.50	0.0%	50.0%
CZ3 - Multi Family	New	Space Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	$ 4,997.55	$ 3.70	43.34	0.0%	50.0%
CZ3 - Multi Family	New	Water Heating	Combined Boiler + DHW System (Tankless)	Combined tankless boiler unit for space and DHW	Lost Opportunity	Gas space heating AFUE 80% and separate water heating tankless unit	Combined tankless boiler unit for space and DHW	LO20Fast	0	household	1.00	1.00	0.16%	CNGC Program Data	CNGC: 2018 COMBO Data 10.2.17 Rev1	Calculated	21	$ 4,997.55	$ 3.70	37.50	0.0%	50.0%

Commercial Equipment

Measure					Characteristics									Sources			Measure Assumptions in 2017						
Segment	Vintage	End Use	Measure	Efficient Definition in 2018	Replacement Type	Baseline Definition	Efficient Definition / Measure Description	Measure Ramp Rate Name	Ramp Offset	Input Unit of Measure	Input Units	Units per Square Foot	Transmission Losses	Lifetime Source	Costs Source	Savings Source	Measure Lifetime (Years)	Incremental Measure Cost ($)	Incremental Non-Energy Benefits ($)	Cost Scalar	Measure Savings @ meter (kWh) (NEM Only)	Base Saturation	Applicability
Office	Existing	Heating	Furnace	AFUE 95%	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	0.04	0.16%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	$ -	100.0%	2.54	74.5%	50.0%
Office	Existing	Heating	Boiler	AFUE 98%	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	1	1 kBtu/hr	1.00	0.03	0.16%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	$ -	104.2%	4.47	16.7%	100.0%
Office	Existing	Heating	Unit Heater	Infrared Radiant	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	0.02	0.16%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	$ -	100.0%	3.20	9.1%	100.0%
Office	Existing	Water Heating	Water Heater	TE 0.94	Turnover	TE 0.80	TE 0.94	LO20Fast	0	1 kBtu/hr	1.00	0.00	0.16%	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	15	$ 8.96	$ -	105.9%	5.04	31.1%	100.0%
Office	Existing	Food Preparation	Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-ILTRM-v5.0-23	10	$ 177.71	$ 5.73	104.2%	304.67	0.9%	100.0%
Office	Existing	Food Preparation	Conveyor Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	17	$ 1,743.88	$ -	107.9%	733.00	0.4%	100.0%
Office	Existing	Food Preparation	Double Rack Oven	FTSC Qualified (>50% Cooking Efficiency)	Turnover	Standard	FTSC Qualified (>50% Cooking Efficiency)	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	12	$ 8,560.74	$ -	107.9%	2,064.00	0.4%	100.0%
Office	Existing	Food Preparation	Fryer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO12Med	2	1 unit	1.00	0.00	0.16%	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	15	$ 1,200.00	$ -	110.1%	505.23	1.8%	100.0%
Office	Existing	Food Preparation	Broiler	Infrared Burners	Turnover	Standard	Infrared Burners	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	12	$ 1,000.00	$ -	107.9%	239.00	0.4%	100.0%
Office	Existing	Food Preparation	Griddle	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_GRD-Food Preparation-ILTRM-v5.0-1	COOK_GRD-Food Preparation-EIA14-2014 Ref. Case-5	COOK_GRD-Food Preparation-ILTRM-v5.0-1	12	$ 360.00	$ -	104.2%	148.41	1.0%	100.0%
Office	Existing	Food Preparation	Range	High Efficiency	Turnover	Standard	High Efficiency	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-1	DOE Commercial R&D 2016 - Table 2-10	DOE Commercial R&D 2016 - Table 2-18	10	$ 400.00	$ -	110.1%	735.00	5.3%	100.0%
Office	Existing	Food Preparation	Steamer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	12	$ 998.00	$ 2.63	105.9%	1,007.26	0.4%	100.0%
Office	Existing	Food Preparation	Food Prep Other	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	N/A	N/A	N/A	10	$ 1.00	$ -	110.1%	0.01	0.8%	100.0%
Office	Existing	Miscellaneous	Pool Heater	Condensing (EF .90)	Turnover	Standard (EF .82)	Condensing (EF .90)	LO3Slow	0	1 unit	1.00	0.00	0.16%	DOE Commercial R&D 2016 - Table 7-6	DOE Commercial R&D 2016 - Table 7-7	DOE Commercial R&D 2016 - Table 7-9	6	$ 11,506.00	$ -	102.4%	2,233.50	1.0%	100.0%
Office	Existing	Miscellaneous	Miscellaneous	Standard	Turnover	Standard	Standard	LO3Slow	0	1 unit	1.00	0.01	0.16%	N/A	N/A	N/A	5	$ -	$ -	100.0%	-	100.0%	100.0%
Office	New	Heating	Furnace	AFUE 95%	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	0.03	0.16%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	$ -	100.0%	2.67	74.5%	50.0%
Office	New	Heating	Boiler	AFUE 98%	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	1	1 kBtu/hr	1.00	0.03	0.16%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	$ -	104.2%	4.57	16.7%	100.0%
Office	New	Heating	Unit Heater	Infrared Radiant	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	0.02	0.16%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	$ -	100.0%	3.20	9.1%	100.0%
Office	New	Water Heating	Water Heater	TE 0.94	Turnover	TE 0.80	TE 0.94	LO20Fast	0	1 kBtu/hr	1.00	0.00	0.16%	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	15	$ 8.96	$ -	105.9%	6.53	34.3%	100.0%
Office	New	Food Preparation	Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-ILTRM-v5.0-23	10	$ 177.71	$ 5.73	104.2%	304.67	0.9%	100.0%
Office	New	Food Preparation	Conveyor Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	17	$ 1,743.88	$ -	107.9%	733.00	0.4%	100.0%
Office	New	Food Preparation	Double Rack Oven	FTSC Qualified (>50% Cooking Efficiency)	Turnover	Standard	FTSC Qualified (>50% Cooking Efficiency)	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	12	$ 8,560.74	$ -	107.9%	2,064.00	0.4%	100.0%
Office	New	Food Preparation	Fryer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO12Med	2	1 unit	1.00	0.00	0.16%	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	15	$ 1,200.00	$ -	110.1%	505.23	1.8%	100.0%
Office	New	Food Preparation	Broiler	Infrared Burners	Turnover	Standard	Infrared Burners	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	12	$ 1,000.00	$ -	107.9%	239.00	0.4%	100.0%
Office	New	Food Preparation	Griddle	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_GRD-Food Preparation-ILTRM-v5.0-1	COOK_GRD-Food Preparation-EIA14-2014 Ref. Case-5	COOK_GRD-Food Preparation-ILTRM-v5.0-1	12	$ 360.00	$ -	104.2%	148.41	1.0%	100.0%
Office	New	Food Preparation	Range	High Efficiency	Turnover	Standard	High Efficiency	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-1	DOE Commercial R&D 2016 - Table 2-10	DOE Commercial R&D 2016 - Table 2-18	10	$ 400.00	$ -	110.1%	735.00	5.3%	100.0%
Office	New	Food Preparation	Steamer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	12	$ 998.00	$ 2.63	105.9%	1,007.26	0.4%	100.0%
Office	New	Food Preparation	Food Prep Other	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	N/A	N/A	N/A	10	$ 1.00	$ -	110.1%	0.01	0.8%	100.0%
Office	New	Miscellaneous	Pool Heater	Condensing (EF .90)	Turnover	Standard (EF .82)	Condensing (EF .90)	LO3Slow	0	1 unit	1.00	0.00	0.16%	DOE Commercial R&D 2016 - Table 7-6	DOE Commercial R&D 2016 - Table 7-7	DOE Commercial R&D 2016 - Table 7-9	6	$ 11,506.00	$ -	102.4%	2,233.50	1.0%	100.0%
Office	New	Miscellaneous	Miscellaneous	Standard	Turnover	Standard	Standard	LO3Slow	0	1 unit	1.00	1.00	0.16%	N/A	N/A	N/A	5	$ -	$ -	100.0%	-	100.0%	100.0%
Retail	Existing	Heating	Furnace	AFUE 95%	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	0.05	0.16%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	$ -	100.0%	1.95	79.6%	45.0%
Retail	Existing	Heating	Boiler	AFUE 98%	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	1	1 kBtu/hr	1.00	0.05	0.16%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	$ -	104.2%	4.00	4.7%	100.0%
Retail	Existing	Heating	Unit Heater	Infrared Radiant	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	0.02	0.16%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	$ -	100.0%	3.20	35.6%	100.0%
Retail	Existing	Water Heating	Water Heater	TE 0.94	Turnover	TE 0.80	TE 0.94	LO20Fast	0	1 kBtu/hr	1.00	0.01	0.16%	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	15	$ 8.96	$ -	105.9%	5.62	32.7%	100.0%
Retail	Existing	Food Preparation	Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-ILTRM-v5.0-23	10	$ 177.71	$ 5.73	104.2%	304.67	3.8%	100.0%
Retail	Existing	Food Preparation	Conveyor Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	17	$ 1,743.88	$ -	107.9%	733.00	1.9%	100.0%
Retail	Existing	Food Preparation	Double Rack Oven	FTSC Qualified (>50% Cooking Efficiency)	Turnover	Standard	FTSC Qualified (>50% Cooking Efficiency)	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	12	$ 8,560.74	$ -	107.9%	2,064.00	1.9%	100.0%
Retail	Existing	Food Preparation	Fryer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO12Med	2	1 unit	1.00	0.00	0.16%	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	15	$ 1,200.00	$ -	110.1%	505.23	6.6%	100.0%
Retail	Existing	Food Preparation	Broiler	Infrared Burners	Turnover	Standard	Infrared Burners	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	12	$ 1,000.00	$ -	107.9%	239.00	1.2%	100.0%
Retail	Existing	Food Preparation	Griddle	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_GRD-Food Preparation-ILTRM-v5.0-1	COOK_GRD-Food Preparation-EIA14-2014 Ref. Case-5	COOK_GRD-Food Preparation-ILTRM-v5.0-1	12	$ 360.00	$ -	104.2%	148.41	4.3%	100.0%
Retail	Existing	Food Preparation	Range	High Efficiency	Turnover	Standard	High Efficiency	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-1	DOE Commercial R&D 2016 - Table 2-10	DOE Commercial R&D 2016 - Table 2-18	10	$ 400.00	$ -	110.1%	735.00	5.8%	100.0%
Retail	Existing	Food Preparation	Steamer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	12	$ 998.00	$ 2.63	105.9%	1,007.26	1.1%	100.0%
Retail	Existing	Food Preparation	Food Prep Other	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	N/A	N/A	N/A	10	$ 1.00	$ -	110.1%	0.01	1.1%	100.0%
Retail	Existing	Miscellaneous	Pool Heater	Condensing (EF .90)	Turnover	Standard (EF .82)	Condensing (EF .90)	LO3Slow	0	1 unit	1.00	0.00	0.16%	DOE Commercial R&D 2016 - Table 7-6	DOE Commercial R&D 2016 - Table 7-7	DOE Commercial R&D 2016 - Table 7-9	6	$ 11,506.00	$ -	102.4%	2,233.50	0.3%	100.0%
Retail	Existing	Miscellaneous	Miscellaneous	Standard	Turnover	Standard	Standard	LO3Slow	0	1 unit	1.00	0.01	0.16%	N/A	N/A	N/A	5	$ -	$ -	100.0%	-	100.0%	100.0%
Retail	New	Heating	Furnace	AFUE 95%	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	0.05	0.16%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	$ -	100.0%	1.95	79.6%	45.0%
Retail	New	Heating	Boiler	AFUE 98%	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	1	1 kBtu/hr	1.00	0.05	0.16%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	$ -	104.2%	4.16	4.7%	100.0%
Retail	New	Heating	Unit Heater	Infrared Radiant	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	0.02	0.16%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	$ -	100.0%	3.20	35.6%	100.0%
Retail	New	Water Heating	Water Heater	TE 0.94	Turnover	TE 0.80	TE 0.94	LO20Fast	0	1 kBtu/hr	1.00	0.00	0.16%	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	15	$ 8.96	$ -	105.9%	7.29	35.9%	100.0%
Retail	New	Food Preparation	Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-ILTRM-v5.0-23	10	$ 177.71	$ 5.73	104.2%	304.67	3.8%	100.0%
Retail	New	Food Preparation	Conveyor Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	17	$ 1,743.88	$ -	107.9%	733.00	1.9%	100.0%
Retail	New	Food Preparation	Double Rack Oven	FTSC Qualified (>50% Cooking Efficiency)	Turnover	Standard	FTSC Qualified (>50% Cooking Efficiency)	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	12	$ 8,560.74	$ -	107.9%	2,064.00	1.9%	100.0%
Retail	New	Food Preparation	Fryer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO12Med	2	1 unit	1.00	0.00	0.16%	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	15	$ 1,200.00	$ -	110.1%	505.23	6.6%	100.0%
Retail	New	Food Preparation	Broiler	Infrared Burners	Turnover	Standard	Infrared Burners	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	12	$ 1,000.00	$ -	107.9%	239.00	1.2%	100.0%
Retail	New	Food Preparation	Griddle	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_GRD-Food Preparation-ILTRM-v5.0-1	COOK_GRD-Food Preparation-EIA14-2014 Ref. Case-5	COOK_GRD-Food Preparation-ILTRM-v5.0-1	12	$ 360.00	$ -	104.2%	148.41	4.3%	100.0%
Retail	New	Food Preparation	Range	High Efficiency	Turnover	Standard	High Efficiency	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-1	DOE Commercial R&D 2016 - Table 2-10	DOE Commercial R&D 2016 - Table 2-18	10	$ 400.00	$ -	110.1%	735.00	5.8%	100.0%
Retail	New	Food Preparation	Steamer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	12	$ 998.00	$ 2.63	105.9%	1,007.26	1.1%	100.0%
Retail	New	Food Preparation	Food Prep Other	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	N/A	N/A	N/A	10	$ 1.00	$ -	110.1%	0.01	1.1%	100.0%
Retail	New	Miscellaneous	Pool Heater	Condensing (EF .90)	Turnover	Standard (EF .82)	Condensing (EF .90)	LO3Slow	0	1 unit	1.00	0.00	0.16%	DOE Commercial R&D 2016 - Table 7-6	DOE Commercial R&D 2016 - Table 7-7	DOE Commercial R&D 2016 - Table 7-9	6	$ 11,506.00	$ -	102.4%	2,233.50	0.3%	100.0%
Retail	New	Miscellaneous	Miscellaneous	Standard	Turnover	Standard	Standard	LO3Slow	0	1 unit	1.00	1.00	0.16%	N/A	N/A	N/A	5	$ -	$ -	100.0%	-	100.0%	100.0%
Restaurant	Existing	Heating	Furnace	AFUE 95%	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	0.07	0.16%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	$ -	100.0%	0.95	74.3%	30.0%
Restaurant	Existing	Heating	Boiler	AFUE 98%	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	1	1 kBtu/hr	1.00	0.07	0.16%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	$ -	104.2%	2.46	2.9%	100.0%
Restaurant	Existing	Heating	Unit Heater	Infrared Radiant	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	0.02	0.16%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	$ -	100.0%	3.20	12.3%	100.0%
Restaurant	Existing	Water Heating	Water Heater	TE 0.94	Turnover	TE 0.80	TE 0.94	LO20Fast	0	1 kBtu/hr	1.00	0.02	0.16%	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	15	$ 8.96	$ -	105.9%	5.15	73.3%	100.0%
Restaurant	Existing	Food Preparation	Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-ILTRM-v5.0-23	10	$ 177.71	$ 5.73	104.2%	304.67	14.6%	100.0%
Restaurant	Existing	Food Preparation	Conveyor Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	17	$ 1,743.88	$ -	107.9%	733.00	7.3%	100.0%
Restaurant	Existing	Food Preparation	Double Rack Oven	FTSC Qualified (>50% Cooking Efficiency)	Turnover	Standard	FTSC Qualified (>50% Cooking Efficiency)	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	12	$ 8,560.74	$ -	107.9%	2,064.00	7.3%	100.0%
Restaurant	Existing	Food Preparation	Fryer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO12Med	2	1 unit	1.00	0.00	0.16%	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	15	$ 1,200.00	$ -	110.1%	505.23	58.4%	100.0%
Restaurant	Existing	Food Preparation	Broiler	Infrared Burners	Turnover	Standard	Infrared Burners	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	12	$ 1,000.00	$ -	107.9%	239.00	23.1%	100.0%
Restaurant	Existing	Food Preparation	Griddle	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_GRD-Food Preparation-ILTRM-v5.0-1	COOK_GRD-Food Preparation-EIA14-2014 Ref. Case-5	COOK_GRD-Food Preparation-ILTRM-v5.0-1	12	$ 360.00	$ -	104.2%	148.41	33.7%	100.0%
Restaurant	Existing	Food Preparation	Range	High Efficiency	Turnover	Standard	High Efficiency	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-1	DOE Commercial R&D 2016 - Table 2-10	DOE Commercial R&D 2016 - Table 2-18	10	$ 400.00	$ -	110.1%	735.00	51.5%	100.0%
Restaurant	Existing	Food Preparation	Steamer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	12	$ 998.00	$ 2.63	105.9%	1,007.26	6.7%	100.0%
Restaurant	Existing	Food Preparation	Food Prep Other	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	N/A	N/A	N/A	10	$ 1.00	$ -	110.1%	0.01	6.7%	100.0%
Restaurant	Existing	Miscellaneous	Pool Heater	Condensing (EF .90)	Turnover	Standard (EF .82)	Condensing (EF .90)	LO3Slow	0	1 unit	1.00	0.00	0.16%	DOE Commercial R&D 2016 - Table 7-6	DOE Commercial R&D 2016 - Table 7-7	DOE Commercial R&D 2016 - Table 7-9	6	$ 11,506.00	$ -	102.4%	2,233.50	0.6%	100.0%
Restaurant	Existing	Miscellaneous	Miscellaneous	Standard	Turnover	Standard	Standard	LO3Slow	0	1 unit	1.00	0.05	0.16%	N/A	N/A	N/A	5	$ -	$ -	100.0%	-	100.0%	100.0%
Restaurant	New	Heating	Furnace	AFUE 95%	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	0.07	0.16%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	$ -	100.0%	0.95	74.3%	30.0%
Restaurant	New	Heating	Boiler	AFUE 98%	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	1	1 kBtu/hr	1.00	0.07	0.16%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	$ -	104.2%	2.49	2.9%	100.0%
Restaurant	New	Heating	Unit Heater	Infrared Radiant	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	0.02	0.16%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	$ -	100.0%	3.20	12.3%	100.0%
Restaurant	New	Water Heating	Water Heater	TE 0.94	Turnover	TE 0.80	TE 0.94	LO20Fast	0	1 kBtu/hr	1.00	0.01	0.16%	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	15	$ 8.96	$ -	105.9%	6.68	80.7%	100.0%
Restaurant	New	Food Preparation	Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-ILTRM-v5.0-23	10	$ 177.71	$ 5.73	104.2%	304.67	14.6%	100.0%
Restaurant	New	Food Preparation	Conveyor Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	17	$ 1,743.88	$ -	107.9%	733.00	7.3%	100.0%
Restaurant	New	Food Preparation	Double Rack Oven	FTSC Qualified (>50% Cooking Efficiency)	Turnover	Standard	FTSC Qualified (>50% Cooking Efficiency)	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	12	$ 8,560.74	$ -	107.9%	2,064.00	7.3%	100.0%
Restaurant	New	Food Preparation	Fryer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO12Med	2	1 unit	1.00	0.00	0.16%	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	15	$ 1,200.00	$ -	110.1%	505.23	58.4%	100.0%
Restaurant	New	Food Preparation	Broiler	Infrared Burners	Turnover	Standard	Infrared Burners	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	12	$ 1,000.00	$ -	107.9%	239.00	23.1%	100.0%
Restaurant	New	Food Preparation	Griddle	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_GRD-Food Preparation-ILTRM-v5.0-1	COOK_GRD-Food Preparation-EIA14-2014 Ref. Case-5	COOK_GRD-Food Preparation-ILTRM-v5.0-1	12	$ 360.00	$ -	104.2%	148.41	33.7%	100.0%
Restaurant	New	Food Preparation	Range	High Efficiency	Turnover	Standard	High Efficiency	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-1	DOE Commercial R&D 2016 - Table 2-10	DOE Commercial R&D 2016 - Table 2-18	10	$ 400.00	$ -	110.1%	735.00	51.5%	100.0%
Restaurant	New	Food Preparation	Steamer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	12	$ 998.00	$ 2.63	105.9%	1,007.26	6.7%	100.0%
Restaurant	New	Food Preparation	Food Prep Other	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	N/A	N/A	N/A	10	$ 1.00	$ -	110.1%	0.01	6.7%	100.0%
Restaurant	New	Miscellaneous	Pool Heater	Condensing (EF .90)	Turnover	Standard (EF .82)	Condensing (EF .90)	LO3Slow	0	1 unit	1.00	0.00	0.16%	DOE Commercial R&D 2016 - Table 7-6	DOE Commercial R&D 2016 - Table 7-7	DOE Commercial R&D 2016 - Table 7-9	6	$ 11,506.00	$ -	102.4%	2,233.50	0.6%	100.0%
Restaurant	New	Miscellaneous	Miscellaneous	Standard	Turnover	Standard	Standard	LO3Slow	0	1 unit	1.00	1.00	0.16%	N/A	N/A	N/A	5	$ -	$ -	100.0%	-	100.0%	100.0%
Grocery	Existing	Heating	Furnace	AFUE 95%	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	0.04	0.16%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	$ -	100.0%	2.42	84.0%	25.0%
Grocery	Existing	Heating	Boiler	AFUE 98%	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	1	1 kBtu/hr	1.00	0.04	0.16%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	$ -	104.2%	4.76	2.5%	100.0%
Grocery	Existing	Heating	Unit Heater	Infrared Radiant	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	0.02	0.16%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	$ -	100.0%	3.20	48.9%	100.0%
Grocery	Existing	Water Heating	Water Heater	TE 0.94	Turnover	TE 0.80	TE 0.94	LO20Fast	0	1 kBtu/hr	1.00	0.01	0.16%	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	15	$ 8.96	$ -	105.9%	5.51	76.6%	100.0%
Grocery	Existing	Food Preparation	Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-ILTRM-v5.0-23	10	$ 177.71	$ 5.73	104.2%	304.67	24.3%	100.0%
Grocery	Existing	Food Preparation	Conveyor Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	17	$ 1,743.88	$ -	107.9%	733.00	12.1%	100.0%
Grocery	Existing	Food Preparation	Double Rack Oven	FTSC Qualified (>50% Cooking Efficiency)	Turnover	Standard	FTSC Qualified (>50% Cooking Efficiency)	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	12	$ 8,560.74	$ -	107.9%	2,064.00	12.1%	100.0%
Grocery	Existing	Food Preparation	Fryer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO12Med	2	1 unit	1.00	0.00	0.16%	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	15	$ 1,200.00	$ -	110.1%	505.23	51.7%	100.0%
Grocery	Existing	Food Preparation	Broiler	Infrared Burners	Turnover	Standard	Infrared Burners	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	12	$ 1,000.00	$ -	107.9%	239.00	2.9%	100.0%
Grocery	Existing	Food Preparation	Griddle	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_GRD-Food Preparation-ILTRM-v5.0-1	COOK_GRD-Food Preparation-EIA14-2014 Ref. Case-5	COOK_GRD-Food Preparation-ILTRM-v5.0-1	12	$ 360.00	$ -	104.2%	148.41	6.4%	100.0%
Grocery	Existing	Food Preparation	Range	High Efficiency	Turnover	Standard	High Efficiency	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-1	DOE Commercial R&D 2016 - Table 2-10	DOE Commercial R&D 2016 - Table 2-18	10	$ 400.00	$ -	110.1%	735.00	26.8%	100.0%
Grocery	Existing	Food Preparation	Steamer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	12	$ 998.00	$ 2.63	105.9%	1,007.26	2.0%	100.0%
Grocery	Existing	Food Preparation	Food Prep Other	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	N/A	N/A	N/A	10	$ 1.00	$ -	110.1%	0.01	2.0%	100.0%
Grocery	Existing	Miscellaneous	Pool Heater	Condensing (EF .90)	Turnover	Standard (EF .82)	Condensing (EF .90)	LO3Slow	0	1 unit	1.00	0.00	0.16%	DOE Commercial R&D 2016 - Table 7-6	DOE Commercial R&D 2016 - Table 7-7	DOE Commercial R&D 2016 - Table 7-9	6	$ 11,506.00	$ -	102.4%	2,233.50	0.2%	100.0%
Grocery	Existing	Miscellaneous	Miscellaneous	Standard	Turnover	Standard	Standard	LO3Slow	0	1 unit	1.00	0.02	0.16%	N/A	N/A	N/A	5	$ -	$ -	100.0%	-	100.0%	100.0%
Grocery	New	Heating	Furnace	AFUE 95%	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	0.04	0.16%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	$ -	100.0%	2.42	84.0%	25.0%
Grocery	New	Heating	Boiler	AFUE 98%	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	1	1 kBtu/hr	1.00	0.04	0.16%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	$ -	104.2%	4.67	2.5%	100.0%
Grocery	New	Heating	Unit Heater	Infrared Radiant	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	0.02	0.16%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	$ -	100.0%	3.20	48.9%	100.0%
Grocery	New	Water Heating	Water Heater	TE 0.94	Turnover	TE 0.80	TE 0.94	LO20Fast	0	1 kBtu/hr	1.00	0.00	0.16%	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	15	$ 8.96	$ -	105.9%	7.33	84.3%	100.0%
Grocery	New	Food Preparation	Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-ILTRM-v5.0-23	10	$ 177.71	$ 5.73	104.2%	304.67	24.3%	100.0%
Grocery	New	Food Preparation	Conveyor Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	17	$ 1,743.88	$ -	107.9%	733.00	12.1%	100.0%
Grocery	New	Food Preparation	Double Rack Oven	FTSC Qualified (>50% Cooking Efficiency)	Turnover	Standard	FTSC Qualified (>50% Cooking Efficiency)	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	12	$ 8,560.74	$ -	107.9%	2,064.00	12.1%	100.0%
Grocery	New	Food Preparation	Fryer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO12Med	2	1 unit	1.00	0.00	0.16%	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	15	$ 1,200.00	$ -	110.1%	505.23	51.7%	100.0%
Grocery	New	Food Preparation	Broiler	Infrared Burners	Turnover	Standard	Infrared Burners	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	12	$ 1,000.00	$ -	107.9%	239.00	2.9%	100.0%
Grocery	New	Food Preparation	Griddle	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_GRD-Food Preparation-ILTRM-v5.0-1	COOK_GRD-Food Preparation-EIA14-2014 Ref. Case-5	COOK_GRD-Food Preparation-ILTRM-v5.0-1	12	$ 360.00	$ -	104.2%	148.41	6.4%	100.0%
Grocery	New	Food Preparation	Range	High Efficiency	Turnover	Standard	High Efficiency	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-1	DOE Commercial R&D 2016 - Table 2-10	DOE Commercial R&D 2016 - Table 2-18	10	$ 400.00	$ -	110.1%	735.00	26.8%	100.0%
Grocery	New	Food Preparation	Steamer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	12	$ 998.00	$ 2.63	105.9%	1,007.26	2.0%	100.0%
Grocery	New	Food Preparation	Food Prep Other	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	N/A	N/A	N/A	10	$ 1.00	$ -	110.1%	0.01	2.0%	100.0%
Grocery	New	Miscellaneous	Pool Heater	Condensing (EF .90)	Turnover	Standard (EF .82)	Condensing (EF .90)	LO3Slow	0	1 unit	1.00	0.00	0.16%	DOE Commercial R&D 2016 - Table 7-6	DOE Commercial R&D 2016 - Table 7-7	DOE Commercial R&D 2016 - Table 7-9	6	$ 11,506.00	$ -	102.4%	2,233.50	0.2%	100.0%
Grocery	New	Miscellaneous	Miscellaneous	Standard	Turnover	Standard	Standard	LO3Slow	0	1 unit	1.00	1.00	0.16%	N/A	N/A	N/A	5	$ -	$ -	100.0%	-	100.0%	100.0%
Education	Existing	Heating	Furnace	AFUE 95%	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	0.05	0.16%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	$ -	100.0%	0.56	51.0%	55.0%
Education	Existing	Heating	Boiler	AFUE 98%	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	1	1 kBtu/hr	1.00	0.05	0.16%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	$ -	104.2%	0.83	49.0%	100.0%
Education	Existing	Heating	Unit Heater	Infrared Radiant	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	0.00	0.16%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	$ -	100.0%	3.20	14.1%	100.0%
Education	Existing	Water Heating	Water Heater	TE 0.94	Turnover	TE 0.80	TE 0.94	LO20Fast	0	1 kBtu/hr	1.00	0.01	0.16%	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	15	$ 8.96	$ -	105.9%	3.03	80.8%	100.0%
Education	Existing	Food Preparation	Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-ILTRM-v5.0-23	10	$ 177.71	$ 5.73	104.2%	304.67	6.0%	100.0%
Education	Existing	Food Preparation	Conveyor Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	17	$ 1,743.88	$ -	107.9%	733.00	3.0%	100.0%
Education	Existing	Food Preparation	Double Rack Oven	FTSC Qualified (>50% Cooking Efficiency)	Turnover	Standard	FTSC Qualified (>50% Cooking Efficiency)	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	12	$ 8,560.74	$ -	107.9%	2,064.00	3.0%	100.0%
Education	Existing	Food Preparation	Fryer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO12Med	2	1 unit	1.00	0.00	0.16%	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	15	$ 1,200.00	$ -	110.1%	505.23	6.7%	100.0%
Education	Existing	Food Preparation	Broiler	Infrared Burners	Turnover	Standard	Infrared Burners	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	12	$ 1,000.00	$ -	107.9%	239.00	2.6%	100.0%
Education	Existing	Food Preparation	Griddle	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_GRD-Food Preparation-ILTRM-v5.0-1	COOK_GRD-Food Preparation-EIA14-2014 Ref. Case-5	COOK_GRD-Food Preparation-ILTRM-v5.0-1	12	$ 360.00	$ -	104.2%	148.41	3.1%	100.0%
Education	Existing	Food Preparation	Range	High Efficiency	Turnover	Standard	High Efficiency	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-1	DOE Commercial R&D 2016 - Table 2-10	DOE Commercial R&D 2016 - Table 2-18	10	$ 400.00	$ -	110.1%	735.00	15.9%	100.0%
Education	Existing	Food Preparation	Steamer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	12	$ 998.00	$ 2.63	105.9%	1,007.26	4.7%	100.0%
Education	Existing	Food Preparation	Food Prep Other	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	N/A	N/A	N/A	10	$ 1.00	$ -	110.1%	0.01	4.7%	100.0%
Education	Existing	Miscellaneous	Pool Heater	Condensing (EF .90)	Turnover	Standard (EF .82)	Condensing (EF .90)	LO3Slow	0	1 unit	1.00	0.00	0.16%	DOE Commercial R&D 2016 - Table 7-6	DOE Commercial R&D 2016 - Table 7-7	DOE Commercial R&D 2016 - Table 7-9	6	$ 11,506.00	$ -	102.4%	2,233.50	1.2%	100.0%
Education	Existing	Miscellaneous	Miscellaneous	Standard	Turnover	Standard	Standard	LO3Slow	0	1 unit	1.00	0.01	0.16%	N/A	N/A	N/A	5	$ -	$ -	100.0%	-	100.0%	100.0%
Education	New	Heating	Furnace	AFUE 95%	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	0.05	0.16%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	$ -	100.0%	0.56	51.0%	55.0%
Education	New	Heating	Boiler	AFUE 98%	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	1	1 kBtu/hr	1.00	0.05	0.16%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	$ -	104.2%	0.86	49.0%	100.0%
Education	New	Heating	Unit Heater	Infrared Radiant	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	0.00	0.16%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	$ -	100.0%	3.20	14.1%	100.0%
Education	New	Water Heating	Water Heater	TE 0.94	Turnover	TE 0.80	TE 0.94	LO20Fast	0	1 kBtu/hr	1.00	0.00	0.16%	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	15	$ 8.96	$ -	105.9%	3.92	88.9%	100.0%
Education	New	Food Preparation	Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-ILTRM-v5.0-23	10	$ 177.71	$ 5.73	104.2%	304.67	6.0%	100.0%
Education	New	Food Preparation	Conveyor Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	17	$ 1,743.88	$ -	107.9%	733.00	3.0%	100.0%
Education	New	Food Preparation	Double Rack Oven	FTSC Qualified (>50% Cooking Efficiency)	Turnover	Standard	FTSC Qualified (>50% Cooking Efficiency)	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	12	$ 8,560.74	$ -	107.9%	2,064.00	3.0%	100.0%
Education	New	Food Preparation	Fryer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO12Med	2	1 unit	1.00	0.00	0.16%	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	15	$ 1,200.00	$ -	110.1%	505.23	6.7%	100.0%
Education	New	Food Preparation	Broiler	Infrared Burners	Turnover	Standard	Infrared Burners	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	12	$ 1,000.00	$ -	107.9%	239.00	2.6%	100.0%
Education	New	Food Preparation	Griddle	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_GRD-Food Preparation-ILTRM-v5.0-1	COOK_GRD-Food Preparation-EIA14-2014 Ref. Case-5	COOK_GRD-Food Preparation-ILTRM-v5.0-1	12	$ 360.00	$ -	104.2%	148.41	3.1%	100.0%
Education	New	Food Preparation	Range	High Efficiency	Turnover	Standard	High Efficiency	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-1	DOE Commercial R&D 2016 - Table 2-10	DOE Commercial R&D 2016 - Table 2-18	10	$ 400.00	$ -	110.1%	735.00	15.9%	100.0%
Education	New	Food Preparation	Steamer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	12	$ 998.00	$ 2.63	105.9%	1,007.26	4.7%	100.0%
Education	New	Food Preparation	Food Prep Other	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	N/A	N/A	N/A	10	$ 1.00	$ -	110.1%	0.01	4.7%	100.0%
Education	New	Miscellaneous	Pool Heater	Condensing (EF .90)	Turnover	Standard (EF .82)	Condensing (EF .90)	LO3Slow	0	1 unit	1.00	0.00	0.16%	DOE Commercial R&D 2016 - Table 7-6	DOE Commercial R&D 2016 - Table 7-7	DOE Commercial R&D 2016 - Table 7-9	6	$ 11,506.00	$ -	102.4%	2,233.50	1.2%	100.0%
Education	New	Miscellaneous	Miscellaneous	Standard	Turnover	Standard	Standard	LO3Slow	0	1 unit	1.00	1.00	0.16%	N/A	N/A	N/A	5	$ -	$ -	100.0%	-	100.0%	100.0%
Healthcare	Existing	Heating	Furnace	AFUE 95%	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	0.04	0.16%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	$ -	100.0%	1.23	61.7%	65.0%

Commercial Equipment

Measure					Characteristics									Sources			Measure Assumptions in 2017						
Segment	Vintage	End Use	Measure	Efficient Definition in 2018	Replacement Type	Baseline Definition	Efficient Definition / Measure Description	Measure Ramp Rate Name	Ramp Offset	Input Unit of Measure	Input Units	Units per Square Foot	Transmission Losses	Lifetime Source	Costs Source	Savings Source	Measure Lifetime (Years)	Incremental Measure Cost ($)	Incremental Non-Energy Benefits ($)	Cost Scalar	Measure Savings @ meter (kWh) (NEM Only)	Base Saturation	Applicability
Healthcare	Existing	Heating	Boiler	AFUE 98%	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	1	1 kBtu/hr	1.00	0.04	0.16%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	$ -	104.2%	2.83	34.0%	100.0%
Healthcare	Existing	Heating	Unit Heater	Infrared Radiant	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	0.02	0.16%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	$ -	100.0%	3.20	9.7%	100.0%
Healthcare	Existing	Water Heating	Water Heater	TE 0.94	Turnover	TE 0.80	TE 0.94	LO20Fast	0	1 kBtu/hr	1.00	0.01	0.16%	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	15	$ 8.96	$ -	105.9%	8.92	75.1%	100.0%
Healthcare	Existing	Food Preparation	Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-ILTRM-v5.0-23	10	$ 177.71	$ 5.73	104.2%	304.67	7.9%	100.0%
Healthcare	Existing	Food Preparation	Conveyor Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	17	$ 1,743.88	$ -	107.9%	733.00	4.0%	100.0%
Healthcare	Existing	Food Preparation	Double Rack Oven	FTSC Qualified (>50% Cooking Efficiency)	Turnover	Standard	FTSC Qualified (>50% Cooking Efficiency)	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	12	$ 8,560.74	$ -	107.9%	2,064.00	4.0%	100.0%
Healthcare	Existing	Food Preparation	Fryer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO12Med	2	1 unit	1.00	0.00	0.16%	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	15	$ 1,200.00	$ -	110.1%	505.23	4.6%	100.0%
Healthcare	Existing	Food Preparation	Broiler	Infrared Burners	Turnover	Standard	Infrared Burners	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	12	$ 1,000.00	$ -	107.9%	239.00	2.5%	100.0%
Healthcare	Existing	Food Preparation	Griddle	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_GRD-Food Preparation-ILTRM-v5.0-1	COOK_GRD-Food Preparation-EIA14-2014 Ref. Case-5	COOK_GRD-Food Preparation-ILTRM-v5.0-1	12	$ 360.00	$ -	104.2%	148.41	6.1%	100.0%
Healthcare	Existing	Food Preparation	Range	High Efficiency	Turnover	Standard	High Efficiency	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-1	DOE Commercial R&D 2016 - Table 2-10	DOE Commercial R&D 2016 - Table 2-18	10	$ 400.00	$ -	110.1%	735.00	35.8%	100.0%
Healthcare	Existing	Food Preparation	Steamer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	12	$ 998.00	$ 2.63	105.9%	1,007.26	5.2%	100.0%
Healthcare	Existing	Food Preparation	Food Prep Other	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	N/A	N/A	N/A	10	$ 1.00	$ -	110.1%	0.01	5.2%	100.0%
Healthcare	Existing	Miscellaneous	Pool Heater	Condensing (EF .90)	Turnover	Standard (EF .82)	Condensing (EF .90)	LO3Slow	0	1 unit	1.00	0.00	0.16%	DOE Commercial R&D 2016 - Table 7-6	DOE Commercial R&D 2016 - Table 7-7	DOE Commercial R&D 2016 - Table 7-9	6	$ 11,506.00	$ -	102.4%	2,233.50	1.4%	100.0%
Healthcare	Existing	Miscellaneous	Miscellaneous	Standard	Turnover	Standard	Standard	LO3Slow	0	1 unit	1.00	0.04	0.16%	N/A	N/A	N/A	5	$ -	$ -	100.0%	-	100.0%	100.0%
Healthcare	New	Heating	Furnace	AFUE 95%	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	0.04	0.16%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	$ -	100.0%	1.23	61.7%	65.0%
Healthcare	New	Heating	Boiler	AFUE 98%	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	1	1 kBtu/hr	1.00	0.04	0.16%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	$ -	104.2%	2.76	34.0%	100.0%
Healthcare	New	Heating	Unit Heater	Infrared Radiant	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	0.02	0.16%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	$ -	100.0%	3.20	9.7%	100.0%
Healthcare	New	Water Heating	Water Heater	TE 0.94	Turnover	TE 0.80	TE 0.94	LO20Fast	0	1 kBtu/hr	1.00	0.01	0.16%	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	15	$ 8.96	$ -	105.9%	11.57	82.6%	100.0%
Healthcare	New	Food Preparation	Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-ILTRM-v5.0-23	10	$ 177.71	$ 5.73	104.2%	304.67	7.9%	100.0%
Healthcare	New	Food Preparation	Conveyor Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	17	$ 1,743.88	$ -	107.9%	733.00	4.0%	100.0%
Healthcare	New	Food Preparation	Double Rack Oven	FTSC Qualified (>50% Cooking Efficiency)	Turnover	Standard	FTSC Qualified (>50% Cooking Efficiency)	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	12	$ 8,560.74	$ -	107.9%	2,064.00	4.0%	100.0%
Healthcare	New	Food Preparation	Fryer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO12Med	2	1 unit	1.00	0.00	0.16%	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	15	$ 1,200.00	$ -	110.1%	505.23	4.6%	100.0%
Healthcare	New	Food Preparation	Broiler	Infrared Burners	Turnover	Standard	Infrared Burners	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	12	$ 1,000.00	$ -	107.9%	239.00	2.5%	100.0%
Healthcare	New	Food Preparation	Griddle	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_GRD-Food Preparation-ILTRM-v5.0-1	COOK_GRD-Food Preparation-EIA14-2014 Ref. Case-5	COOK_GRD-Food Preparation-ILTRM-v5.0-1	12	$ 360.00	$ -	104.2%	148.41	6.1%	100.0%
Healthcare	New	Food Preparation	Range	High Efficiency	Turnover	Standard	High Efficiency	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-1	DOE Commercial R&D 2016 - Table 2-10	DOE Commercial R&D 2016 - Table 2-18	10	$ 400.00	$ -	110.1%	735.00	35.8%	100.0%
Healthcare	New	Food Preparation	Steamer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	12	$ 998.00	$ 2.63	105.9%	1,007.26	5.2%	100.0%
Healthcare	New	Food Preparation	Food Prep Other	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	N/A	N/A	N/A	10	$ 1.00	$ -	110.1%	0.01	5.2%	100.0%
Healthcare	New	Miscellaneous	Pool Heater	Condensing (EF .90)	Turnover	Standard (EF .82)	Condensing (EF .90)	LO3Slow	0	1 unit	1.00	0.00	0.16%	DOE Commercial R&D 2016 - Table 7-6	DOE Commercial R&D 2016 - Table 7-7	DOE Commercial R&D 2016 - Table 7-9	6	$ 11,506.00	$ -	102.4%	2,233.50	1.4%	100.0%
Healthcare	New	Miscellaneous	Miscellaneous	Standard	Turnover	Standard	Standard	LO3Slow	0	1 unit	1.00	1.00	0.16%	N/A	N/A	N/A	5	$ -	$ -	100.0%	-	100.0%	100.0%
Lodging	Existing	Heating	Furnace	AFUE 95%	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	0.03	0.16%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	$ -	100.0%	1.61	51.9%	80.0%
Lodging	Existing	Heating	Boiler	AFUE 98%	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	1	1 kBtu/hr	1.00	0.03	0.16%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	$ -	104.2%	3.77	21.9%	100.0%
Lodging	Existing	Heating	Unit Heater	Infrared Radiant	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	0.02	0.16%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	$ -	100.0%	3.20	8.1%	100.0%
Lodging	Existing	Water Heating	Water Heater	TE 0.94	Turnover	TE 0.80	TE 0.94	LO20Fast	0	1 kBtu/hr	1.00	0.02	0.16%	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	15	$ 8.96	$ -	105.9%	2.99	80.8%	100.0%
Lodging	Existing	Food Preparation	Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-ILTRM-v5.0-23	10	$ 177.71	$ 5.73	104.2%	304.67	8.0%	100.0%
Lodging	Existing	Food Preparation	Conveyor Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	17	$ 1,743.88	$ -	107.9%	733.00	4.0%	100.0%
Lodging	Existing	Food Preparation	Double Rack Oven	FTSC Qualified (>50% Cooking Efficiency)	Turnover	Standard	FTSC Qualified (>50% Cooking Efficiency)	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	12	$ 8,560.74	$ -	107.9%	2,064.00	4.0%	100.0%
Lodging	Existing	Food Preparation	Fryer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO12Med	2	1 unit	1.00	0.00	0.16%	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	15	$ 1,200.00	$ -	110.1%	505.23	10.6%	100.0%
Lodging	Existing	Food Preparation	Broiler	Infrared Burners	Turnover	Standard	Infrared Burners	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	12	$ 1,000.00	$ -	107.9%	239.00	6.9%	100.0%
Lodging	Existing	Food Preparation	Griddle	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_GRD-Food Preparation-ILTRM-v5.0-1	COOK_GRD-Food Preparation-EIA14-2014 Ref. Case-5	COOK_GRD-Food Preparation-ILTRM-v5.0-1	12	$ 360.00	$ -	104.2%	148.41	10.0%	100.0%
Lodging	Existing	Food Preparation	Range	High Efficiency	Turnover	Standard	High Efficiency	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-1	DOE Commercial R&D 2016 - Table 2-10	DOE Commercial R&D 2016 - Table 2-18	10	$ 400.00	$ -	110.1%	735.00	28.5%	100.0%
Lodging	Existing	Food Preparation	Steamer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	12	$ 998.00	$ 2.63	105.9%	1,007.26	5.0%	100.0%
Lodging	Existing	Food Preparation	Food Prep Other	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	N/A	N/A	N/A	10	$ 1.00	$ -	110.1%	0.01	5.0%	100.0%
Lodging	Existing	Miscellaneous	Pool Heater	Condensing (EF .90)	Turnover	Standard (EF .82)	Condensing (EF .90)	LO3Slow	0	1 unit	1.00	0.00	0.16%	DOE Commercial R&D 2016 - Table 7-6	DOE Commercial R&D 2016 - Table 7-7	DOE Commercial R&D 2016 - Table 7-9	6	$ 11,506.00	$ -	102.4%	2,233.50	42.9%	100.0%
Lodging	Existing	Miscellaneous	Miscellaneous	Standard	Turnover	Standard	Standard	LO3Slow	0	1 unit	1.00	0.01	0.16%	N/A	N/A	N/A	5	$ -	$ -	100.0%	-	100.0%	100.0%
Lodging	New	Heating	Furnace	AFUE 95%	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	0.03	0.16%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	$ -	100.0%	1.61	51.9%	80.0%
Lodging	New	Heating	Boiler	AFUE 98%	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	1	1 kBtu/hr	1.00	0.03	0.16%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	$ -	104.2%	3.79	21.9%	100.0%
Lodging	New	Heating	Unit Heater	Infrared Radiant	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	0.02	0.16%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	$ -	100.0%	3.20	8.1%	100.0%
Lodging	New	Water Heating	Water Heater	TE 0.94	Turnover	TE 0.80	TE 0.94	LO20Fast	0	1 kBtu/hr	1.00	0.01	0.16%	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	15	$ 8.96	$ -	105.9%	3.88	88.9%	100.0%
Lodging	New	Food Preparation	Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-ILTRM-v5.0-23	10	$ 177.71	$ 5.73	104.2%	304.67	8.0%	100.0%
Lodging	New	Food Preparation	Conveyor Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	17	$ 1,743.88	$ -	107.9%	733.00	4.0%	100.0%
Lodging	New	Food Preparation	Double Rack Oven	FTSC Qualified (>50% Cooking Efficiency)	Turnover	Standard	FTSC Qualified (>50% Cooking Efficiency)	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	12	$ 8,560.74	$ -	107.9%	2,064.00	4.0%	100.0%
Lodging	New	Food Preparation	Fryer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO12Med	2	1 unit	1.00	0.00	0.16%	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	15	$ 1,200.00	$ -	110.1%	505.23	10.6%	100.0%
Lodging	New	Food Preparation	Broiler	Infrared Burners	Turnover	Standard	Infrared Burners	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	12	$ 1,000.00	$ -	107.9%	239.00	6.9%	100.0%
Lodging	New	Food Preparation	Griddle	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_GRD-Food Preparation-ILTRM-v5.0-1	COOK_GRD-Food Preparation-EIA14-2014 Ref. Case-5	COOK_GRD-Food Preparation-ILTRM-v5.0-1	12	$ 360.00	$ -	104.2%	148.41	10.0%	100.0%
Lodging	New	Food Preparation	Range	High Efficiency	Turnover	Standard	High Efficiency	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-1	DOE Commercial R&D 2016 - Table 2-10	DOE Commercial R&D 2016 - Table 2-18	10	$ 400.00	$ -	110.1%	735.00	28.5%	100.0%
Lodging	New	Food Preparation	Steamer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	12	$ 998.00	$ 2.63	105.9%	1,007.26	5.0%	100.0%
Lodging	New	Food Preparation	Food Prep Other	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	N/A	N/A	N/A	10	$ 1.00	$ -	110.1%	0.01	5.0%	100.0%
Lodging	New	Miscellaneous	Pool Heater	Condensing (EF .90)	Turnover	Standard (EF .82)	Condensing (EF .90)	LO3Slow	0	1 unit	1.00	0.00	0.16%	DOE Commercial R&D 2016 - Table 7-6	DOE Commercial R&D 2016 - Table 7-7	DOE Commercial R&D 2016 - Table 7-9	6	$ 11,506.00	$ -	102.4%	2,233.50	42.9%	100.0%
Lodging	New	Miscellaneous	Miscellaneous	Standard	Turnover	Standard	Standard	LO3Slow	0	1 unit	1.00	1.00	0.16%	N/A	N/A	N/A	5	$ -	$ -	100.0%	-	100.0%	100.0%
Warehouse	Existing	Heating	Furnace	AFUE 95%	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	0.02	0.16%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	$ -	100.0%	3.42	42.9%	90.0%
Warehouse	Existing	Heating	Boiler	AFUE 98%	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	1	1 kBtu/hr	1.00	0.02	0.16%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	$ -	104.2%	8.16	6.0%	100.0%
Warehouse	Existing	Heating	Unit Heater	Infrared Radiant	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	0.02	0.16%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	$ -	100.0%	3.20	53.4%	100.0%
Warehouse	Existing	Water Heating	Water Heater	TE 0.94	Turnover	TE 0.80	TE 0.94	LO20Fast	0	1 kBtu/hr	1.00	0.00	0.16%	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	15	$ 8.96	$ -	105.9%	5.16	51.4%	100.0%
Warehouse	Existing	Food Preparation	Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-ILTRM-v5.0-23	10	$ 177.71	$ 5.73	104.2%	304.67	0.0%	100.0%
Warehouse	Existing	Food Preparation	Conveyor Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	17	$ 1,743.88	$ -	107.9%	733.00	0.0%	100.0%
Warehouse	Existing	Food Preparation	Double Rack Oven	FTSC Qualified (>50% Cooking Efficiency)	Turnover	Standard	FTSC Qualified (>50% Cooking Efficiency)	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	12	$ 8,560.74	$ -	107.9%	2,064.00	0.0%	100.0%
Warehouse	Existing	Food Preparation	Fryer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO12Med	2	1 unit	1.00	0.00	0.16%	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	15	$ 1,200.00	$ -	110.1%	505.23	0.7%	100.0%
Warehouse	Existing	Food Preparation	Broiler	Infrared Burners	Turnover	Standard	Infrared Burners	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	12	$ 1,000.00	$ -	107.9%	239.00	0.0%	100.0%
Warehouse	Existing	Food Preparation	Griddle	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_GRD-Food Preparation-ILTRM-v5.0-1	COOK_GRD-Food Preparation-EIA14-2014 Ref. Case-5	COOK_GRD-Food Preparation-ILTRM-v5.0-1	12	$ 360.00	$ -	104.2%	148.41	0.0%	100.0%
Warehouse	Existing	Food Preparation	Range	High Efficiency	Turnover	Standard	High Efficiency	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-1	DOE Commercial R&D 2016 - Table 2-10	DOE Commercial R&D 2016 - Table 2-18	10	$ 400.00	$ -	110.1%	735.00	1.4%	100.0%
Warehouse	Existing	Food Preparation	Steamer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	12	$ 998.00	$ 2.63	105.9%	1,007.26	0.0%	100.0%
Warehouse	Existing	Food Preparation	Food Prep Other	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	N/A	N/A	N/A	10	$ 1.00	$ -	110.1%	0.01	0.0%	100.0%
Warehouse	Existing	Miscellaneous	Pool Heater	Condensing (EF .90)	Turnover	Standard (EF .82)	Condensing (EF .90)	LO3Slow	0	1 unit	1.00	0.00	0.16%	DOE Commercial R&D 2016 - Table 7-6	DOE Commercial R&D 2016 - Table 7-7	DOE Commercial R&D 2016 - Table 7-9	6	$ 11,506.00	$ -	102.4%	2,233.50	0.0%	100.0%
Warehouse	Existing	Miscellaneous	Miscellaneous	Standard	Turnover	Standard	Standard	LO3Slow	0	1 unit	1.00	0.01	0.16%	N/A	N/A	N/A	5	$ -	$ -	100.0%	-	100.0%	100.0%
Warehouse	New	Heating	Furnace	AFUE 95%	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	0.02	0.16%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	$ -	100.0%	3.42	42.9%	90.0%
Warehouse	New	Heating	Boiler	AFUE 98%	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	1	1 kBtu/hr	1.00	0.02	0.16%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	$ -	104.2%	8.16	6.0%	100.0%
Warehouse	New	Heating	Unit Heater	Infrared Radiant	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	0.02	0.16%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	$ -	100.0%	3.20	53.4%	100.0%
Warehouse	New	Water Heating	Water Heater	TE 0.94	Turnover	TE 0.80	TE 0.94	LO20Fast	0	1 kBtu/hr	1.00	0.00	0.16%	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	15	$ 8.96	$ -	105.9%	6.69	56.5%	100.0%
Warehouse	New	Food Preparation	Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-ILTRM-v5.0-23	10	$ 177.71	$ 5.73	104.2%	304.67	0.0%	100.0%
Warehouse	New	Food Preparation	Conveyor Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	17	$ 1,743.88	$ -	107.9%	733.00	0.0%	100.0%
Warehouse	New	Food Preparation	Double Rack Oven	FTSC Qualified (>50% Cooking Efficiency)	Turnover	Standard	FTSC Qualified (>50% Cooking Efficiency)	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	12	$ 8,560.74	$ -	107.9%	2,064.00	0.0%	100.0%
Warehouse	New	Food Preparation	Fryer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO12Med	2	1 unit	1.00	0.00	0.16%	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	15	$ 1,200.00	$ -	110.1%	505.23	0.7%	100.0%
Warehouse	New	Food Preparation	Broiler	Infrared Burners	Turnover	Standard	Infrared Burners	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	12	$ 1,000.00	$ -	107.9%	239.00	0.0%	100.0%
Warehouse	New	Food Preparation	Griddle	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_GRD-Food Preparation-ILTRM-v5.0-1	COOK_GRD-Food Preparation-EIA14-2014 Ref. Case-5	COOK_GRD-Food Preparation-ILTRM-v5.0-1	12	$ 360.00	$ -	104.2%	148.41	0.0%	100.0%
Warehouse	New	Food Preparation	Range	High Efficiency	Turnover	Standard	High Efficiency	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-1	DOE Commercial R&D 2016 - Table 2-10	DOE Commercial R&D 2016 - Table 2-18	10	$ 400.00	$ -	110.1%	735.00	1.4%	100.0%
Warehouse	New	Food Preparation	Steamer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	12	$ 998.00	$ 2.63	105.9%	1,007.26	0.0%	100.0%
Warehouse	New	Food Preparation	Food Prep Other	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	N/A	N/A	N/A	10	$ 1.00	$ -	110.1%	0.01	0.0%	100.0%
Warehouse	New	Miscellaneous	Pool Heater	Condensing (EF .90)	Turnover	Standard (EF .82)	Condensing (EF .90)	LO3Slow	0	1 unit	1.00	0.00	0.16%	DOE Commercial R&D 2016 - Table 7-6	DOE Commercial R&D 2016 - Table 7-7	DOE Commercial R&D 2016 - Table 7-9	6	$ 11,506.00	$ -	102.4%	2,233.50	0.0%	100.0%
Warehouse	New	Miscellaneous	Miscellaneous	Standard	Turnover	Standard	Standard	LO3Slow	0	1 unit	1.00	1.00	0.16%	N/A	N/A	N/A	5	$ -	$ -	100.0%	-	100.0%	100.0%
Miscellaneous	Existing	Heating	Furnace	AFUE 95%	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	0.07	0.16%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	$ -	100.0%	1.47	74.1%	55.0%
Miscellaneous	Existing	Heating	Boiler	AFUE 98%	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	1	1 kBtu/hr	1.00	0.07	0.16%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	$ -	104.2%	3.12	18.2%	100.0%
Miscellaneous	Existing	Heating	Unit Heater	Infrared Radiant	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	0.03	0.16%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	$ -	100.0%	3.20	15.6%	100.0%
Miscellaneous	Existing	Water Heating	Water Heater	TE 0.94	Turnover	TE 0.80	TE 0.94	LO20Fast	0	1 kBtu/hr	1.00	0.01	0.16%	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	15	$ 8.96	$ -	105.9%	4.68	57.5%	100.0%
Miscellaneous	Existing	Food Preparation	Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-ILTRM-v5.0-23	10	$ 177.71	$ 5.73	104.2%	304.67	3.0%	100.0%
Miscellaneous	Existing	Food Preparation	Conveyor Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	17	$ 1,743.88	$ -	107.9%	733.00	1.5%	100.0%
Miscellaneous	Existing	Food Preparation	Double Rack Oven	FTSC Qualified (>50% Cooking Efficiency)	Turnover	Standard	FTSC Qualified (>50% Cooking Efficiency)	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	12	$ 8,560.74	$ -	107.9%	2,064.00	1.5%	100.0%
Miscellaneous	Existing	Food Preparation	Fryer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO12Med	2	1 unit	1.00	0.00	0.16%	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	15	$ 1,200.00	$ -	110.1%	505.23	4.8%	100.0%
Miscellaneous	Existing	Food Preparation	Broiler	Infrared Burners	Turnover	Standard	Infrared Burners	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	12	$ 1,000.00	$ -	107.9%	239.00	3.4%	100.0%
Miscellaneous	Existing	Food Preparation	Griddle	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_GRD-Food Preparation-ILTRM-v5.0-1	COOK_GRD-Food Preparation-EIA14-2014 Ref. Case-5	COOK_GRD-Food Preparation-ILTRM-v5.0-1	12	$ 360.00	$ -	104.2%	148.41	4.2%	100.0%
Miscellaneous	Existing	Food Preparation	Range	High Efficiency	Turnover	Standard	High Efficiency	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-1	DOE Commercial R&D 2016 - Table 2-10	DOE Commercial R&D 2016 - Table 2-18	10	$ 400.00	$ -	110.1%	735.00	16.1%	100.0%
Miscellaneous	Existing	Food Preparation	Steamer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	12	$ 998.00	$ 2.63	105.9%	1,007.26	1.2%	100.0%
Miscellaneous	Existing	Food Preparation	Food Prep Other	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	N/A	N/A	N/A	10	$ 1.00	$ -	110.1%	0.01	1.2%	100.0%
Miscellaneous	Existing	Miscellaneous	Pool Heater	Condensing (EF .90)	Turnover	Standard (EF .82)	Condensing (EF .90)	LO3Slow	0	1 unit	1.00	0.00	0.16%	DOE Commercial R&D 2016 - Table 7-6	DOE Commercial R&D 2016 - Table 7-7	DOE Commercial R&D 2016 - Table 7-9	6	$ 11,506.00	$ -	102.4%	2,233.50	7.0%	100.0%
Miscellaneous	Existing	Miscellaneous	Miscellaneous	Standard	Turnover	Standard	Standard	LO3Slow	0	1 unit	1.00	0.03	0.16%	N/A	N/A	N/A	5	$ -	$ -	100.0%	-	100.0%	100.0%
Miscellaneous	New	Heating	Furnace	AFUE 95%	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	0.07	0.16%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	$ -	100.0%	1.47	74.1%	55.0%
Miscellaneous	New	Heating	Boiler	AFUE 98%	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	1	1 kBtu/hr	1.00	0.07	0.16%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	$ -	104.2%	3.25	18.2%	100.0%
Miscellaneous	New	Heating	Unit Heater	Infrared Radiant	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	0.03	0.16%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	$ -	100.0%	3.20	15.6%	100.0%
Miscellaneous	New	Water Heating	Water Heater	TE 0.94	Turnover	TE 0.80	TE 0.94	LO20Fast	0	1 kBtu/hr	1.00	0.01	0.16%	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	DHW_WH-Water Heating-NMTRM-2016-7	15	$ 8.96	$ -	105.9%	6.07	63.2%	100.0%
Miscellaneous	New	Food Preparation	Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-AEO17-3	COOK_OVN-Food Preparation-ILTRM-v5.0-23	10	$ 177.71	$ 5.73	104.2%	304.67	3.0%	100.0%
Miscellaneous	New	Food Preparation	Conveyor Oven	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	Turnover	Standard	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	COOK_OVN-Food Preparation-ILTRM-v5.0-24	17	$ 1,743.88	$ -	107.9%	733.00	1.5%	100.0%
Miscellaneous	New	Food Preparation	Double Rack Oven	FTSC Qualified (>50% Cooking Efficiency)	Turnover	Standard	FTSC Qualified (>50% Cooking Efficiency)	LO5Med	2	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	COOK_OVN-Food Preparation-ILTRM-v5.0-25	12	$ 8,560.74	$ -	107.9%	2,064.00	1.5%	100.0%
Miscellaneous	New	Food Preparation	Fryer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO12Med	2	1 unit	1.00	0.00	0.16%	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	COOK_FRY-Food Preparation-ILTRM-v4.0-1	15	$ 1,200.00	$ -	110.1%	505.23	4.8%	100.0%
Miscellaneous	New	Food Preparation	Broiler	Infrared Burners	Turnover	Standard	Infrared Burners	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	COOK_BRL-Food Preparation-ILTRM-v4.0-2	12	$ 1,000.00	$ -	107.9%	239.00	3.4%	100.0%
Miscellaneous	New	Food Preparation	Griddle	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_GRD-Food Preparation-ILTRM-v5.0-1	COOK_GRD-Food Preparation-EIA14-2014 Ref. Case-5	COOK_GRD-Food Preparation-ILTRM-v5.0-1	12	$ 360.00	$ -	104.2%	148.41	4.2%	100.0%
Miscellaneous	New	Food Preparation	Range	High Efficiency	Turnover	Standard	High Efficiency	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_OVN-Food Preparation-AEO17-1	DOE Commercial R&D 2016 - Table 2-10	DOE Commercial R&D 2016 - Table 2-18	10	$ 400.00	$ -	110.1%	735.00	16.1%	100.0%
Miscellaneous	New	Food Preparation	Steamer	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	COOK_STM-Food Preparation-ILTRM-v4.0-32	12	$ 998.00	$ 2.63	105.9%	1,007.26	1.2%	100.0%
Miscellaneous	New	Food Preparation	Food Prep Other	ENERGY STAR	Turnover	Standard	ENERGY STAR	LO5Med	0	1 unit	1.00	0.00	0.16%	N/A	N/A	N/A	10	$ 1.00	$ -	110.1%	0.01	1.2%	100.0%
Miscellaneous	New	Miscellaneous	Pool Heater	Condensing (EF .90)	Turnover	Standard (EF .82)	Condensing (EF .90)	LO3Slow	0	1 unit	1.00	0.00	0.16%	DOE Commercial R&D 2016 - Table 7-6	DOE Commercial R&D 2016 - Table 7-7	DOE Commercial R&D 2016 - Table 7-9	6	$ 11,506.00	$ -	102.4%	2,233.50	7.0%	100.0%
Miscellaneous	New	Miscellaneous	Miscellaneous	Standard	Turnover	Standard	Standard	LO3Slow	0	1 unit	1.00	1.00	0.16%	N/A	N/A	N/A	5	$ -	$ -	100.0%	-	100.0%	100.0%

Commercial Non Equipment

Measure					Characteristics									Sources			Measure Assumptions in 2017							
Segment	Vintage	End Use	Measure	Efficient Definition	Replacement Type	Baseline Definition (NEM Only)	Measure Description	Measure Ramp Rate Name	Ramp Offset	Input Unit of Measure	Bldg Sq Ft	UOM Per Facility	Line Loss	Lifetime Source	Costs Source	Savings Source	Measure Lifetime (Years)	Incremental Measure Cost ($)	Incremental O&M Cost ($)	Incremental Non-Energy Benefits ($)	Cost Scalar	Measure Savings @ generator (kWh) (NEM Only)	Base Saturation	Applicability
Office	Existing	Heating	Insulation - Roof/Ceiling	R-38	Discretionary	R-13	R-38	Retro3Slow	2	sqft roof	10,000	10,000.00	0.16%	INS_CLG-Heating-RTF-v2.1-55	INS_CLG-Heating-RTF-v2.1-55	Building Energy Simulation Tool	45	$ 1.02	$ -	$ 0.02	1.18	0.10	60.0%	85.0%
Office	Existing	Heating	Insulation - Wall Cavity	R-21	Discretionary	R-11 or less	R-21	Retro3Slow	2	sqft wall	10,000	3,675.46	0.16%	INS_WC-Heating-RTF-v2.1-1	INS_WC-Heating-RTF-v2.1-1	Building Energy Simulation Tool	45	$ 1.61	$ -	$ 0.04	1.18	0.26	60.0%	85.0%
Office	Existing	Heating	Insulation - Ducting	50% reduction in thermal losses	Discretionary	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	10,000	10,000.00	0.16%	INS_DCT-All-DEER-1	INS_DCT-All-DEER-1	Building Energy Simulation Tool	20	$ 0.86	$ -	$ -	1.12	-	40.0%	60.0%
Office	Existing	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Discretionary	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	10,000	10,000.00	0.16%	DCT_RPR-All-DEER-1	DCT_RPR-Cooling-RTF-1	Building Energy Simulation Tool	18	$ 0.59	$ -	$ -	1.18	-	15.0%	50.0%
Office	Existing	Heating	Windows - High Efficiency	U-.22 or better	Discretionary	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft window	10,000	1,223.93	0.16%	WND_HE-Heating-RTF-v2.1-46	WND_HE-Heating-RTF-v2.1-46	Building Energy Simulation Tool	45	$ 24.31	$ -	$ 0.05	1.18	0.28	45.0%	100.0%
Office	Existing	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	10,000	0.25	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.88	$ -	$ -	1.06	636.10	20.0%	30.0%
Office	Existing	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	10,000	0.25	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.88	$ -	$ -	1.06	469.63	20.0%	30.0%
Office	Existing	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Discretionary	No control	Reset control installed	Retro5Med	0	BoilerCtrl	10,000	0.63	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 719.34	$ -	$ -	1.18	1,130.84	35.0%	55.0%
Office	Existing	Heating	Steam Trap Maintenance	Cleaning and maintenance	Discretionary	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	10,000	10,000.00	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 0.01	$ -	$ -	1.08	0.03	73.0%	100.0%
Office	Existing	Heating	Gas Boiler - High Turndown	Turndown control installed	Discretionary	No control	Turndown control installed	Retro12Med	0	kbtuh heat	10,000	253.97	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 2.59	$ -	$ -	1.02	1.06	25.0%	50.0%
Office	Existing	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Discretionary	Average performance	Optimized burner controls	Retro3Slow	0	kBtuh heat	10,000	253.97	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 0.87	$ -	$ -	1.02	0.31	5.0%	85.0%
Office	Existing	Heating	HVAC - Shut Off Damper	Damper installed	Discretionary	No damper	Damper installed	Retro12Med	0	BoilerCtrl	10,000	0.63	0.16%	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	15	$ 1,536.09	$ 96.63	$ -	1.02	104.36	0.0%	75.0%
Office	Existing	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Discretionary	Constant ventilation	DCV enabled	RetroEven20	0	sqft	10,000	10,000.00	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.25	$ -	$ 0.00	1.18	0.02	55.0%	75.0%
Office	Existing	Heating	Gas Boiler - Stack Economizer	Economizer installed	Discretionary	None	Economizer installed	Retro12Med	0	BoilerCtrl	10,000	0.63	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 587.69	$ -	$ -	1.18	188.47	15.0%	55.0%
Office	Existing	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Discretionary	None	Tube inserts installed	Retro3Slow	0	sqft	10,000	10,000.00	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Office	Existing	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Discretionary	No insulation	Lines and condensate tank insulated	RetroEven20	0	boiler pipe	10,000	400.00	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 12.90	$ -	$ -	1.06	5.99	30.0%	40.0%
Office	Existing	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Discretionary	No insulation	Insulated water lines	RetroEven20	0	boiler pipe	10,000	400.00	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 24.10	$ -	$ -	1.06	4.01	30.0%	40.0%
Office	Existing	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Discretionary	None	HRV installed	RetroEven20	0	CFM	10,000	900.00	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 7.05	$ -	$ -	1.18	0.20	5.0%	25.0%
Office	Existing	Heating	Thermostat - Programmable	Programmable thermostat installed	Discretionary	Manual control	Programmable thermostat installed	RetroEven20	0	Stat Unit	10,000	10.00	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 188.67	$ -	$ 3.62	1.04	21.35	10.0%	25.0%
Office	Existing	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Discretionary	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	10,000	10,000.00	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.03	1.18	0.07	0.0%	50.0%
Office	Existing	Water Heating	Water Heater - Ozone Laundry	Ozone laundry system	Discretionary	Standard laundry machine	Ozone laundry system	Retro12Med	0	perBldg	10,000	1.00	0.16%	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	10	$ 8,439.88	$ 205.79	$ -	1.02	148.78	0.0%	0.0%
Office	Existing	Water Heating	Water Heater - High MEF Commercial Laundry Washers	ESTAR/High MEF unit installed	Discretionary	Standard laundry machine	ESTAR/High MEF unit installed	Retro3Slow	2	ClothesWashers	10,000	1.00	0.16%	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	11	$ 489.42	$ -	$ 125.05	1.06	35.51	0.0%	0.0%
Office	Existing	Water Heating	Water Heater - Motion Control Faucet	Motion activated faucet	Discretionary	Standard faucet	Motion activated faucet	Retro12Med	0	perBldg	10,000	1.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.02	-	25.0%	65.0%
Office	Existing	Water Heating	Water Heater - Faucet Aerator	1.5 GPM faucet	Discretionary	2.5 GPM faucet	1.5 GPM faucet	Retro5Med	0	faucet	10,000	12.00	0.16%	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-ILTRM-v5.0-15	10	$ 6.88	$ -	$ 13.76	0.98	3.71	25.0%	65.0%
Office	Existing	Water Heating	Water Heater - Drainwater Heat Recovery	Drain HR system installed	Discretionary	None	Drain HR system installed	Retro12Med	0	faucet	10,000	12.00	0.16%	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-MNTRM-v1.0-7	40	$ 880.81	$ -	$ -	1.10	4.13	0.0%	0.0%
Office	Existing	Water Heating	Water Heater - Efficient Dishwasher	ESTAR unit	Discretionary	Standard unit	ESTAR unit	Retro3Slow	1	perBldg	10,000	1.00	0.16%	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	10	$ 122.89	$ -	$ 31.72	1.02	71.00	44.0%	80.0%
Office	Existing	Water Heating	Water Heater - Pre-Rinse Spray Valve	2 GPM sprayer nozzle	Discretionary	3.5 GPM kitchen sprayer	2 GPM sprayer nozzle	Retro12Med	0	KitchenFaucet	10,000	1.00	0.16%	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	4	$ 127.84	$ -	$ 136.94	1.18	23.08	25.0%	65.0%
Office	Existing	Water Heating	Water Heater - Central Controls	Central water boiler controls installed	Discretionary	No central controls	Central water boiler controls installed	Retro12Med	0	perBldg	10,000	1.00	0.16%	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	15	$ 1,410.47	$ -	$ -	1.18	240.45	5.0%	5.0%
Office	Existing	Water Heating	Water Heater - Solar System	Solar system installed	Discretionary	None	Solar system installed	Retro12Med	0	DHW kbtuh	10,000	572.33	0.16%	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-DOE-PTool2014-1	20	$ 326.36	$ 0.81	$ -	1.04	2.11	1.0%	30.0%
Office	Existing	Heating	Destratification Fans (HVLS)	Fans Installed	Discretionary	None/Standard ventilation	Fans Installed	RetroEven20	0	Strat Fan	10,000	0.86	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 7,757.57	$ -	$ 129.87	1.18	766.59	15.0%	20.0%
Office	Existing	Heating	Kitchen Hood - DCV/MUA	DCV/HUA vent hood	Discretionary	Standard kitchen hood	DCV/HUA vent hood	RetroEven20	0	sqft	10,000	10,000.00	0.16%	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	20	$ 0.16	$ -	$ 0.01	1.02	0.05	10.0%	10.0%
Office	Existing	Miscellaneous	Pool Heater - Night Covers	Night cover in place	Discretionary	No cover	Night cover in place	RetroEven20	0	sqft pool	10,000	1,875.00	0.16%	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	5	$ 2.37	$ -	$ -	1.06	0.00	50.0%	100.0%
Office	Existing	Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	10,000	10,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.36	$ -	$ 0.02	1.00	0.07	10.0%	25.0%
Office	Existing	Water Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	10,000	10,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.36	$ -	$ 0.02	1.00	0.02	10.0%	25.0%
Office	Existing	Heating	Steam System Efficiency Improvements	Optimized system	Discretionary	Average system efficiency	Optimized system	Retro1Slow	0	sqft	10,000	10,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Office	Existing	Heating	Commissioning - HVAC	Optimized HVAC design and controls	Discretionary	New construction code	Optimized HVAC design and controls	Retro12Med	0	sqft	10,000	10,000.00	0.16%	COM_CX-All-AEG-5	N/A	COM_CX-All-AEG-5	3	$ 1.11	$ -	$ 0.03	1.11	0.09	0.0%	0.0%
Office	Existing	Heating	Retrocommissioning - HVAC	Optimized HVAC flow and controls	Discretionary	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	sqft	10,000	10,000.00	0.16%	COM_RCX-Heating-7PLN-v5-3	COM_RCX-Heating-7PLN-v5-3	7th Power Plan Calculation	5	$ 0.31	$ -	$ 0.02	1.18	0.05	25.0%	60.0%
Office	Existing	Heating	Strategic Energy Management	Energy management system installed and programmed	Discretionary	No energy management system	Energy management system installed and programmed	RetroEven20	0	sqft	10,000	10,000.00	0.16%	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	5	$ 0.08	$ -	$ 0.01	1.00	0.02	5.0%	25.0%
Office	New	Heating	Insulation - Roof/Ceiling	R-38	Discretionary	R-13	R-38	Retro3Slow	2	sqft roof	10,000	10,000.00	0.16%	INS_CLG-Heating-RTF-v2.1-55	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Office	New	Heating	Insulation - Wall Cavity	R-21	Discretionary	R-11 or less	R-21	Retro3Slow	2	sqft wall	10,000	3,675.46	0.16%	INS_WC-Heating-RTF-v2.1-1	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Office	New	Heating	Insulation - Ducting	50% reduction in thermal losses	Discretionary	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	10,000	10,000.00	0.16%	INS_DCT-All-DEER-1	N/A	Building Energy Simulation Tool	20	$ 1.12	$ -	$ -	1.12	-	0.0%	0.0%
Office	New	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Discretionary	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	10,000	10,000.00	0.16%	DCT_RPR-All-DEER-1	N/A	n/a	18	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Office	New	Heating	Windows - High Efficiency	U-.22 or better	Discretionary	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft window	10,000	1,223.93	0.16%	WND_HE-Heating-RTF-v2.1-46	N/A	n/a	45	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Office	New	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	10,000	0.25	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.88	$ -	$ -	1.06	604.22	5.0%	10.0%
Office	New	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	10,000	0.25	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.88	$ -	$ -	1.06	410.98	5.0%	10.0%
Office	New	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Discretionary	No control	Reset control installed	Retro5Med	0	BoilerCtrl	10,000	0.63	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 719.34	$ -	$ -	1.18	1,074.17	100.0%	100.0%
Office	New	Heating	Steam Trap Maintenance	Cleaning and maintenance	Discretionary	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	10,000	10,000.00	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 0.01	$ -	$ -	1.08	0.03	0.0%	10.0%
Office	New	Heating	Gas Boiler - High Turndown	Turndown control installed	Discretionary	No control	Turndown control installed	Retro12Med	0	kbtuh heat	10,000	253.97	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 2.59	$ -	$ -	1.02	1.01	100.0%	100.0%
Office	New	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Discretionary	Average performance	Optimized burner controls	Retro3Slow	0	kBtuh heat	10,000	253.97	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 0.87	$ -	$ -	1.02	0.29	5.0%	85.0%
Office	New	Heating	HVAC - Shut Off Damper	Damper installed	Discretionary	No damper	Damper installed	Retro12Med	0	BoilerCtrl	10,000	0.63	0.16%	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	15	$ 1,536.09	$ 97.53	$ -	1.02	91.33	0.0%	75.0%
Office	New	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Discretionary	Constant ventilation	DCV enabled	RetroEven20	0	sqft	10,000	10,000.00	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.16	$ -	$ 0.00	1.18	0.02	100.0%	100.0%
Office	New	Heating	Gas Boiler - Stack Economizer	Economizer installed	Discretionary	None	Economizer installed	Retro12Med	0	BoilerCtrl	10,000	0.63	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 587.69	$ -	$ -	1.18	179.03	15.0%	55.0%
Office	New	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Discretionary	None	Tube inserts installed	Retro3Slow	0	sqft	10,000	10,000.00	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Office	New	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Discretionary	No insulation	Lines and condensate tank insulated	RetroEven20	0	boiler pipe	10,000	400.00	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 12.90	$ -	$ -	1.06	5.99	100.0%	100.0%
Office	New	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Discretionary	No insulation	Insulated water lines	RetroEven20	0	boiler pipe	10,000	400.00	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 24.10	$ -	$ -	1.06	4.01	100.0%	100.0%
Office	New	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Discretionary	None	HRV installed	RetroEven20	0	CFM	10,000	900.00	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 7.05	$ -	$ -	1.18	0.20	100.0%	100.0%
Office	New	Heating	Thermostat - Programmable	Programmable thermostat installed	Discretionary	Manual control	Programmable thermostat installed	RetroEven20	0	Stat Unit	10,000	10.00	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 188.67	$ -	$ 3.81	1.04	24.11	0.0%	0.0%
Office	New	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Discretionary	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	10,000	10,000.00	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.02	1.18	0.07	10.0%	75.0%
Office	New	Water Heating	Water Heater - Ozone Laundry	Ozone laundry system	Discretionary	Standard laundry machine	Ozone laundry system	Retro12Med	0	perBldg	10,000	1.00	0.16%	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	10	$ 20,798.30	$ 205.79	$ -	1.02	148.86	0.0%	0.0%
Office	New	Water Heating	Water Heater - High MEF Commercial Laundry Washers	ESTAR/High MEF unit installed	Discretionary	Standard laundry machine	ESTAR/High MEF unit installed	Retro3Slow	2	ClothesWashers	10,000	1.00	0.16%	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	11	$ 489.42	$ -	$ 125.05	1.06	35.51	0.0%	0.0%
Office	New	Water Heating	Water Heater - Motion Control Faucet	Motion activated faucet	Discretionary	Standard faucet	Motion activated faucet	Retro12Med	0	perBldg	10,000	1.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.02	-	0.0%	0.0%
Office	New	Water Heating	Water Heater - Faucet Aerator	1.5 GPM faucet	Discretionary	2.5 GPM faucet	1.5 GPM faucet	Retro5Med	0	faucet	10,000	12.00	0.16%	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-ILTRM-v5.0-15	10	$ 6.88	$ -	$ 13.76	0.98	3.71	100.0%	100.0%
Office	New	Water Heating	Water Heater - Drainwater Heat Recovery	Drain HR system installed	Discretionary	None	Drain HR system installed	Retro12Med	0	faucet	10,000	12.00	0.16%	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-MNTRM-v1.0-7	40	$ 880.81	$ -	$ -	1.10	3.19	0.0%	0.0%
Office	New	Water Heating	Water Heater - Efficient Dishwasher	ESTAR unit	Discretionary	Standard unit	ESTAR unit	Retro3Slow	1	perBldg	10,000	1.00	0.16%	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	10	$ 122.89	$ -	$ 31.72	1.02	71.00	44.0%	80.0%
Office	New	Water Heating	Water Heater - Pre-Rinse Spray Valve	2 GPM sprayer nozzle	Discretionary	3.5 GPM kitchen sprayer	2 GPM sprayer nozzle	Retro12Med	0	KitchenFaucet	10,000	1.00	0.16%	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	4	$ 127.84	$ -	$ 136.94	1.18	23.08	25.0%	65.0%
Office	New	Water Heating	Water Heater - Central Controls	Central water boiler controls installed	Discretionary	No central controls	Central water boiler controls installed	Retro12Med	0	perBldg	10,000	1.00	0.16%	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	15	$ 1,410.47	$ -	$ -	1.18	240.57	5.0%	5.0%
Office	New	Water Heating	Water Heater - Solar System	Solar system installed	Discretionary	None	Solar system installed	Retro12Med	0	DHW kbtuh	10,000	441.75	0.16%	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-DOE-PTool2014-1	20	$ 326.36	$ 0.81	$ -	1.04	2.11	1.0%	30.0%
Office	New	Heating	Destratification Fans (HVLS)	Fans Installed	Discretionary	None/Standard ventilation	Fans Installed	RetroEven20	0	Strat Fan	10,000	0.86	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 7,757.57	$ -	$ 115.13	1.18	728.57	15.0%	20.0%
Office	New	Heating	Kitchen Hood - DCV/MUA	DCV/HUA vent hood	Discretionary	Standard kitchen hood	DCV/HUA vent hood	RetroEven20	0	sqft	10,000	10,000.00	0.16%	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	20	$ 0.16	$ -	$ 0.01	1.02	0.06	10.0%	10.0%
Office	New	Miscellaneous	Pool Heater - Night Covers	Night cover in place	Discretionary	No cover	Night cover in place	RetroEven20	0	sqft pool	10,000	1,875.00	0.16%	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-ILTRM-v4.0-5	5	$ 2.37	$ -	$ -	1.06	0.00	100.0%	100.0%
Office	New	Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	10,000	10,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.39	$ -	$ 0.02	1.00	0.08	10.0%	25.0%
Office	New	Water Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	10,000	10,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.39	$ -	$ 0.02	1.00	0.02	10.0%	25.0%
Office	New	Heating	Steam System Efficiency Improvements	Optimized system	Discretionary	Average system efficiency	Optimized system	Retro1Slow	0	sqft	10,000	10,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Office	New	Heating	Commissioning - HVAC	Optimized HVAC design and controls	Discretionary	New construction code	Optimized HVAC design and controls	Retro12Med	0	sqft	10,000	10,000.00	0.16%	COM_CX-All-AEG-5	COM_CX-All-AEG-5	COM_CX-All-AEG-5	3	$ 1.29	$ -	$ 0.03	1.11	0.10	100.0%	100.0%
Office	New	Heating	Retrocommissioning - HVAC	Optimized HVAC flow and controls	Discretionary	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	sqft	10,000	10,000.00	0.16%	N/A	N/A	7th Power Plan Calculation	5	$ 1.18	$ -	$ 0.02	1.18	0.05	0.0%	0.0%
Office	New	Heating	Strategic Energy Management	Energy management system installed and programmed	Discretionary	No energy management system	Energy management system installed and programmed	RetroEven20	0	sqft	10,000	10,000.00	0.16%	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	5	$ 0.09	$ -	$ 0.01	1.00	0.02	5.0%	25.0%
Retail	Existing	Heating	Insulation - Roof/Ceiling	R-38	Discretionary	R-13	R-38	Retro3Slow	2	sqft roof	100,000	33,333.33	0.16%	INS_CLG-Heating-RTF-v2.1-55	INS_CLG-Heating-RTF-v2.1-55	Building Energy Simulation Tool	45	$ 1.02	$ -	$ 0.05	1.18	0.31	60.0%	85.0%
Retail	Existing	Heating	Insulation - Wall Cavity	R-21	Discretionary	R-11 or less	R-21	Retro3Slow	2	sqft wall	100,000	32,863.35	0.16%	INS_WC-Heating-RTF-v2.1-1	INS_WC-Heating-RTF-v2.1-1	Building Energy Simulation Tool	45	$ 1.61	$ -	$ 0.05	1.18	0.31	60.0%	85.0%
Retail	Existing	Heating	Insulation - Ducting	50% reduction in thermal losses	Discretionary	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	100,000	100,000.00	0.16%	INS_DCT-All-DEER-1	INS_DCT-All-DEER-1	Building Energy Simulation Tool	20	$ 0.86	$ -	$ -	1.12	-	40.0%	60.0%
Retail	Existing	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Discretionary	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	100,000	100,000.00	0.16%	DCT_RPR-All-DEER-1	DCT_RPR-Cooling-RTF-1	Building Energy Simulation Tool	18	$ 0.59	$ -	$ 0.00	1.18	0.01	15.0%	50.0%
Retail	Existing	Heating	Windows - High Efficiency	U-.22 or better	Discretionary	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft window	100,000	1,643.17	0.16%	WND_HE-Heating-RTF-v2.1-46	WND_HE-Heating-RTF-v2.1-46	Building Energy Simulation Tool	45	$ 24.31	$ -	$ 0.35	1.18	2.08	45.0%	100.0%
Retail	Existing	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	100,000	3.56	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.88	$ -	$ -	1.06	582.73	20.0%	30.0%
Retail	Existing	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	100,000	3.56	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.88	$ -	$ -	1.06	342.89	20.0%	30.0%
Retail	Existing	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Discretionary	No control	Reset control installed	Retro5Med	0	BoilerCtrl	100,000	8.89	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 719.34	$ -	$ -	1.18	1,035.96	35.0%	55.0%
Retail	Existing	Heating	Steam Trap Maintenance	Cleaning and maintenance	Discretionary	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	100,000	100,000.00	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 0.01	$ -	$ -	1.08	0.04	73.0%	100.0%
Retail	Existing	Heating	Gas Boiler - High Turndown	Turndown control installed	Discretionary	No control	Turndown control installed	Retro12Med	0	kbtuh heat	100,000	3,555.56	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 2.59	$ -	$ -	1.02	0.97	25.0%	50.0%
Retail	Existing	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Discretionary	Average performance	Optimized burner controls	Retro3Slow	0	kBtuh heat	100,000	3,555.56	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 0.87	$ -	$ -	1.02	0.28	5.0%	85.0%
Retail	Existing	Heating	HVAC - Shut Off Damper	Damper installed	Discretionary	No damper	Damper installed	Retro12Med	0	BoilerCtrl	100,000	8.89	0.16%	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	15	$ 1,536.09	$ 101.67	$ -	1.02	76.20	0.0%	75.0%
Retail	Existing	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Discretionary	Constant ventilation	DCV enabled	RetroEven20	0	sqft	100,000	100,000.00	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.25	$ -	$ 0.01	1.18	0.09	55.0%	75.0%
Retail	Existing	Heating	Gas Boiler - Stack Economizer	Economizer installed	Discretionary	None	Economizer installed	Retro12Med	0	BoilerCtrl	100,000	8.89	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 587.69	$ -	$ -	1.18	172.66	15.0%	55.0%
Retail	Existing	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Discretionary	None	Tube inserts installed	Retro3Slow	0	sqft	100,000	100,000.00	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Retail	Existing	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Discretionary	No insulation	Lines and condensate tank insulated	RetroEven20	0	boiler pipe	100,000	1,264.91	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 12.90	$ -	$ -	1.06	5.99	30.0%	40.0%
Retail	Existing	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Discretionary	No insulation	Insulated water lines	RetroEven20	0	boiler pipe	100,000	1,264.91	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 24.10	$ -	$ -	1.06	4.01	30.0%	40.0%
Retail	Existing	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Discretionary	None	HRV installed	RetroEven20	0	CFM	100,000	23,000.00	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 7.05	$ -	$ -	1.18	0.31	5.0%	10.0%
Retail	Existing	Heating	Thermostat - Programmable	Programmable thermostat installed	Discretionary	Manual control	Programmable thermostat installed	RetroEven20	0	Stat Unit	100,000	100.00	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 188.67	$ -	$ 1.10	1.04	6.47	10.0%	15.0%
Retail	Existing	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Discretionary	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	100,000	100,000.00	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.03	1.18	0.07	0.0%	35.0%
Retail	Existing	Water Heating	Water Heater - Ozone Laundry	Ozone laundry system	Discretionary	Standard laundry machine	Ozone laundry system	Retro12Med	0	perBldg	100,000	1.00	0.16%	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	10	$ 12,085.47	$ 205.79	$ -	1.02	2,130.47	0.0%	0.0%
Retail	Existing	Water Heating	Water Heater - High MEF Commercial Laundry Washers	ESTAR/High MEF unit installed	Discretionary	Standard laundry machine	ESTAR/High MEF unit installed	Retro3Slow	2	ClothesWashers	100,000	1.00	0.16%	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	11	$ 489.42	$ -	$ 125.05	1.06	35.51	0.0%	0.0%
Retail	Existing	Water Heating	Water Heater - Motion Control Faucet	Motion activated faucet	Discretionary	Standard faucet	Motion activated faucet	Retro12Med	0	perBldg	100,000	1.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.02	-	25.0%	65.0%
Retail	Existing	Water Heating	Water Heater - Faucet Aerator	1.5 GPM faucet	Discretionary	2.5 GPM faucet	1.5 GPM faucet	Retro5Med	0	faucet	100,000	12.00	0.16%	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-ILTRM-v5.0-19	10	$ 6.88	$ -	$ 13.76	0.98	5.42	25.0%	65.0%
Retail	Existing	Water Heating	Water Heater - Drainwater Heat Recovery	Drain HR system installed	Discretionary	None	Drain HR system installed	Retro12Med	0	faucet	100,000	12.00	0.16%	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-MNTRM-v1.0-7	40	$ 880.81	$ -	$ -	1.10	59.10	10.0%	20.0%
Retail	Existing	Water Heating	Water Heater - Efficient Dishwasher	ESTAR unit	Discretionary	Standard unit	ESTAR unit	Retro3Slow	1	perBldg	100,000	1.00	0.16%	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	10	$ 122.89	$ -	$ 31.72	1.02	71.00	27.5%	50.0%
Retail	Existing	Water Heating	Water Heater - Pre-Rinse Spray Valve	2 GPM sprayer nozzle	Discretionary	3.5 GPM kitchen sprayer	2 GPM sprayer nozzle	Retro12Med	0	KitchenFaucet	100,000	1.00	0.16%	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	4	$ 127.84	$ -	$ 136.94	1.18	23.08	25.0%	65.0%
Retail	Existing	Water Heating	Water Heater - Central Controls	Central water boiler controls installed	Discretionary	No central controls	Central water boiler controls installed	Retro12Med	0	perBldg	100,000	1.00	0.16%	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	15	$ 1,410.47	$ -	$ -	1.18	3,443.13	5.0%	5.0%
Retail	Existing	Water Heating	Water Heater - Solar System	Solar system installed	Discretionary	None	Solar system installed	Retro12Med	0	DHW kbtuh	100,000	8,195.50	0.16%	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-DOE-PTool2014-1	20	$ 326.36	$ 0.81	$ -	1.04	2.11	1.0%	30.0%
Retail	Existing	Heating	Destratification Fans (HVLS)	Fans Installed	Discretionary	None/Standard ventilation	Fans Installed	RetroEven20	0	Strat Fan	100,000	8.62	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 7,757.57	$ -	$ 129.86	1.18	766.46	15.0%	20.0%
Retail	Existing	Heating	Kitchen Hood - DCV/MUA	DCV/HUA vent hood	Discretionary	Standard kitchen hood	DCV/HUA vent hood	RetroEven20	0	sqft	100,000	100,000.00	0.16%	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	20	$ 0.16	$ -	$ 0.01	1.02	0.05	10.0%	10.0%
Retail	Existing	Miscellaneous	Pool Heater - Night Covers	Night cover in place	Discretionary	No cover	Night cover in place	RetroEven20	0	sqft pool	100,000	1,875.00	0.16%	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-ILTRM-v4.0-5	5	$ 2.37	$ -	$ -	1.06	0.04	50.0%	100.0%
Retail	Existing	Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	100,000	100,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.40	$ -	$ 0.02	1.00	0.07	10.0%	50.0%
Retail	Existing	Water Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	100,000	100,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.40	$ -	$ 0.02	1.00	0.03	10.0%	50.0%
Retail	Existing	Heating	Steam System Efficiency Improvements	Optimized system	Discretionary	Average system efficiency	Optimized system	Retro1Slow	0	sqft	100,000	100,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Retail	Existing	Heating	Commissioning - HVAC	Optimized HVAC design and controls	Discretionary	New construction code	Optimized HVAC design and controls	Retro12Med	0	sqft	100,000	100,000.00	0.16%	COM_CX-All-AEG-5	N/A	COM_CX-All-AEG-5	3	$ 1.11	$ -	$ 0.03	1.11	0.09	0.0%	0.0%
Retail	Existing	Heating	Retrocommissioning - HVAC	Optimized HVAC flow and controls	Discretionary	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	sqft	100,000	100,000.00	0.16%	COM_RCX-Heating-7PLN-v5-6	COM_RCX-Heating-7PLN-v5-6	7th Power Plan Calculation	5	$ 0.31	$ -	$ 0.02	1.18	0.05	20.0%	45.0%
Retail	Existing	Heating	Strategic Energy Management	Energy management system installed and programmed	Discretionary	No energy management system	Energy management system installed and programmed	RetroEven20	0	sqft	100,000	100,000.00	0.16%	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	5	$ 0.08	$ -	$ 0.01	1.00	0.02	5.0%	10.0%
Retail	New	Heating	Insulation - Roof/Ceiling	R-38	Discretionary	R-13	R-38	Retro3Slow	2	sqft roof	100,000	33,333.33	0.16%	INS_CLG-Heating-RTF-v2.1-55	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Retail	New	Heating	Insulation - Wall Cavity	R-21	Discretionary	R-11 or less	R-21	Retro3Slow	2	sqft wall	100,000	32,863.35	0.16%	INS_WC-Heating-RTF-v2.1-1	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Retail	New	Heating	Insulation - Ducting	50% reduction in thermal losses	Discretionary	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	100,000	100,000.00	0.16%	INS_DCT-All-DEER-1	N/A	Building Energy Simulation Tool	20	$ 1.12	$ -	$ -	1.12	-	0.0%	0.0%
Retail	New	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Discretionary	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	100,000	100,000.00	0.16%	DCT_RPR-All-DEER-1	N/A	n/a	18	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Retail	New	Heating	Windows - High Efficiency	U-.22 or better	Discretionary	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft window	100,000	1,643.17	0.16%	WND_HE-Heating-RTF-v2.1-46	N/A	n/a	45	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Retail	New	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	100,000	3.56	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.88	$ -	$ -	1.06	550.46	5.0%	10.0%
Retail	New	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	100,000	3.56	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.88	$ -	$ -	1.06	299.96	5.0%	10.0%
Retail	New	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Discretionary	No control	Reset control installed	Retro5Med	0	BoilerCtrl	100,000	8.89	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 719.34	$ -	$ -	1.18	978.60	100.0%	100.0%
Retail	New	Heating	Steam Trap Maintenance	Cleaning and maintenance	Discretionary	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	100,000	100,000.00	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 0.01	$ -	$ -	1.08	0.04	0.0%	10.0%
Retail	New	Heating	Gas Boiler - High Turndown	Turndown control installed	Discretionary	No control	Turndown control installed	Retro12Med	0	kbtuh heat	100,000	3,555.56	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 2.59	$ -	$ -	1.02	0.92	100.0%	100.0%
Retail	New	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Discretionary	Average performance	Optimized burner controls	Retro3Slow	0	kBtuh heat	100,000	3,555.56	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 0.87	$ -	$ -	1.02	0.27	5.0%	85.0%
Retail	New	Heating	HVAC - Shut Off Damper	Damper installed	Discretionary	No damper	Damper installed	Retro12Med	0	BoilerCtrl	100,000	8.89	0.16%	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	15	$ 1,536.09	$ 102.34	$ -	1.02	66.66	0.0%	75.0%
Retail	New	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Discretionary	Constant ventilation	DCV enabled	RetroEven20	0	sqft	100,000	100,000.00	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.16	$ -	$ 0.02	1.18	0.09	100.0%	100.0%
Retail	New	Heating	Gas Boiler - Stack Economizer	Economizer installed	Discretionary	None	Economizer installed	Retro12Med	0	BoilerCtrl	100,000	8.89	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 587.69	$ -	$ -	1.18	163.10	15.0%	55.0%
Retail	New	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Discretionary	None	Tube inserts installed	Retro3Slow	0	sqft	100,000	100,000.00	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Retail	New	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Discretionary	No insulation	Lines and condensate tank insulated	RetroEven20	0	boiler pipe	100,000	1,264.91	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 12.90	$ -	$ -	1.06	5.99	100.0%	100.0%
Retail	New	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Discretionary	No insulation	Insulated water lines	RetroEven20	0	boiler pipe	100,000	1,264.91	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 24.10	$ -	$ -	1.06	4.01	100.0%	100.0%
Retail	New	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Discretionary	None	HRV installed	RetroEven20	0	CFM	100,000	23,000.00	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 7.05	$ -	$ -	1.18	0.31	100.0%	100.0%
Retail	New	Heating	Thermostat - Programmable	Programmable thermostat installed	Discretionary	Manual control	Programmable thermostat installed	RetroEven20	0	Stat Unit	100,000	100.00	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 188.67	$ -	$ 1.16	1.04	7.42	0.0%	0.0%
Retail	New	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Discretionary	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	100,000	100,000.00	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.02	1.18	0.07	10.0%	50.0%
Retail	New	Water Heating	Water Heater - Ozone Laundry	Ozone laundry system	Discretionary	Standard laundry machine	Ozone laundry system	Retro12Med	0	perBldg	100,000	1.00	0.16%	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	10	$ 20,798.30	$ 205.79	$ -	1.02	2,130.84	0.0%	0.0%
Retail	New	Water Heating	Water Heater - High MEF Commercial Laundry Washers	ESTAR/High MEF unit installed	Discretionary	Standard laundry machine	ESTAR/High MEF unit installed	Retro3Slow	2	ClothesWashers	100,000	1.00	0.16%	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	11	$ 489.42	$ -	$ 125.05	1.06	35.51	0.0%	0.0%
Retail	New	Water Heating	Water Heater - Motion Control Faucet	Motion activated faucet	Discretionary	Standard faucet	Motion activated faucet	Retro12Med	0	perBldg	100,000	1.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.02	-	0.0%	0.0%
Retail	New	Water Heating	Water Heater - Faucet Aerator	1.5 GPM faucet	Discretionary	2.5 GPM faucet	1.5 GPM faucet	Retro5Med	0	faucet	100,000	36.00	0.16%	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-ILTRM-v5.0-19	10	$ 6.88	$ -	$ 13.76	0.98	5.42	100.0%	100.0%
Retail	New	Water Heating	Water Heater - Drainwater Heat Recovery	Drain HR system installed	Discretionary	None	Drain HR system installed	Retro12Med	0	faucet	100,000	36.00	0.16%	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-MNTRM-v1.0-7	40	$ 880.81	$ -	$ -	1.10	15.20	10.0%	20.0%
Retail	New	Water Heating	Water Heater - Efficient Dishwasher	ESTAR unit	Discretionary	Standard unit	ESTAR unit	Retro3Slow	1	perBldg	100,000	1.00	0.16%	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	10	$ 122.89	$ -	$ 31.72	1.02	71.00	27.5%	50.0%
Retail	New	Water Heating	Water Heater - Pre-Rinse Spray Valve	2 GPM sprayer nozzle	Discretionary	3.5 GPM kitchen sprayer	2 GPM sprayer nozzle	Retro12Med	0	KitchenFaucet	100,000	3.00	0.16%	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	4	$ 127.84	$ -	$ 136.94	1.18	23.08	25.0%	65.0%
Retail	New	Water Heating	Water Heater - Central Controls	Central water boiler controls installed	Discretionary	No central controls	Central water boiler controls installed	Retro12Med	0	perBldg	100,000	1.00	0.16%	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	15	$ 1,410.47	$ -	$ -	1.18	3,443.71	5.0%	5.0%
Retail	New	Water Heating	Water Heater - Solar System	Solar system installed	Discretionary	None	Solar system installed	Retro12Med	0	DHW kbtuh	100,000	6,323.55	0.16%	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-DOE-PTool2014-1	20	$ 326.36	$ 0.81	$ -	1.04	2.11	1.0%	30.0%
Retail	New	Heating	Destratification Fans (HVLS)	Fans Installed	Discretionary	None/Standard ventilation	Fans Installed	RetroEven20	0	Strat Fan	100,000	8.62	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 7,757.57	$ -	$ 115.89	1.18	739.56	15.0%	20.0%
Retail	New	Heating	Kitchen Hood - DCV/MUA	DCV/HUA vent hood	Discretionary	Standard kitchen hood	DCV/HUA vent hood	RetroEven20	0	sqft	100,000	100,000.00	0.16%	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	20	$ 0.16	$ -	$ 0.01	1.02	0.06	10.0%	10.0%
Retail	New	Miscellaneous	Pool Heater - Night Covers	Night cover in place	Discretionary	No cover	Night cover in place	RetroEven20	0	sqft pool	100,000	1,875.00	0.16%	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-ILTRM-v4.0-5	5	$ 2.37	$ -	$ -	1.06	0.04	100.0%	100.0%
Retail	New	Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	100,000	100,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.42	$ -	$ 0.02	1.00	0.08	10.0%	50.0%
Retail	New	Water Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	100,000	100,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.42	$ -	$ 0.02	1.00	0.02	10.0%	50.0%
Retail	New	Heating	Steam System Efficiency Improvements	Optimized system	Discretionary	Average system efficiency	Optimized system	Retro1Slow	0	sqft	100,000	100,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Retail	New	Heating	Commissioning - HVAC	Optimized HVAC design and controls	Discretionary	New construction code	Optimized HVAC design and controls	Retro12Med	0	sqft	100,000	100,000.00	0.16%	COM_CX-All-AEG-5	COM_CX-All-AEG-5	COM_CX-All-AEG-5	3	$ 1.29	$ -	$ 0.03	1.11	0.10	100.0%	100.0%
Retail	New	Heating	Retrocommissioning - HVAC	Optimized HVAC flow and controls	Discretionary	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	sqft	100,000	100,000.00	0.16%	N/A	N/A	7th Power Plan Calculation	5	$ 1.18	$ -	$ 0.02	1.18	0.06	0.0%	0.0%

Commercial Non Equipment

Segment	Vintage	End Use	Measure	Efficient Definition	Replacement Type	Baseline Definition (NEM Only)	Measure Description	Measure Ramp Rate Name	Ramp Offset	Input Unit of Measure	Bldg Sq Ft	UOM Per Facility	Line Loss	Lifetime Source	Costs Source	Savings Source	Measure Lifetime (Years)	Incremental Measure Cost ($)	Incremental O&M Cost ($)	Incremental Non-Energy Benefits ($)	Cost Scalar	Measure Savings @ generator (kWh) (NEM Only)	Base Saturation	Applicability
Measure					Characteristics									Sources			Measure Assumptions in 2017							
Retail	New	Heating	Strategic Energy Management	Energy management system installed and programmed	Discretionary	No energy management system	Energy management system installed and programmed	RetroEven20	0	sqft	100,000	100,000.00	0.16%	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	5	$ 0.09	$ -	$ 0.01	1.00	0.02	0.0%	0.0%
Restaurant	Existing	Heating	Insulation - Roof/Ceiling	R-38	Discretionary	R-13	R-38	Retro3Slow	2	sqft roof	5,500	5,500.00	0.16%	INS_CLG-Heating-RTF-v2.1-55	INS_CLG-Heating-RTF-v2.1-55	Building Energy Simulation Tool	45	$ 1.02	$ -	$ 0.02	1.18	0.07	60.0%	85.0%
Restaurant	Existing	Heating	Insulation - Wall Cavity	R-21	Discretionary	R-11 or less	R-21	Retro3Slow	2	sqft wall	5,500	3,297.46	0.16%	INS_WC-Heating-RTF-v2.1-1	INS_WC-Heating-RTF-v2.1-1	Building Energy Simulation Tool	45	$ 1.61	$ -	$ 0.01	1.18	0.07	60.0%	85.0%
Restaurant	Existing	Heating	Insulation - Ducting	50% reduction in thermal losses	Discretionary	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	5,500	5,500.00	0.16%	INS_DCT-All-DEER-1	INS_DCT-All-DEER-1	Building Energy Simulation Tool	20	$ 0.86	$ -	$ -	1.12	-	40.0%	60.0%
Restaurant	Existing	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Discretionary	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	5,500	5,500.00	0.16%	DCT_RPR-All-DEER-1	DCT_RPR-Cooling-RTF-1	Building Energy Simulation Tool	18	$ 0.59	$ -	$ -	1.18	-	15.0%	50.0%
Restaurant	Existing	Heating	Windows - High Efficiency	U-.22 or better	Discretionary	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft window	5,500	989.24	0.16%	WND_HE-Heating-RTF-v2.1-46	WND_HE-Heating-RTF-v2.1-46	Building Energy Simulation Tool	45	$ 24.31	$ -	$ 0.03	1.18	0.14	45.0%	100.0%
Restaurant	Existing	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	5,500	0.28	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.88	$ -	$ -	1.06	359.63	20.0%	30.0%
Restaurant	Existing	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	5,500	0.28	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.88	$ -	$ -	1.06	167.23	20.0%	30.0%
Restaurant	Existing	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Discretionary	No control	Reset control installed	Retro5Med	0	BoilerCtrl	5,500	0.70	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 719.34	$ -	$ -	1.18	639.34	35.0%	55.0%
Restaurant	Existing	Heating	Steam Trap Maintenance	Cleaning and maintenance	Discretionary	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	5,500	5,500.00	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 0.01	$ -	$ -	1.08	0.04	73.0%	100.0%
Restaurant	Existing	Heating	Gas Boiler - High Turndown	Turndown control installed	Discretionary	No control	Turndown control installed	Retro12Med	0	kbtuh heat	5,500	279.37	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 2.59	$ -	$ -	1.02	0.60	25.0%	50.0%
Restaurant	Existing	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Discretionary	Average performance	Optimized burner controls	Retro3Slow	0	kBtuh heat	5,500	279.37	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 0.87	$ -	$ -	1.02	0.17	5.0%	85.0%
Restaurant	Existing	Heating	HVAC - Shut Off Damper	Damper installed	Discretionary	No damper	Damper installed	Retro12Med	0	BoilerCtrl	5,500	0.70	0.16%	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	15	$ 1.536.09	$ 106.71	$ -	1.02	37.16	0.0%	75.0%
Restaurant	Existing	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Discretionary	Constant ventilation	DCV enabled	RetroEven20	0	sqft	5,500	5,500.00	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.25	$ -	$ 0.02	1.18	0.09	55.0%	75.0%
Restaurant	Existing	Heating	Gas Boiler - Stack Economizer	Economizer installed	Discretionary	None	Economizer installed	Retro12Med	0	BoilerCtrl	5,500	0.70	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 587.69	$ -	$ -	1.18	106.56	15.0%	55.0%
Restaurant	Existing	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Discretionary	None	Tube inserts installed	Retro3Slow	0	sqft	5,500	5,500.00	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Restaurant	Existing	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Discretionary	No insulation	Lines and condensate tank insulated	RetroEven20	0	boiler pipe	5,500	296.65	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 12.90	$ -	$ -	1.06	5.99	30.0%	40.0%
Restaurant	Existing	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Discretionary	No insulation	Insulated water lines	RetroEven20	0	boiler pipe	5,500	296.65	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 24.10	$ -	$ -	1.06	4.01	30.0%	40.0%
Restaurant	Existing	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Discretionary	None	HRV installed	RetroEven20	0	CFM	5,500	3,850.00	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 7.05	$ -	$ -	1.18	0.36	5.0%	15.0%
Restaurant	Existing	Heating	Thermostat - Programmable	Programmable thermostat installed	Discretionary	Manual control	Programmable thermostat installed	RetroEven20	0	Stat Unit	5,500	5.50	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 188.67	$ -	$ 3.82	1.04	18.54	20.0%	25.0%
Restaurant	Existing	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Discretionary	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	5,500	5,500.00	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.02	1.18	0.05	0.0%	75.0%
Restaurant	Existing	Water Heating	Water Heater - Ozone Laundry	Ozone laundry system	Discretionary	Standard laundry machine	Ozone laundry system	Retro12Med	0	perBldg	5,500	1.00	0.16%	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	10	$ 30,831.28	$ 205.79	$ -	1.02	298.93	0.0%	0.0%
Restaurant	Existing	Water Heating	Water Heater - High MEF Commercial Laundry Washers	ESTAR/High MEF unit installed	Discretionary	Standard laundry machine	ESTAR/High MEF unit installed	Retro3Slow	2	ClothesWashers	5,500	1.00	0.16%	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	11	$ 489.42	$ -	$ 125.05	1.06	35.51	0.0%	0.0%
Restaurant	Existing	Water Heating	Water Heater - Motion Control Faucet	Motion activated faucet	Discretionary	Standard faucet	Motion activated faucet	Retro12Med	0	perBldg	5,500	1.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.02	-	25.0%	65.0%
Restaurant	Existing	Water Heating	Water Heater - Faucet Aerator	1.5 GPM faucet	Discretionary	2.5 GPM faucet	1.5 GPM faucet	Retro5Med	0	faucet	5,500	12.00	0.16%	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-ILTRM-v5.0-18	10	$ 6.88	$ -	$ 13.76	0.98	23.43	25.0%	65.0%
Restaurant	Existing	Water Heating	Water Heater - Drainwater Heat Recovery	Drain HR system installed	Discretionary	None	Drain HR system installed	Retro12Med	0	faucet	5,500	12.00	0.16%	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-MNTRM-v1.0-7	40	$ 880.81	$ -	$ -	1.10	8.29	10.0%	40.0%
Restaurant	Existing	Water Heating	Water Heater - Efficient Dishwasher	ESTAR unit	Discretionary	Standard unit	ESTAR unit	Retro3Slow	1	perBldg	5,500	1.00	0.16%	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	10	$ 122.89	$ -	$ 31.72	1.02	71.00	55.0%	100.0%
Restaurant	Existing	Water Heating	Water Heater - Pre-Rinse Spray Valve	2 GPM sprayer nozzle	Discretionary	3.5 GPM kitchen sprayer	2 GPM sprayer nozzle	Retro12Med	0	KitchenFaucet	5,500	2.00	0.16%	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	4	$ 127.84	$ -	$ 136.94	1.18	23.08	25.0%	65.0%
Restaurant	Existing	Water Heating	Water Heater - Central Controls	Central water boiler controls installed	Discretionary	No central controls	Central water boiler controls installed	Retro12Med	0	perBldg	5,500	1.00	0.16%	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	15	$ 1,410.47	$ -	$ -	1.18	483.11	5.0%	5.0%
Restaurant	Existing	Water Heating	Water Heater - Solar System	Solar system installed	Discretionary	None	Solar system installed	Retro12Med	0	DHW kbtuh	5,500	1,149.92	0.16%	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-DOE-PTool2014-1	20	$ 326.36	$ 0.81	$ -	1.04	2.11	1.0%	30.0%
Restaurant	Existing	Heating	Destratification Fans (HVLS)	Fans Installed	Discretionary	None/Standard ventilation	Fans Installed	RetroEven20	0	Strat Fan	5,500	0.47	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 7,757.57	$ -	$ 115.57	1.18	561.53	15.0%	15.0%
Restaurant	Existing	Heating	Kitchen Hood - DCV/MUA	DCV/HUA vent hood	Discretionary	Standard kitchen hood	DCV/HUA vent hood	RetroEven20	0	sqft	5,500	5,500.00	0.16%	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	20	$ 0.12	$ -	$ 0.01	1.02	0.04	10.0%	50.0%
Restaurant	Existing	Miscellaneous	Pool Heater - Night Covers	Night cover in place	Discretionary	No cover	Night cover in place	RetroEven20	0	sqft pool	5,500	1,875.00	0.16%	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	5	$ 2.37	$ -	$ -	1.06	0.01	50.0%	100.0%
Restaurant	Existing	Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	5,500	5,500.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.50	$ -	$ 0.02	1.00	0.05	0.0%	0.0%
Restaurant	Existing	Water Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	5,500	5,500.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.50	$ -	$ 0.02	1.00	0.07	0.0%	0.0%
Restaurant	Existing	Heating	Steam System Efficiency Improvements	Optimized system	Discretionary	Average system efficiency	Optimized system	Retro1Slow	0	sqft	5,500	5,500.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Restaurant	Existing	Heating	Commissioning - HVAC	Optimized HVAC design and controls	Discretionary	New construction code	Optimized HVAC design and controls	Retro12Med	0	sqft	5,500	5,500.00	0.16%	COM_CX-All-AEG-5	N/A	COM_CX-All-AEG-5	3	$ 1.11	$ -	$ 0.03	1.11	0.07	0.0%	0.0%
Restaurant	Existing	Heating	Retrocommissioning - HVAC	Optimized HVAC flow and controls	Discretionary	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	sqft	5,500	5,500.00	0.16%	COM_RCX-Heating-7PLN-v5-13	COM_RCX-Heating-7PLN-v5-13	7th Power Plan Calculation	5	$ 0.31	$ -	$ 0.02	1.18	0.04	25.0%	35.0%
Restaurant	Existing	Heating	Strategic Energy Management	Energy management system installed and programmed	Discretionary	No energy management system	Energy management system installed and programmed	RetroEven20	0	sqft	5,500	5,500.00	0.16%	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	5	$ 0.06	$ -	$ 0.01	1.00	0.02	0.0%	0.0%
Restaurant	New	Heating	Insulation - Roof/Ceiling	R-38	Discretionary	R-13	R-38	Retro3Slow	2	sqft roof	5,500	5,500.00	0.16%	INS_CLG-Heating-RTF-v2.1-55	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Restaurant	New	Heating	Insulation - Wall Cavity	R-21	Discretionary	R-11 or less	R-21	Retro3Slow	2	sqft wall	5,500	3,297.46	0.16%	INS_WC-Heating-RTF-v2.1-1	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Restaurant	New	Heating	Insulation - Ducting	50% reduction in thermal losses	Discretionary	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	5,500	5,500.00	0.16%	INS_DCT-All-DEER-1	N/A	Building Energy Simulation Tool	20	$ 1.12	$ -	$ -	1.12	-	0.0%	0.0%
Restaurant	New	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Discretionary	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	5,500	5,500.00	0.16%	DCT_RPR-All-DEER-1	N/A	n/a	18	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Restaurant	New	Heating	Windows - High Efficiency	U-.22 or better	Discretionary	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft window	5,500	989.24	0.16%	WND_HE-Heating-RTF-v2.1-46	N/A	n/a	45	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Restaurant	New	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	5,500	0.28	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.88	$ -	$ -	1.06	328.94	5.0%	10.0%
Restaurant	New	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	5,500	0.28	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.88	$ -	$ -	1.06	146.34	5.0%	10.0%
Restaurant	New	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Discretionary	No control	Reset control installed	Retro5Med	0	BoilerCtrl	5,500	0.70	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 719.34	$ -	$ -	1.18	584.79	100.0%	100.0%
Restaurant	New	Heating	Steam Trap Maintenance	Cleaning and maintenance	Discretionary	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	5,500	5,500.00	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 0.01	$ -	$ -	1.08	0.03	0.0%	10.0%
Restaurant	New	Heating	Gas Boiler - High Turndown	Turndown control installed	Discretionary	No control	Turndown control installed	Retro12Med	0	kbtuh heat	5,500	279.37	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 2.59	$ -	$ -	1.02	0.55	100.0%	100.0%
Restaurant	New	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Discretionary	Average performance	Optimized burner controls	Retro3Slow	0	kBtuh heat	5,500	279.37	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 0.87	$ -	$ -	1.02	0.16	5.0%	85.0%
Restaurant	New	Heating	HVAC - Shut Off Damper	Damper installed	Discretionary	No damper	Damper installed	Retro12Med	0	BoilerCtrl	5,500	0.70	0.16%	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	15	$ 1,536.09	$ 107.03	$ -	1.02	32.52	0.0%	75.0%
Restaurant	New	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Discretionary	Constant ventilation	DCV enabled	RetroEven20	0	sqft	5,500	5,500.00	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.16	$ -	$ 0.02	1.18	0.09	100.0%	100.0%
Restaurant	New	Heating	Gas Boiler - Stack Economizer	Economizer installed	Discretionary	None	Economizer installed	Retro12Med	0	BoilerCtrl	5,500	0.70	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 587.69	$ -	$ -	1.18	97.46	15.0%	55.0%
Restaurant	New	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Discretionary	None	Tube inserts installed	Retro3Slow	0	sqft	5,500	5,500.00	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Restaurant	New	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Discretionary	No insulation	Lines and condensate tank insulated	RetroEven20	0	boiler pipe	5,500	296.65	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 12.90	$ -	$ -	1.06	5.99	100.0%	100.0%
Restaurant	New	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Discretionary	No insulation	Insulated water lines	RetroEven20	0	boiler pipe	5,500	296.65	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 24.10	$ -	$ -	1.06	4.01	100.0%	100.0%
Restaurant	New	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Discretionary	None	HRV installed	RetroEven20	0	CFM	5,500	3,850.00	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 7.05	$ -	$ -	1.18	0.36	100.0%	100.0%
Restaurant	New	Heating	Thermostat - Programmable	Programmable thermostat installed	Discretionary	Manual control	Programmable thermostat installed	RetroEven20	0	Stat Unit	5,500	5.50	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 188.67	$ -	$ 3.63	1.04	19.04	0.0%	0.0%
Restaurant	New	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Discretionary	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	5,500	5,500.00	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.02	1.18	0.06	20.0%	100.0%
Restaurant	New	Water Heating	Water Heater - Ozone Laundry	Ozone laundry system	Discretionary	Standard laundry machine	Ozone laundry system	Retro12Med	0	perBldg	5,500	1.00	0.16%	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	10	$ 20,798.30	$ 205.79	$ -	1.02	298.84	0.0%	0.0%
Restaurant	New	Water Heating	Water Heater - High MEF Commercial Laundry Washers	ESTAR/High MEF unit installed	Discretionary	Standard laundry machine	ESTAR/High MEF unit installed	Retro3Slow	2	ClothesWashers	5,500	1.00	0.16%	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	11	$ 489.42	$ -	$ 125.05	1.06	35.51	0.0%	0.0%
Restaurant	New	Water Heating	Water Heater - Motion Control Faucet	Motion activated faucet	Discretionary	Standard faucet	Motion activated faucet	Retro12Med	0	perBldg	5,500	1.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.02	-	0.0%	0.0%
Restaurant	New	Water Heating	Water Heater - Faucet Aerator	1.5 GPM faucet	Discretionary	2.5 GPM faucet	1.5 GPM faucet	Retro5Med	0	faucet	5,500	12.00	0.16%	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-ILTRM-v5.0-18	10	$ 6.88	$ -	$ 13.76	0.98	23.43	100.0%	100.0%
Restaurant	New	Water Heating	Water Heater - Drainwater Heat Recovery	Drain HR system installed	Discretionary	None	Drain HR system installed	Retro12Med	0	faucet	5,500	12.00	0.16%	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-MNTRM-v1.0-7	40	$ 880.81	$ -	$ -	1.10	6.40	10.0%	40.0%
Restaurant	New	Water Heating	Water Heater - Efficient Dishwasher	ESTAR unit	Discretionary	Standard unit	ESTAR unit	Retro3Slow	1	perBldg	5,500	1.00	0.16%	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	10	$ 122.89	$ -	$ 31.72	1.02	71.00	55.0%	100.0%
Restaurant	New	Water Heating	Water Heater - Pre-Rinse Spray Valve	2 GPM sprayer nozzle	Discretionary	3.5 GPM kitchen sprayer	2 GPM sprayer nozzle	Retro12Med	0	KitchenFaucet	5,500	2.00	0.16%	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	4	$ 127.84	$ -	$ 136.94	1.18	23.08	25.0%	65.0%
Restaurant	New	Water Heating	Water Heater - Central Controls	Central water boiler controls installed	Discretionary	No central controls	Central water boiler controls installed	Retro12Med	0	perBldg	5,500	1.00	0.16%	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	15	$ 1,410.47	$ -	$ -	1.18	482.97	5.0%	5.0%
Restaurant	New	Water Heating	Water Heater - Solar System	Solar system installed	Discretionary	None	Solar system installed	Retro12Med	0	DHW kbtuh	5,500	886.86	0.16%	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-DOE-PTool2014-1	20	$ 326.36	$ 0.81	$ -	1.04	2.11	1.0%	30.0%
Restaurant	New	Heating	Destratification Fans (HVLS)	Fans Installed	Discretionary	None/Standard ventilation	Fans Installed	RetroEven20	0	Strat Fan	5,500	0.47	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 7,757.57	$ -	$ 101.43	1.18	532.19	15.0%	15.0%
Restaurant	New	Heating	Kitchen Hood - DCV/MUA	DCV/HUA vent hood	Discretionary	Standard kitchen hood	DCV/HUA vent hood	RetroEven20	0	sqft	5,500	5,500.00	0.16%	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	20	$ 0.12	$ -	$ 0.01	1.02	0.05	10.0%	50.0%
Restaurant	New	Miscellaneous	Pool Heater - Night Covers	Night cover in place	Discretionary	No cover	Night cover in place	RetroEven20	0	sqft pool	5,500	1,875.00	0.16%	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-ILTRM-v4.0-5	5	$ 2.37	$ -	$ -	1.06	0.01	100.0%	100.0%
Restaurant	New	Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	5,500	5,500.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.49	$ -	$ 0.02	1.00	0.06	0.0%	0.0%
Restaurant	New	Water Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	5,500	5,500.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.49	$ -	$ 0.02	1.00	0.06	0.0%	0.0%
Restaurant	New	Heating	Steam System Efficiency Improvements	Optimized system	Discretionary	Average system efficiency	Optimized system	Retro1Slow	0	sqft	5,500	5,500.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Restaurant	New	Heating	Commissioning - HVAC	Optimized HVAC design and controls	Discretionary	New construction code	Optimized HVAC design and controls	Retro12Med	0	sqft	5,500	5,500.00	0.16%	COM_CX-All-AEG-5	COM_CX-All-AEG-5	COM_CX-All-AEG-5	3	$ 1.29	$ -	$ 0.03	1.11	0.07	100.0%	100.0%
Restaurant	New	Heating	Retrocommissioning - HVAC	Optimized HVAC flow and controls	Discretionary	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	sqft	5,500	5,500.00	0.16%	N/A	N/A	7th Power Plan Calculation	5	$ 1.18	$ -	$ 0.02	1.18	0.04	0.0%	0.0%
Restaurant	New	Heating	Strategic Energy Management	Energy management system installed and programmed	Discretionary	No energy management system	Energy management system installed and programmed	RetroEven20	0	sqft	5,500	5,500.00	0.16%	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	5	$ 0.06	$ -	$ 0.01	1.00	0.02	0.0%	0.0%
Grocery	Existing	Heating	Insulation - Roof/Ceiling	R-38	Discretionary	R-13	R-38	Retro3Slow	2	sqft roof	20,000	20,000.00	0.16%	INS_CLG-Heating-RTF-v2.1-55	INS_CLG-Heating-RTF-v2.1-55	Building Energy Simulation Tool	45	$ 1.02	$ -	$ 0.00	1.18	0.01	60.0%	85.0%
Grocery	Existing	Heating	Insulation - Wall Cavity	R-21	Discretionary	R-11 or less	R-21	Retro3Slow	2	sqft wall	20,000	11,294.42	0.16%	INS_WC-Heating-RTF-v2.1-1	INS_WC-Heating-RTF-v2.1-1	Building Energy Simulation Tool	45	$ 1.61	$ -	$ 0.00	1.18	0.03	60.0%	85.0%
Grocery	Existing	Heating	Insulation - Ducting	50% reduction in thermal losses	Discretionary	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	20,000	20,000.00	0.16%	INS_DCT-All-DEER-1	INS_DCT-All-DEER-1	Building Energy Simulation Tool	20	$ 0.86	$ -	$ -	1.12	-	40.0%	60.0%
Grocery	Existing	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Discretionary	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	20,000	20,000.00	0.16%	DCT_RPR-All-DEER-1	DCT_RPR-Cooling-RTF-1	Building Energy Simulation Tool	18	$ 0.59	$ -	$ 0.00	1.18	0.00	15.0%	50.0%
Grocery	Existing	Heating	Windows - High Efficiency	U-.22 or better	Discretionary	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft window	20,000	3,761.04	0.16%	WND_HE-Heating-RTF-v2.1-46	WND_HE-Heating-RTF-v2.1-46	Building Energy Simulation Tool	45	$ 24.31	$ -	$ 0.02	1.18	0.12	45.0%	100.0%
Grocery	Existing	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	20,000	0.59	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.88	$ -	$ -	1.06	724.28	20.0%	30.0%
Grocery	Existing	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	20,000	0.59	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.88	$ -	$ -	1.06	426.18	20.0%	30.0%
Grocery	Existing	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Discretionary	No control	Reset control installed	Retro5Med	0	BoilerCtrl	20,000	1.48	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 719.34	$ -	$ -	1.18	1,287.61	35.0%	55.0%
Grocery	Existing	Heating	Steam Trap Maintenance	Cleaning and maintenance	Discretionary	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	20,000	20,000.00	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 0.01	$ -	$ -	1.08	0.04	73.0%	100.0%
Grocery	Existing	Heating	Gas Boiler - High Turndown	Turndown control installed	Discretionary	No control	Turndown control installed	Retro12Med	0	kbtuh heat	20,000	592.59	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 2.59	$ -	$ -	1.02	1.21	25.0%	50.0%
Grocery	Existing	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Discretionary	Average performance	Optimized burner controls	Retro3Slow	0	kBtuh heat	20,000	592.59	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 0.87	$ -	$ -	1.02	0.35	5.0%	85.0%
Grocery	Existing	Heating	HVAC - Shut Off Damper	Damper installed	Discretionary	No damper	Damper installed	Retro12Med	0	BoilerCtrl	20,000	1.48	0.16%	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	15	$ 1,536.09	$ 98.84	$ -	1.02	94.71	0.0%	75.0%
Grocery	Existing	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Discretionary	Constant ventilation	DCV enabled	RetroEven20	0	sqft	20,000	20,000.00	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.25	$ -	$ 0.00	1.18	0.02	55.0%	75.0%
Grocery	Existing	Heating	Gas Boiler - Stack Economizer	Economizer installed	Discretionary	None	Economizer installed	Retro12Med	0	BoilerCtrl	20,000	1.48	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 587.69	$ -	$ -	1.18	214.60	15.0%	55.0%
Grocery	Existing	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Discretionary	None	Tube inserts installed	Retro3Slow	0	sqft	20,000	20,000.00	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Grocery	Existing	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Discretionary	No insulation	Lines and condensate tank insulated	RetroEven20	0	boiler pipe	20,000	565.69	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 12.90	$ -	$ -	1.06	5.99	30.0%	40.0%
Grocery	Existing	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Discretionary	No insulation	Insulated water lines	RetroEven20	0	boiler pipe	20,000	565.69	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 24.10	$ -	$ -	1.06	4.01	30.0%	40.0%
Grocery	Existing	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Discretionary	None	HRV installed	RetroEven20	0	CFM	20,000	2,400.00	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 7.05	$ -	$ -	1.18	0.43	5.0%	10.0%
Grocery	Existing	Heating	Thermostat - Programmable	Programmable thermostat installed	Discretionary	Manual control	Programmable thermostat installed	RetroEven20	0	Stat Unit	20,000	20.00	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 188.67	$ -	$ 4.14	1.04	24.71	10.0%	20.0%
Grocery	Existing	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Discretionary	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	20,000	20,000.00	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.03	1.18	0.07	0.0%	30.0%
Grocery	Existing	Water Heating	Water Heater - Ozone Laundry	Ozone laundry system	Discretionary	Standard laundry machine	Ozone laundry system	Retro12Med	0	perBldg	20,000	1.00	0.16%	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	10	$ 12.860.96	$ 205.79	$ -	1.02	453.44	0.0%	0.0%
Grocery	Existing	Water Heating	Water Heater - High MEF Commercial Laundry Washers	ESTAR/High MEF unit installed	Discretionary	Standard laundry machine	ESTAR/High MEF unit installed	Retro3Slow	2	ClothesWashers	20,000	1.00	0.16%	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	11	$ 489.42	$ -	$ 125.05	1.06	35.51	0.0%	0.0%
Grocery	Existing	Water Heating	Water Heater - Motion Control Faucet	Motion activated faucet	Discretionary	Standard faucet	Motion activated faucet	Retro12Med	0	perBldg	20,000	1.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.02	-	25.0%	65.0%
Grocery	Existing	Water Heating	Water Heater - Faucet Aerator	1.5 GPM faucet	Discretionary	2.5 GPM faucet	1.5 GPM faucet	Retro5Med	0	faucet	20,000	12.00	0.16%	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-ILTRM-v5.0-20	10	$ 6.88	$ -	$ 13.76	0.98	5.42	25.0%	65.0%
Grocery	Existing	Water Heating	Water Heater - Drainwater Heat Recovery	Drain HR system installed	Discretionary	None	Drain HR system installed	Retro12Med	0	faucet	20,000	12.00	0.16%	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-MNTRM-v1.0-7	40	$ 880.81	$ -	$ -	1.10	12.58	0.0%	0.0%
Grocery	Existing	Water Heating	Water Heater - Efficient Dishwasher	ESTAR unit	Discretionary	Standard unit	ESTAR unit	Retro3Slow	1	perBldg	20,000	1.00	0.16%	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	10	$ 122.89	$ -	$ 31.72	1.02	71.00	55.0%	100.0%
Grocery	Existing	Water Heating	Water Heater - Pre-Rinse Spray Valve	2 GPM sprayer nozzle	Discretionary	3.5 GPM kitchen sprayer	2 GPM sprayer nozzle	Retro12Med	0	KitchenFaucet	20,000	1.00	0.16%	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	4	$ 127.84	$ -	$ 136.94	1.18	23.08	25.0%	65.0%
Grocery	Existing	Water Heating	Water Heater - Central Controls	Central water boiler controls installed	Discretionary	No central controls	Central water boiler controls installed	Retro12Med	0	perBldg	20,000	1.00	0.16%	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	15	$ 1.410.47	$ -	$ -	1.18	732.81	5.0%	5.0%
Grocery	Existing	Water Heating	Water Heater - Solar System	Solar system installed	Discretionary	None	Solar system installed	Retro12Med	0	DHW kbtuh	20,000	1,744.28	0.16%	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-DOE-PTool2014-1	20	$ 326.36	$ 0.81	$ -	1.04	2.11	1.0%	30.0%
Grocery	Existing	Heating	Destratification Fans (HVLS)	Fans Installed	Discretionary	None/Standard ventilation	Fans Installed	RetroEven20	0	Strat Fan	20,000	1.72	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 7,757.57	$ -	$ 130.84	1.18	780.47	15.0%	20.0%
Grocery	Existing	Heating	Kitchen Hood - DCV/MUA	DCV/HUA vent hood	Discretionary	Standard kitchen hood	DCV/HUA vent hood	RetroEven20	0	sqft	20,000	20,000.00	0.16%	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	20	$ 0.16	$ -	$ 0.01	1.02	0.06	10.0%	20.0%
Grocery	Existing	Miscellaneous	Pool Heater - Night Covers	Night cover in place	Discretionary	No cover	Night cover in place	RetroEven20	0	sqft pool	20,000	1,875.00	0.16%	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	5	$ 2.37	$ -	$ -	1.06	0.01	50.0%	100.0%
Grocery	Existing	Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	20,000	20,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.41	$ -	$ 0.02	1.00	0.07	10.0%	50.0%
Grocery	Existing	Water Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	20,000	20,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.41	$ -	$ 0.02	1.00	0.03	10.0%	50.0%
Grocery	Existing	Heating	Steam System Efficiency Improvements	Optimized system	Discretionary	Average system efficiency	Optimized system	Retro1Slow	0	sqft	20,000	20,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Grocery	Existing	Heating	Commissioning - HVAC	Optimized HVAC design and controls	Discretionary	New construction code	Optimized HVAC design and controls	Retro12Med	0	sqft	20,000	20,000.00	0.16%	COM_CX-All-AEG-5	N/A	COM_CX-All-AEG-5	3	$ 1.11	$ -	$ 0.03	1.11	0.09	0.0%	0.0%
Grocery	Existing	Heating	Retrocommissioning - HVAC	Optimized HVAC flow and controls	Discretionary	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	sqft	20,000	20,000.00	0.16%	COM_RCX-Heating-7PLN-v5-11	COM_RCX-Heating-7PLN-v5-11	7th Power Plan Calculation	5	$ 0.19	$ -	$ 0.02	1.18	0.05	15.0%	45.0%
Grocery	Existing	Heating	Strategic Energy Management	Energy management system installed and programmed	Discretionary	No energy management system	Energy management system installed and programmed	RetroEven20	0	sqft	20,000	20,000.00	0.16%	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	5	$ 0.08	$ -	$ 0.01	1.00	0.02	0.0%	0.0%
Grocery	New	Heating	Insulation - Roof/Ceiling	R-38	Discretionary	R-13	R-38	Retro3Slow	2	sqft roof	35,000	35,000.00	0.16%	INS_CLG-Heating-RTF-v2.1-55	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Grocery	New	Heating	Insulation - Wall Cavity	R-21	Discretionary	R-11 or less	R-21	Retro3Slow	2	sqft wall	35,000	14,941.11	0.16%	INS_WC-Heating-RTF-v2.1-1	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Grocery	New	Heating	Insulation - Ducting	50% reduction in thermal losses	Discretionary	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	35,000	35,000.00	0.16%	INS_DCT-All-DEER-1	N/A	Building Energy Simulation Tool	20	$ 1.12	$ -	$ -	1.12	-	0.0%	0.0%
Grocery	New	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Discretionary	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	35,000	35,000.00	0.16%	DCT_RPR-All-DEER-1	N/A	n/a	18	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Grocery	New	Heating	Windows - High Efficiency	U-.22 or better	Discretionary	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft window	35,000	4,975.39	0.16%	WND_HE-Heating-RTF-v2.1-46	N/A	n/a	45	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Grocery	New	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	35,000	1.04	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.88	$ -	$ -	1.06	617.30	5.0%	10.0%
Grocery	New	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	35,000	1.04	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.88	$ -	$ -	1.06	372.91	5.0%	10.0%
Grocery	New	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Discretionary	No control	Reset control installed	Retro5Med	0	BoilerCtrl	35,000	2.59	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 719.34	$ -	$ -	1.18	1,097.43	100.0%	100.0%
Grocery	New	Heating	Steam Trap Maintenance	Cleaning and maintenance	Discretionary	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	35,000	35,000.00	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 0.01	$ -	$ -	1.08	0.04	0.0%	10.0%
Grocery	New	Heating	Gas Boiler - High Turndown	Turndown control installed	Discretionary	No control	Turndown control installed	Retro12Med	0	kbtuh heat	35,000	1,037.04	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 2.59	$ -	$ -	1.02	1.03	100.0%	100.0%
Grocery	New	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Discretionary	Average performance	Optimized burner controls	Retro3Slow	0	kBtuh heat	35,000	1,037.04	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 0.87	$ -	$ -	1.02	0.30	5.0%	85.0%
Grocery	New	Heating	HVAC - Shut Off Damper	Damper installed	Discretionary	No damper	Damper installed	Retro12Med	0	BoilerCtrl	35,000	2.59	0.16%	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	15	$ 1.536.09	$ 99.67	$ -	1.02	82.87	0.0%	75.0%
Grocery	New	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Discretionary	Constant ventilation	DCV enabled	RetroEven20	0	sqft	35,000	35,000.00	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.16	$ -	$ 0.02	1.18	0.09	100.0%	100.0%
Grocery	New	Heating	Gas Boiler - Stack Economizer	Economizer installed	Discretionary	None	Economizer installed	Retro12Med	0	BoilerCtrl	35,000	2.59	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 587.69	$ -	$ -	1.18	182.90	15.0%	55.0%
Grocery	New	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Discretionary	None	Tube inserts installed	Retro3Slow	0	sqft	35,000	35,000.00	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Grocery	New	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Discretionary	No insulation	Lines and condensate tank insulated	RetroEven20	0	boiler pipe	35,000	748.33	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 12.90	$ -	$ -	1.06	5.99	100.0%	100.0%
Grocery	New	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Discretionary	No insulation	Insulated water lines	RetroEven20	0	boiler pipe	35,000	748.33	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 24.10	$ -	$ -	1.06	4.01	100.0%	100.0%
Grocery	New	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Discretionary	None	HRV installed	RetroEven20	0	CFM	35,000	4,200.00	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 7.05	$ -	$ -	1.18	0.43	100.0%	100.0%
Grocery	New	Heating	Thermostat - Programmable	Programmable thermostat installed	Discretionary	Manual control	Programmable thermostat installed	RetroEven20	0	Stat Unit	35,000	35.00	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 188.67	$ -	$ 4.59	1.04	29.69	0.0%	0.0%
Grocery	New	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Discretionary	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	35,000	35,000.00	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.03	1.18	0.09	10.0%	50.0%
Grocery	New	Water Heating	Water Heater - Ozone Laundry	Ozone laundry system	Discretionary	Standard laundry machine	Ozone laundry system	Retro12Med	0	perBldg	35,000	1.00	0.16%	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	10	$ 20,798.30	$ 205.79	$ -	1.02	793.43	0.0%	0.0%
Grocery	New	Water Heating	Water Heater - High MEF Commercial Laundry Washers	ESTAR/High MEF unit installed	Discretionary	Standard laundry machine	ESTAR/High MEF unit installed	Retro3Slow	2	ClothesWashers	35,000	1.00	0.16%	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	11	$ 489.42	$ -	$ 125.05	1.06	35.51	0.0%	0.0%
Grocery	New	Water Heating	Water Heater - Motion Control Faucet	Motion activated faucet	Discretionary	Standard faucet	Motion activated faucet	Retro12Med	0	perBldg	35,000	1.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.02	-	0.0%	0.0%
Grocery	New	Water Heating	Water Heater - Faucet Aerator	1.5 GPM faucet	Discretionary	2.5 GPM faucet	1.5 GPM faucet	Retro5Med	0	faucet	35,000	12.00	0.16%	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-ILTRM-v5.0-20	10	$ 6.88	$ -	$ 13.76	0.98	5.42	100.0%	100.0%
Grocery	New	Water Heating	Water Heater - Drainwater Heat Recovery	Drain HR system installed	Discretionary	None	Drain HR system installed	Retro12Med	0	faucet	35,000	12.00	0.16%	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-MNTRM-v1.0-7	40	$ 880.81	$ -	$ -	1.10	16.98	0.0%	0.0%
Grocery	New	Water Heating	Water Heater - Efficient Dishwasher	ESTAR unit	Discretionary	Standard unit	ESTAR unit	Retro3Slow	1	perBldg	35,000	1.00	0.16%	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	10	$ 122.89	$ -	$ 31.72	1.02	71.00	55.0%	100.0%
Grocery	New	Water Heating	Water Heater - Pre-Rinse Spray Valve	2 GPM sprayer nozzle	Discretionary	3.5 GPM kitchen sprayer	2 GPM sprayer nozzle	Retro12Med	0	KitchenFaucet	35,000	1.00	0.16%	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	4	$ 127.84	$ -	$ 136.94	1.18	23.08	25.0%	65.0%
Grocery	New	Water Heating	Water Heater - Central Controls	Central water boiler controls installed	Discretionary	No central controls	Central water boiler controls installed	Retro12Med	0	perBldg	35,000	1.00	0.16%	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	15	$ 1,410.47	$ -	$ -	1.18	1,282.28	5.0%	5.0%
Grocery	New	Water Heating	Water Heater - Solar System	Solar system installed	Discretionary	None	Solar system installed	Retro12Med	0	DHW kbtuh	35,000	2,354.60	0.16%	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-DOE-PTool2014-1	20	$ 326.36	$ 0.81	$ -	1.04	2.11	1.0%	30.0%
Grocery	New	Heating	Destratification Fans (HVLS)	Fans Installed	Discretionary	None/Standard ventilation	Fans Installed	RetroEven20	0	Strat Fan	35,000	3.02	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 7.757.57	$ -	$ 117.08	1.18	756.57	15.0%	20.0%
Grocery	New	Heating	Kitchen Hood - DCV/MUA	DCV/HUA vent hood	Discretionary	Standard kitchen hood	DCV/HUA vent hood	RetroEven20	0	sqft	35,000	35,000.00	0.16%	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	20	$ 0.16	$ -	$ 0.01	1.02	0.06	10.0%	20.0%
Grocery	New	Miscellaneous	Pool Heater - Night Covers	Night cover in place	Discretionary	No cover	Night cover in place	RetroEven20	0	sqft pool	35,000	1,875.00	0.16%	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-ILTRM-v4.0-5	5	$ 2.37	$ -	$ -	1.06	0.01	100.0%	100.0%
Grocery	New	Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	35,000	35,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.44	$ -	$ 0.02	1.00	0.08	10.0%	50.0%
Grocery	New	Water Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	35,000	35,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.44	$ -	$ 0.02	1.00	0.03	10.0%	50.0%
Grocery	New	Heating	Steam System Efficiency Improvements	Optimized system	Discretionary	Average system efficiency	Optimized system	Retro1Slow	0	sqft	35,000	35,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Grocery	New	Heating	Commissioning - HVAC	Optimized HVAC design and controls	Discretionary	New construction code	Optimized HVAC design and controls	Retro12Med	0	sqft	35,000	35,000.00	0.16%	COM_CX-All-AEG-5	COM_CX-All-AEG-5	COM_CX-All-AEG-5	3	$ 1.29	$ -	$ 0.03	1.11	0.10	100.0%	100.0%

Commercial Non Equipment

Measure					Characteristics									Sources			Measure Assumptions in 2017							
Segment	Vintage	End Use	Measure	Efficient Definition	Replacement Type	Baseline Definition (NEM Only)	Measure Description	Measure Ramp Rate Name	Ramp Offset	Input Unit of Measure	Bldg Sq Ft	UOM Per Facility	Line Loss	Lifetime Source	Costs Source	Savings Source	Measure Lifetime (Years)	Incremental Measure Cost ($)	Incremental O&M Cost ($)	Incremental Non-Energy Benefits ($)	Cost Scalar	Measure Savings @ generator (kWh) (NEM Only)	Base Saturation	Applicability
Grocery	New	Heating	Retrocommissioning - HVAC	Optimized HVAC flow and controls	Discretionary	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	sqft	35,000	35,000.00	0.16%	N/A	N/A	7th Power Plan Calculation	5	$ 1.18	$ -	$ 0.02	1.18	0.06	0.0%	0.0%
Grocery	New	Heating	Strategic Energy Management	Energy management system installed and programmed	Discretionary	No energy management system	Energy management system installed and programmed	RetroEven20	0	sqft	35,000	35,000.00	0.16%	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	5	$ 0.09	$ -	$ 0.01	1.00	0.02	0.0%	0.0%
Education	Existing	Heating	Insulation - Roof/Ceiling	R-38	Discretionary	R-13	R-38	Retro3Slow	2	sqft roof	30,000	30,000.00	0.16%	INS_CLG-Heating-RTF-v2.1-55	INS_CLG-Heating-RTF-v2.1-55	Building Energy Simulation Tool	45	$ 1.02	$ -	$ 0.01	1.18	0.02	60.0%	85.0%
Education	Existing	Heating	Insulation - Wall Cavity	R-21	Discretionary	R-11 or less	R-21	Retro3Slow	2	sqft wall	30,000	9,332.56	0.16%	INS_WC-Heating-RTF-v2.1-1	INS_WC-Heating-RTF-v2.1-1	Building Energy Simulation Tool	45	$ 1.61	$ -	$ 0.01	1.18	0.02	60.0%	85.0%
Education	Existing	Heating	Insulation - Ducting	50% reduction in thermal losses	Discretionary	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	30,000	30,000.00	0.16%	INS_DCT-All-DEER-1	INS_DCT-All-DEER-1	Building Energy Simulation Tool	20	$ 0.86	$ -	$ -	1.12	-	40.0%	60.0%
Education	Existing	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Discretionary	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	30,000	30,000.00	0.16%	DCT_RPR-All-DEER-1	DCT_RPR-Cooling-RTF-1	Building Energy Simulation Tool	18	$ 0.59	$ -	$ -	1.18	-	15.0%	50.0%
Education	Existing	Heating	Windows - High Efficiency	U-.22 or better	Discretionary	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft window	30,000	2,333.14	0.16%	WND_HE-Heating-RTF-v2.1-46	WND_HE-Heating-RTF-v2.1-46	Building Energy Simulation Tool	45	$ 24.31	$ -	$ 0.05	1.18	0.13	45.0%	100.0%
Education	Existing	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	30,000	1.07	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.88	$ -	$ -	1.06	120.19	20.0%	30.0%
Education	Existing	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	30,000	1.07	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.88	$ -	$ -	1.06	99.30	20.0%	30.0%
Education	Existing	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Discretionary	No control	Reset control installed	Retro5Med	0	BoilerCtrl	30,000	2.67	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 719.34	$ -	$ -	1.18	213.67	35.0%	55.0%
Education	Existing	Heating	Steam Trap Maintenance	Cleaning and maintenance	Discretionary	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	30,000	30,000.00	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 0.00	$ -	$ -	1.08	0.01	73.0%	100.0%
Education	Existing	Heating	Gas Boiler - High Turndown	Turndown control installed	Discretionary	No control	Turndown control installed	Retro12Med	0	kbtuh heat	30,000	1,066.67	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 2.59	$ -	$ -	1.02	0.20	25.0%	50.0%
Education	Existing	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Discretionary	Average performance	Optimized burner controls	Retro3Slow	0	kBtuh heat	30,000	1,066.67	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 0.87	$ -	$ -	1.02	0.06	5.0%	85.0%
Education	Existing	Heating	HVAC - Shut Off Damper	Damper installed	Discretionary	No damper	Damper installed	Retro12Med	0	BoilerCtrl	30,000	2.67	0.16%	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	15	$ 1,536.09	$ 105.45	$ -	1.02	22.07	0.0%	75.0%
Education	Existing	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Discretionary	Constant ventilation	DCV enabled	RetroEven20	0	sqft	30,000	30,000.00	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.25	$ -	$ 0.01	1.18	0.02	55.0%	75.0%
Education	Existing	Heating	Gas Boiler - Stack Economizer	Economizer installed	Discretionary	None	Economizer installed	Retro12Med	0	BoilerCtrl	30,000	2.67	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 587.69	$ -	$ -	1.18	35.61	15.0%	55.0%
Education	Existing	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Discretionary	None	Tube inserts installed	Retro3Slow	0	sqft	30,000	30,000.00	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Education	Existing	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Discretionary	No insulation	Lines and condenstate tank insulated	RetroEven20	0	boiler pipe	30,000	692.82	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 12.90	$ -	$ -	1.06	5.99	30.0%	40.0%
Education	Existing	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Discretionary	No insulation	Insulated water lines	RetroEven20	0	boiler pipe	30,000	692.82	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 24.10	$ -	$ -	1.06	4.01	30.0%	40.0%
Education	Existing	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Discretionary	None	HRV installed	RetroEven20	0	CFM	30,000	14,100.00	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 7.05	$ -	$ -	1.18	0.16	5.0%	20.0%
Education	Existing	Heating	Thermostat - Programmable	Programmable thermostat installed	Discretionary	Manual control	Programmable thermostat installed	RetroEven20	0	Stat Unit	30,000	30.00	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 188.67	$ -	$ 0.78	1.04	1.94	10.0%	20.0%
Education	Existing	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Discretionary	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	30,000	30,000.00	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.02	1.18	0.02	0.0%	40.0%
Education	Existing	Water Heating	Water Heater - Ozone Laundry	Ozone laundry system	Discretionary	Standard laundry machine	Ozone laundry system	Retro12Med	0	perBldg	30,000	1.00	0.16%	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	10	$ 6,688.98	$ 205.79	$ -	1.02	353.75	0.0%	0.0%
Education	Existing	Water Heating	Water Heater - High MEF Commercial Laundry Washers	ESTAR/High MEF unit installed	Discretionary	Standard laundry machine	ESTAR/High MEF unit installed	Retro3Slow	2	ClothesWashers	30,000	5.00	0.16%	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	11	$ 489.42	$ -	$ 125.05	1.06	35.51	8.0%	20.0%
Education	Existing	Water Heating	Water Heater - Motion Control Faucet	Motion activated faucet	Discretionary	Standard faucet	Motion activated faucet	Retro12Med	0	perBldg	30,000	1.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.02	-	25.0%	65.0%
Education	Existing	Water Heating	Water Heater - Faucet Aerator	1.5 GPM faucet	Discretionary	2.5 GPM faucet	1.5 GPM faucet	Retro5Med	0	faucet	30,000	12.00	0.16%	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-ILTRM-v5.0-23	10	$ 6.88	$ -	$ 13.76	0.98	13.37	25.0%	65.0%
Education	Existing	Water Heating	Water Heater - Drainwater Heat Recovery	Drain HR system installed	Discretionary	None	Drain HR system installed	Retro12Med	0	faucet	30,000	12.00	0.16%	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-MNTRM-v1.0-7	40	$ 880.81	$ -	$ -	1.10	9.81	0.0%	0.0%
Education	Existing	Water Heating	Water Heater - Efficient Dishwasher	ESTAR unit	Discretionary	Standard unit	ESTAR unit	Retro3Slow	1	perBldg	30,000	1.00	0.16%	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	10	$ 122.89	$ -	$ 31.72	1.02	71.00	55.0%	100.0%
Education	Existing	Water Heating	Water Heater - Pre-Rinse Spray Valve	2 GPM sprayer nozzle	Discretionary	3.5 GPM kitchen sprayer	2 GPM sprayer nozzle	Retro12Med	0	KitchenFaucet	30,000	1.00	0.16%	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	4	$ 127.84	$ -	$ 136.94	1.18	23.08	25.0%	65.0%
Education	Existing	Water Heating	Water Heater - Central Controls	Central water boiler controls installed	Discretionary	No central controls	Central water boiler controls installed	Retro12Med	0	perBldg	30,000	1.00	0.16%	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	15	$ 1,410.47	$ -	$ -	1.18	571.70	5.0%	5.0%
Education	Existing	Water Heating	Water Heater - Solar System	Solar system installed	Discretionary	None	Solar system installed	Retro12Med	0	DHW kbtuh	30,000	1,360.80	0.16%	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-DOE-PTool2014-1	20	$ 326.36	$ 0.81	$ -	1.04	2.11	1.0%	30.0%
Education	Existing	Heating	Destratification Fans (HVLS)	Fans Installed	Discretionary	None/Standard ventilation	Fans Installed	RetroEven20	0	Strat Fan	30,000	2.59	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 7,757.57	$ -	$ 92.44	1.18	229.88	15.0%	25.0%
Education	Existing	Heating	Kitchen Hood - DCV/MUA	DCV/HUA vent hood	Discretionary	Standard kitchen hood	DCV/HUA vent hood	RetroEven20	0	sqft	30,000	30,000.00	0.16%	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	20	$ 0.05	$ -	$ 0.01	1.02	0.02	10.0%	20.0%
Education	Existing	Miscellaneous	Pool Heater - Night Covers	Night cover in place	Discretionary	No cover	Night cover in place	RetroEven20	0	sqft pool	30,000	1,875.00	0.16%	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	5	$ 2.37	$ -	$ -	1.06	0.01	50.0%	100.0%
Education	Existing	Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	30,000	30,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-2	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.15	$ -	$ 0.02	1.00	0.02	10.0%	40.0%
Education	Existing	Water Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	30,000	30,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-2	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.15	$ -	$ 0.02	1.00	0.02	10.0%	40.0%
Education	Existing	Heating	Steam System Efficiency Improvements	Optimized system	Discretionary	Average system efficiency	Optimized system	Retro1Slow	0	sqft	30,000	30,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Education	Existing	Heating	Commissioning - HVAC	Optimized HVAC design and controls	Discretionary	New construction code	Optimized HVAC design and controls	Retro12Med	0	sqft	30,000	30,000.00	0.16%	COM_CX-All-AEG-5	N/A	COM_CX-All-AEG-5	3	$ 1.11	$ -	$ 0.03	1.11	0.03	0.0%	0.0%
Education	Existing	Heating	Retrocommissioning - HVAC	Optimized HVAC flow and controls	Discretionary	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	sqft	30,000	30,000.00	0.16%	COM_RCX-Heating-7PLN-v5-8	COM_RCX-Heating-7PLN-v5-8	7th Power Plan Calculation	5	$ 0.16	$ -	$ 0.01	1.18	0.01	25.0%	60.0%
Education	Existing	Heating	Strategic Energy Management	Energy management system installed and programmed	Discretionary	No energy management system	Energy management system installed and programmed	RetroEven20	0	sqft	30,000	30,000.00	0.16%	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	5	$ 0.02	$ -	$ 0.01	1.00	0.01	5.0%	45.0%
Education	New	Heating	Insulation - Roof/Ceiling	R-38	Discretionary	R-13	R-38	Retro3Slow	2	sqft roof	30,000	30,000.00	0.16%	INS_CLG-Heating-RTF-v2.1-55	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Education	New	Heating	Insulation - Wall Cavity	R-21	Discretionary	R-11 or less	R-21	Retro3Slow	2	sqft wall	30,000	9,332.56	0.16%	INS_WC-Heating-RTF-v2.1-1	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Education	New	Heating	Insulation - Ducting	50% reduction in thermal losses	Discretionary	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	30,000	30,000.00	0.16%	INS_DCT-All-DEER-1	N/A	Building Energy Simulation Tool	20	$ 1.12	$ -	$ -	1.12	-	0.0%	0.0%
Education	New	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Discretionary	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	30,000	30,000.00	0.16%	DCT_RPR-All-DEER-1	N/A	n/a	18	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Education	New	Heating	Windows - High Efficiency	U-.22 or better	Discretionary	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft window	30,000	2,333.14	0.16%	WND_HE-Heating-RTF-v2.1-46	N/A	n/a	45	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Education	New	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	30,000	1.07	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.88	$ -	$ -	1.06	114.18	5.0%	10.0%
Education	New	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	30,000	1.07	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.88	$ -	$ -	1.06	86.88	5.0%	10.0%
Education	New	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Discretionary	No control	Reset control installed	Retro5Med	0	BoilerCtrl	30,000	2.67	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 719.34	$ -	$ -	1.18	202.99	100.0%	100.0%
Education	New	Heating	Steam Trap Maintenance	Cleaning and maintenance	Discretionary	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	30,000	30,000.00	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 0.00	$ -	$ -	1.08	0.01	0.0%	10.0%
Education	New	Heating	Gas Boiler - High Turndown	Turndown control installed	Discretionary	No control	Turndown control installed	Retro12Med	0	kbtuh heat	30,000	1,066.67	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 2.59	$ -	$ -	1.02	0.19	100.0%	100.0%
Education	New	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Discretionary	Average performance	Optimized burner controls	Retro3Slow	0	kBtuh heat	30,000	1,066.67	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 0.87	$ -	$ -	1.02	0.06	5.0%	85.0%
Education	New	Heating	HVAC - Shut Off Damper	Damper installed	Discretionary	No damper	Damper installed	Retro12Med	0	BoilerCtrl	30,000	2.67	0.16%	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	15	$ 1,536.09	$ 105.64	$ -	1.02	19.31	0.0%	75.0%
Education	New	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Discretionary	Constant ventilation	DCV enabled	RetroEven20	0	sqft	30,000	30,000.00	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.16	$ -	$ 0.01	1.18	0.02	100.0%	100.0%
Education	New	Heating	Gas Boiler - Stack Economizer	Economizer installed	Discretionary	None	Economizer installed	Retro12Med	0	BoilerCtrl	30,000	2.67	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 587.69	$ -	$ -	1.18	33.83	15.0%	55.0%
Education	New	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Discretionary	None	Tube inserts installed	Retro3Slow	0	sqft	30,000	30,000.00	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Education	New	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Discretionary	No insulation	Lines and condenstate tank insulated	RetroEven20	0	boiler pipe	30,000	692.82	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 12.90	$ -	$ -	1.06	5.99	100.0%	100.0%
Education	New	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Discretionary	No insulation	Insulated water lines	RetroEven20	0	boiler pipe	30,000	692.82	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 24.10	$ -	$ -	1.06	4.01	100.0%	100.0%
Education	New	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Discretionary	None	HRV installed	RetroEven20	0	CFM	30,000	14,100.00	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 7.05	$ -	$ -	1.18	0.16	100.0%	100.0%
Education	New	Heating	Thermostat - Programmable	Programmable thermostat installed	Discretionary	Manual control	Programmable thermostat installed	RetroEven20	0	Stat Unit	30,000	30.00	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 188.67	$ -	$ 0.80	1.04	2.25	0.0%	0.0%
Education	New	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Discretionary	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	30,000	30,000.00	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.02	1.18	0.03	10.0%	60.0%
Education	New	Water Heating	Water Heater - Ozone Laundry	Ozone laundry system	Discretionary	Standard laundry machine	Ozone laundry system	Retro12Med	0	perBldg	30,000	1.00	0.16%	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	10	$ 20,798.30	$ 205.79	$ -	1.02	353.85	0.0%	0.0%
Education	New	Water Heating	Water Heater - High MEF Commercial Laundry Washers	ESTAR/High MEF unit installed	Discretionary	Standard laundry machine	ESTAR/High MEF unit installed	Retro3Slow	2	ClothesWashers	30,000	5.00	0.16%	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	11	$ 489.42	$ -	$ 125.05	1.06	35.51	8.0%	20.0%
Education	New	Water Heating	Water Heater - Motion Control Faucet	Motion activated faucet	Discretionary	Standard faucet	Motion activated faucet	Retro12Med	0	perBldg	30,000	1.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.02	-	0.0%	0.0%
Education	New	Water Heating	Water Heater - Faucet Aerator	1.5 GPM faucet	Discretionary	2.5 GPM faucet	1.5 GPM faucet	Retro5Med	0	faucet	30,000	12.00	0.16%	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-ILTRM-v5.0-23	10	$ 6.88	$ -	$ 13.76	0.98	13.37	100.0%	100.0%
Education	New	Water Heating	Water Heater - Drainwater Heat Recovery	Drain HR system installed	Discretionary	None	Drain HR system installed	Retro12Med	0	faucet	30,000	12.00	0.16%	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-MNTRM-v1.0-7	40	$ 880.81	$ -	$ -	1.10	7.57	0.0%	0.0%
Education	New	Water Heating	Water Heater - Efficient Dishwasher	ESTAR unit	Discretionary	Standard unit	ESTAR unit	Retro3Slow	1	perBldg	30,000	1.00	0.16%	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	10	$ 122.89	$ -	$ 31.72	1.02	71.00	55.0%	100.0%
Education	New	Water Heating	Water Heater - Pre-Rinse Spray Valve	2 GPM sprayer nozzle	Discretionary	3.5 GPM kitchen sprayer	2 GPM sprayer nozzle	Retro12Med	0	KitchenFaucet	30,000	1.00	0.16%	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	4	$ 127.84	$ -	$ 136.94	1.18	23.08	25.0%	65.0%
Education	New	Water Heating	Water Heater - Central Controls	Central water boiler controls installed	Discretionary	No central controls	Central water boiler controls installed	Retro12Med	0	perBldg	30,000	1.00	0.16%	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	15	$ 1,410.47	$ -	$ -	1.18	571.87	5.0%	5.0%
Education	New	Water Heating	Water Heater - Solar System	Solar system installed	Discretionary	None	Solar system installed	Retro12Med	0	DHW kbtuh	30,000	1,050.09	0.16%	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-DOE-PTool2014-1	20	$ 326.36	$ 0.81	$ -	1.04	2.11	1.0%	30.0%
Education	New	Heating	Destratification Fans (HVLS)	Fans Installed	Discretionary	None/Standard ventilation	Fans Installed	RetroEven20	0	Strat Fan	30,000	2.59	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 7,757.57	$ -	$ 79.93	1.18	223.92	15.0%	25.0%
Education	New	Heating	Kitchen Hood - DCV/MUA	DCV/HUA vent hood	Discretionary	Standard kitchen hood	DCV/HUA vent hood	RetroEven20	0	sqft	30,000	30,000.00	0.16%	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	20	$ 0.05	$ -	$ 0.01	1.02	0.02	10.0%	20.0%
Education	New	Miscellaneous	Pool Heater - Night Covers	Night cover in place	Discretionary	No cover	Night cover in place	RetroEven20	0	sqft pool	30,000	1,875.00	0.16%	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-ILTRM-v4.0-5	5	$ 2.37	$ -	$ -	1.06	0.01	100.0%	100.0%
Education	New	Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	30,000	30,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-2	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.15	$ -	$ 0.02	1.00	0.02	10.0%	40.0%
Education	New	Water Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	30,000	30,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-2	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.15	$ -	$ 0.02	1.00	0.01	10.0%	40.0%
Education	New	Heating	Steam System Efficiency Improvements	Optimized system	Discretionary	Average system efficiency	Optimized system	Retro1Slow	0	sqft	30,000	30,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Education	New	Heating	Commissioning - HVAC	Optimized HVAC design and controls	Discretionary	New construction code	Optimized HVAC design and controls	Retro12Med	0	sqft	30,000	30,000.00	0.16%	COM_CX-All-AEG-5	COM_CX-All-AEG-5	COM_CX-All-AEG-5	3	$ 1.29	$ -	$ 0.03	1.11	0.03	100.0%	100.0%
Education	New	Heating	Retrocommissioning - HVAC	Optimized HVAC flow and controls	Discretionary	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	sqft	30,000	30,000.00	0.16%	N/A	N/A	7th Power Plan Calculation	5	$ 1.18	$ -	$ 0.01	1.18	0.02	0.0%	0.0%
Education	New	Heating	Strategic Energy Management	Energy management system installed and programmed	Discretionary	No energy management system	Energy management system installed and programmed	RetroEven20	0	sqft	30,000	30,000.00	0.16%	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	5	$ 0.03	$ -	$ 0.01	1.00	0.01	5.0%	45.0%
Healthcare	Existing	Heating	Insulation - Roof/Ceiling	R-38	Discretionary	R-13	R-38	Retro3Slow	2	sqft roof	30,000	15,000.00	0.16%	INS_CLG-Heating-RTF-v2.1-55	INS_CLG-Heating-RTF-v2.1-55	Building Energy Simulation Tool	45	$ 1.02	$ -	$ 0.01	1.18	0.03	60.0%	85.0%
Healthcare	Existing	Heating	Insulation - Wall Cavity	R-21	Discretionary	R-11 or less	R-21	Retro3Slow	2	sqft wall	30,000	13,118.84	0.16%	INS_WC-Heating-RTF-v2.1-1	INS_WC-Heating-RTF-v2.1-1	Building Energy Simulation Tool	45	$ 1.61	$ -	$ 0.01	1.18	0.07	60.0%	85.0%
Healthcare	Existing	Heating	Insulation - Ducting	50% reduction in thermal losses	Discretionary	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	30,000	30,000.00	0.16%	INS_DCT-All-DEER-1	INS_DCT-All-DEER-1	Building Energy Simulation Tool	20	$ 0.86	$ -	$ -	1.12	-	40.0%	60.0%
Healthcare	Existing	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Discretionary	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	30,000	30,000.00	0.16%	DCT_RPR-All-DEER-1	DCT_RPR-Cooling-RTF-1	Building Energy Simulation Tool	18	$ 0.59	$ -	$ -	1.18	-	15.0%	50.0%
Healthcare	Existing	Heating	Windows - High Efficiency	U-.22 or better	Discretionary	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft window	30,000	655.94	0.16%	WND_HE-Heating-RTF-v2.1-46	WND_HE-Heating-RTF-v2.1-46	Building Energy Simulation Tool	45	$ 24.31	$ -	$ 0.24	1.18	1.18	45.0%	100.0%
Healthcare	Existing	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	30,000	0.97	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.88	$ -	$ -	1.06	435.14	20.0%	30.0%
Healthcare	Existing	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	30,000	0.97	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.88	$ -	$ -	1.06	216.98	20.0%	30.0%
Healthcare	Existing	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Discretionary	No control	Reset control installed	Retro5Med	0	BoilerCtrl	30,000	2.42	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 719.34	$ -	$ -	1.18	773.58	35.0%	55.0%
Healthcare	Existing	Heating	Steam Trap Maintenance	Cleaning and maintenance	Discretionary	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	30,000	30,000.00	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 0.01	$ -	$ -	1.08	0.03	73.0%	100.0%
Healthcare	Existing	Heating	Gas Boiler - High Turndown	Turndown control installed	Discretionary	No control	Turndown control installed	Retro12Med	0	kbtuh heat	30,000	969.70	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 2.59	$ -	$ -	1.02	0.73	25.0%	50.0%
Healthcare	Existing	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Discretionary	Average performance	Optimized burner controls	Retro3Slow	0	kBtuh heat	30,000	969.70	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 0.87	$ -	$ -	1.02	0.21	5.0%	85.0%
Healthcare	Existing	Heating	HVAC - Shut Off Damper	Damper installed	Discretionary	No damper	Damper installed	Retro12Med	0	BoilerCtrl	30,000	2.42	0.16%	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	15	$ 1,536.09	$ 102.85	$ -	1.02	48.22	0.0%	75.0%
Healthcare	Existing	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Discretionary	Constant ventilation	DCV enabled	RetroEven20	0	sqft	30,000	30,000.00	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.25	$ -	$ 0.01	1.18	0.02	55.0%	75.0%
Healthcare	Existing	Heating	Gas Boiler - Stack Economizer	Economizer installed	Discretionary	None	Economizer installed	Retro12Med	0	BoilerCtrl	30,000	2.42	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 587.69	$ -	$ -	1.18	128.93	15.0%	55.0%
Healthcare	Existing	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Discretionary	None	Tube inserts installed	Retro3Slow	0	sqft	30,000	30,000.00	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Healthcare	Existing	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Discretionary	No insulation	Lines and condenstate tank insulated	RetroEven20	0	boiler pipe	30,000	692.82	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 12.90	$ -	$ -	1.06	5.99	30.0%	40.0%
Healthcare	Existing	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Discretionary	No insulation	Insulated water lines	RetroEven20	0	boiler pipe	30,000	692.82	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 24.10	$ -	$ -	1.06	4.01	30.0%	40.0%
Healthcare	Existing	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Discretionary	None	HRV installed	RetroEven20	0	CFM	30,000	7,500.00	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 7.05	$ -	$ -	1.18	0.69	5.0%	15.0%
Healthcare	Existing	Heating	Thermostat - Programmable	Programmable thermostat installed	Discretionary	Manual control	Programmable thermostat installed	RetroEven20	0	Stat Unit	30,000	30.00	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 188.67	$ -	$ 6.24	1.04	30.99	10.0%	15.0%
Healthcare	Existing	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Discretionary	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	30,000	30,000.00	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.02	1.18	0.05	0.0%	35.0%
Healthcare	Existing	Water Heating	Water Heater - Ozone Laundry	Ozone laundry system	Discretionary	Standard laundry machine	Ozone laundry system	Retro12Med	0	perBldg	30,000	1.00	0.16%	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	10	$ 20,798.30	$ 205.79	$ -	1.02	1,833.20	10.0%	20.0%
Healthcare	Existing	Water Heating	Water Heater - High MEF Commercial Laundry Washers	ESTAR/High MEF unit installed	Discretionary	Standard laundry machine	ESTAR/High MEF unit installed	Retro3Slow	2	ClothesWashers	30,000	10.00	0.16%	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	11	$ 489.42	$ -	$ 125.05	1.06	35.51	8.0%	20.0%
Healthcare	Existing	Water Heating	Water Heater - Motion Control Faucet	Motion activated faucet	Discretionary	Standard faucet	Motion activated faucet	Retro12Med	0	perBldg	30,000	1.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.02	-	25.0%	65.0%
Healthcare	Existing	Water Heating	Water Heater - Faucet Aerator	1.5 GPM faucet	Discretionary	2.5 GPM faucet	1.5 GPM faucet	Retro5Med	0	faucet	30,000	24.00	0.16%	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-ILTRM-v5.0-24	10	$ 6.88	$ -	$ 13.76	0.98	24.41	25.0%	65.0%
Healthcare	Existing	Water Heating	Water Heater - Drainwater Heat Recovery	Drain HR system installed	Discretionary	None	Drain HR system installed	Retro12Med	0	faucet	30,000	24.00	0.16%	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-MNTRM-v1.0-7	40	$ 880.81	$ -	$ -	1.10	35.17	5.0%	10.0%
Healthcare	Existing	Water Heating	Water Heater - Efficient Dishwasher	ESTAR unit	Discretionary	Standard unit	ESTAR unit	Retro3Slow	1	perBldg	30,000	1.00	0.16%	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	10	$ 122.89	$ -	$ 31.72	1.02	71.00	55.0%	100.0%
Healthcare	Existing	Water Heating	Water Heater - Pre-Rinse Spray Valve	2 GPM sprayer nozzle	Discretionary	3.5 GPM kitchen sprayer	2 GPM sprayer nozzle	Retro12Med	0	KitchenFaucet	30,000	1.00	0.16%	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	4	$ 127.84	$ -	$ 136.94	1.18	23.08	25.0%	65.0%
Healthcare	Existing	Water Heating	Water Heater - Central Controls	Central water boiler controls installed	Discretionary	No central controls	Central water boiler controls installed	Retro12Med	0	perBldg	30,000	1.00	0.16%	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	15	$ 1,410.47	$ -	$ -	1.18	2,048.91	5.0%	5.0%
Healthcare	Existing	Water Heating	Water Heater - Solar System	Solar system installed	Discretionary	None	Solar system installed	Retro12Med	0	DHW kbtuh	30,000	4,876.91	0.16%	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-DOE-PTool2014-1	20	$ 326.36	$ 0.81	$ -	1.04	2.11	1.0%	30.0%
Healthcare	Existing	Heating	Destratification Fans (HVLS)	Fans Installed	Discretionary	None/Standard ventilation	Fans Installed	RetroEven20	0	Strat Fan	30,000	2.59	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 7,757.57	$ -	$ 116.91	1.18	580.76	15.0%	25.0%
Healthcare	Existing	Heating	Kitchen Hood - DCV/MUA	DCV/HUA vent hood	Discretionary	Standard kitchen hood	DCV/HUA vent hood	RetroEven20	0	sqft	30,000	30,000.00	0.16%	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	20	$ 0.12	$ -	$ 0.01	1.02	0.04	10.0%	20.0%
Healthcare	Existing	Miscellaneous	Pool Heater - Night Covers	Night cover in place	Discretionary	No cover	Night cover in place	RetroEven20	0	sqft pool	30,000	1,875.00	0.16%	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	5	$ 2.37	$ -	$ -	1.06	0.04	50.0%	100.0%
Healthcare	Existing	Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	30,000	30,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-6	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.44	$ -	$ 0.02	1.00	0.05	10.0%	50.0%
Healthcare	Existing	Water Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	30,000	30,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-6	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.44	$ -	$ 0.02	1.00	0.06	10.0%	50.0%
Healthcare	Existing	Heating	Steam System Efficiency Improvements	Optimized system	Discretionary	Average system efficiency	Optimized system	Retro1Slow	0	sqft	30,000	30,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Healthcare	Existing	Heating	Commissioning - HVAC	Optimized HVAC design and controls	Discretionary	New construction code	Optimized HVAC design and controls	Retro12Med	0	sqft	30,000	30,000.00	0.16%	COM_CX-All-AEG-5	N/A	COM_CX-All-AEG-5	3	$ 1.11	$ -	$ 0.03	1.11	0.07	0.0%	0.0%
Healthcare	Existing	Heating	Retrocommissioning - HVAC	Optimized HVAC flow and controls	Discretionary	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	sqft	30,000	30,000.00	0.16%	COM_RCX-Heating-7PLN-v5-15	COM_RCX-Heating-7PLN-v5-15	7th Power Plan Calculation	5	$ 0.16	$ -	$ 0.02	1.18	0.04	25.0%	60.0%
Healthcare	Existing	Heating	Strategic Energy Management	Energy management system installed and programmed	Discretionary	No energy management system	Energy management system installed and programmed	RetroEven20	0	sqft	30,000	30,000.00	0.16%	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	5	$ 0.06	$ -	$ 0.01	1.00	0.02	5.0%	35.0%
Healthcare	New	Heating	Insulation - Roof/Ceiling	R-38	Discretionary	R-13	R-38	Retro3Slow	2	sqft roof	30,000	15,000.00	0.16%	INS_CLG-Heating-RTF-v2.1-55	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Healthcare	New	Heating	Insulation - Wall Cavity	R-21	Discretionary	R-11 or less	R-21	Retro3Slow	2	sqft wall	30,000	13,118.84	0.16%	INS_WC-Heating-RTF-v2.1-1	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Healthcare	New	Heating	Insulation - Ducting	50% reduction in thermal losses	Discretionary	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	30,000	30,000.00	0.16%	INS_DCT-All-DEER-1	N/A	Building Energy Simulation Tool	20	$ 1.12	$ -	$ -	1.12	-	0.0%	0.0%
Healthcare	New	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Discretionary	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	30,000	30,000.00	0.16%	DCT_RPR-All-DEER-1	N/A	n/a	18	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Healthcare	New	Heating	Windows - High Efficiency	U-.22 or better	Discretionary	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft window	30,000	655.94	0.16%	WND_HE-Heating-RTF-v2.1-46	N/A	n/a	45	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Healthcare	New	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	30,000	0.97	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.88	$ -	$ -	1.06	365.60	5.0%	10.0%
Healthcare	New	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	30,000	0.97	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.88	$ -	$ -	1.06	189.86	5.0%	10.0%
Healthcare	New	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Discretionary	No control	Reset control installed	Retro5Med	0	BoilerCtrl	30,000	2.42	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 719.34	$ -	$ -	1.18	649.96	100.0%	100.0%
Healthcare	New	Heating	Steam Trap Maintenance	Cleaning and maintenance	Discretionary	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	30,000	30,000.00	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 0.01	$ -	$ -	1.08	0.02	0.0%	10.0%
Healthcare	New	Heating	Gas Boiler - High Turndown	Turndown control installed	Discretionary	No control	Turndown control installed	Retro12Med	0	kbtuh heat	30,000	969.70	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 2.59	$ -	$ -	1.02	0.61	100.0%	100.0%
Healthcare	New	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Discretionary	Average performance	Optimized burner controls	Retro3Slow	0	kBtuh heat	30,000	969.70	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 0.87	$ -	$ -	1.02	0.18	5.0%	85.0%
Healthcare	New	Heating	HVAC - Shut Off Damper	Damper installed	Discretionary	No damper	Damper installed	Retro12Med	0	BoilerCtrl	30,000	2.42	0.16%	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	15	$ 1,536.09	$ 103.27	$ -	1.02	42.19	0.0%	75.0%
Healthcare	New	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Discretionary	Constant ventilation	DCV enabled	RetroEven20	0	sqft	30,000	30,000.00	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.16	$ -	$ 0.01	1.18	0.02	100.0%	100.0%
Healthcare	New	Heating	Gas Boiler - Stack Economizer	Economizer installed	Discretionary	None	Economizer installed	Retro12Med	0	BoilerCtrl	30,000	2.42	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 587.69	$ -	$ -	1.18	108.33	15.0%	55.0%
Healthcare	New	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Discretionary	None	Tube inserts installed	Retro3Slow	0	sqft	30,000	30,000.00	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Healthcare	New	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Discretionary	No insulation	Lines and condenstate tank insulated	RetroEven20	0	boiler pipe	30,000	692.82	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 12.90	$ -	$ -	1.06	5.99	100.0%	100.0%
Healthcare	New	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Discretionary	No insulation	Insulated water lines	RetroEven20	0	boiler pipe	30,000	692.82	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 24.10	$ -	$ -	1.06	4.01	100.0%	100.0%
Healthcare	New	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Discretionary	None	HRV installed	RetroEven20	0	CFM	30,000	7,500.00	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 7.05	$ -	$ -	1.18	0.69	100.0%	100.0%
Healthcare	New	Heating	Thermostat - Programmable	Programmable thermostat installed	Discretionary	Manual control	Programmable thermostat installed	RetroEven20	0	Stat Unit	30,000	30.00	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 188.67	$ -	$ 2.53	1.04	13.33	0.0%	0.0%
Healthcare	New	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Discretionary	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	30,000	30,000.00	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.02	1.18	0.06	10.0%	50.0%
Healthcare	New	Water Heating	Water Heater - Ozone Laundry	Ozone laundry system	Discretionary	Standard laundry machine	Ozone laundry system	Retro12Med	0	perBldg	30,000	1.00	0.16%	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	10	$ 20,798.30	$ 205.79	$ -	1.02	1,833.20	10.0%	20.0%
Healthcare	New	Water Heating	Water Heater - High MEF Commercial Laundry Washers	ESTAR/High MEF unit installed	Discretionary	Standard laundry machine	ESTAR/High MEF unit installed	Retro3Slow	2	ClothesWashers	30,000	10.00	0.16%	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	11	$ 489.42	$ -	$ 125.05	1.06	35.51	8.0%	20.0%
Healthcare	New	Water Heating	Water Heater - Motion Control Faucet	Motion activated faucet	Discretionary	Standard faucet	Motion activated faucet	Retro12Med	0	perBldg	30,000	1.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.02	-	0.0%	0.0%
Healthcare	New	Water Heating	Water Heater - Faucet Aerator	1.5 GPM faucet	Discretionary	2.5 GPM faucet	1.5 GPM faucet	Retro5Med	0	faucet	30,000	24.00	0.16%	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-ILTRM-v5.0-24	10	$ 6.88	$ -	$ 13.76	0.98	24.41	100.0%	100.0%
Healthcare	New	Water Heating	Water Heater - Drainwater Heat Recovery	Drain HR system installed	Discretionary	None	Drain HR system installed	Retro12Med	0	faucet	30,000	24.00	0.16%	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-MNTRM-v1.0-7	40	$ 880.81	$ -	$ -	1.10	13.56	5.0%	10.0%
Healthcare	New	Water Heating	Water Heater - Efficient Dishwasher	ESTAR unit	Discretionary	Standard unit	ESTAR unit	Retro3Slow	1	perBldg	30,000	1.00	0.16%	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	10	$ 122.89	$ -	$ 31.72	1.02	71.00	55.0%	100.0%
Healthcare	New	Water Heating	Water Heater - Pre-Rinse Spray Valve	2 GPM sprayer nozzle	Discretionary	3.5 GPM kitchen sprayer	2 GPM sprayer nozzle	Retro12Med	0	KitchenFaucet	30,000	2.00	0.16%	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	4	$ 127.84	$ -	$ 136.94	1.18	23.08	25.0%	65.0%
Healthcare	New	Water Heating	Water Heater - Central Controls	Central water boiler controls installed	Discretionary	No central controls	Central water boiler controls installed	Retro12Med	0	perBldg	30,000	1.00	0.16%	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	15	$ 1,410.47	$ -	$ -	1.18	2,048.68	5.0%	5.0%
Healthcare	New	Water Heating	Water Heater - Solar System	Solar system installed	Discretionary	None	Solar system installed	Retro12Med	0	DHW kbtuh	30,000	3,761.91	0.16%	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-DOE-PTool2014-1	20	$ 326.36	$ 0.81	$ -	1.04	2.11	1.0%	30.0%
Healthcare	New	Heating	Destratification Fans (HVLS)	Fans Installed	Discretionary	None/Standard ventilation	Fans Installed	RetroEven20	0	Strat Fan	30,000	2.59	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 7,757.57	$ -	$ 101.70	1.18	536.05	15.0%	25.0%
Healthcare	New	Heating	Kitchen Hood - DCV/MUA	DCV/HUA vent hood	Discretionary	Standard kitchen hood	DCV/HUA vent hood	RetroEven20	0	sqft	30,000	30,000.00	0.16%	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	20	$ 0.12	$ -	$ 0.01	1.02	0.05	10.0%	20.0%
Healthcare	New	Miscellaneous	Pool Heater - Night Covers	Night cover in place	Discretionary	No cover	Night cover in place	RetroEven20	0	sqft pool	30,000	1,875.00	0.16%	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-ILTRM-v4.0-5	5	$ 2.37	$ -	$ -	1.06	0.04	100.0%	100.0%
Healthcare	New	Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	30,000	30,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-6	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.43	$ -	$ 0.02	1.00	0.06	10.0%	50.0%
Healthcare	New	Water Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	30,000	30,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-6	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.43	$ -	$ 0.02	1.00	0.05	10.0%	50.0%
Healthcare	New	Heating	Steam System Efficiency Improvements	Optimized system	Discretionary	Average system efficiency	Optimized system	Retro1Slow	0	sqft	30,000	30,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%

Commercial Non Equipment

Measure					Characteristics									Sources			Measure Assumptions in 2017							
Segment	Vintage	End Use	Measure	Efficient Definition	Replacement Type	Baseline Definition (NEM Only)	Measure Description	Measure Ramp Rate Name	Ramp Offset	Input Unit of Measure	Bldg Sq Ft	UOM Per Facility	Line Loss	Lifetime Source	Costs Source	Savings Source	Measure Lifetime (Years)	Incremental Measure Cost ($)	Incremental O&M Cost ($)	Incremental Non-Energy Benefits ($)	Cost Scalar	Measure Savings @ generator (kWh) (NEM Only)	Base Saturation	Applicability
Healthcare	New	Heating	Commissioning - HVAC	Optimized HVAC design and controls	Discretionary	New construction code	Optimized HVAC design and controls	Retro12Med	0	sqft	30,000	30,000.00	0.16%	COM_CX-All-AEG-5	COM_CX-All-AEG-5	COM_CX-All-AEG-5	3	$ 1.29	$ -	$ 0.03	1.11	0.07	100.0%	100.0%
Healthcare	New	Heating	Retrocommissioning - HVAC	Optimized HVAC flow and controls	Discretionary	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	sqft	30,000	30,000.00	0.16%	N/A	N/A	7th Power Plan Calculation	5	$ 1.18	$ -	$ 0.02	1.18	0.04	0.0%	0.0%
Healthcare	New	Heating	Strategic Energy Management	Energy management system installed and programmed	Discretionary	No energy management system	Energy management system installed and programmed	RetroEven20	0	sqft	30,000	30,000.00	0.16%	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	5	$ 0.06	$ -	$ 0.01	1.00	0.02	5.0%	35.0%
Lodging	Existing	Heating	Insulation - Roof/Ceiling	R-38	Discretionary	R-13	R-38	Retro3Slow	2	sqft roof	50,000	16,666.67	0.16%	INS_CLG-Heating-RTF-v2.1-55	INS_CLG-Heating-RTF-v2.1-55	Building Energy Simulation Tool	45	$ 1.02	$ -	$ 0.03	1.18	0.16	60.0%	85.0%
Lodging	Existing	Heating	Insulation - Wall Cavity	R-21	Discretionary	R-11 or less	R-21	Retro3Slow	2	sqft wall	50,000	19,335.27	0.16%	INS_WC-Heating-RTF-v2.1-1	INS_WC-Heating-RTF-v2.1-1	Building Energy Simulation Tool	45	$ 1.61	$ -	$ 0.00	1.18	0.02	60.0%	85.0%
Lodging	Existing	Heating	Insulation - Ducting	50% reduction in thermal losses	Discretionary	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	50,000	50,000.00	0.16%	INS_DCT-All-DEER-1	INS_DCT-All-DEER-1	Building Energy Simulation Tool	20	$ 0.86	$ -	$ -	1.12	-	40.0%	60.0%
Lodging	Existing	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Discretionary	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	50,000	50,000.00	0.16%	DCT_RPR-All-DEER-1	DCT_RPR-Cooling-RTF-1	Building Energy Simulation Tool	18	$ 0.59	$ -	$ -	1.18	-	15.0%	50.0%
Lodging	Existing	Heating	Windows - High Efficiency	U-.22 or better	Discretionary	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft window	50,000	7,734.11	0.16%	WND_HE-Heating-RTF-v2.1-46	WND_HE-Heating-RTF-v2.1-46	Building Energy Simulation Tool	45	$ 24.31	$ -	$ 0.03	1.18	0.16	45.0%	100.0%
Lodging	Existing	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	50,000	1.23	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.88	$ -	$ -	1.06	576.53	20.0%	30.0%
Lodging	Existing	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	50,000	1.23	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.88	$ -	$ -	1.06	283.51	20.0%	30.0%
Lodging	Existing	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Discretionary	No control	Reset control installed	Retro5Med	0	BoilerCtrl	50,000	3.07	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 719.34	$ -	$ -	1.18	1,024.94	35.0%	55.0%
Lodging	Existing	Heating	Steam Trap Maintenance	Cleaning and maintenance	Discretionary	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	50,000	50,000.00	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 0.01	$ -	$ -	1.08	0.03	73.0%	100.0%
Lodging	Existing	Heating	Gas Boiler - High Turndown	Turndown control installed	Discretionary	No control	Turndown control installed	Retro12Med	0	kbtuh heat	50,000	1,226.05	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 2.59	$ -	$ -	1.02	0.96	25.0%	50.0%
Lodging	Existing	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Discretionary	Average performance	Optimized burner controls	Retro3Slow	0	kBtuh heat	50,000	1,226.05	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 0.87	$ -	$ -	1.02	0.28	5.0%	85.0%
Lodging	Existing	Heating	HVAC - Shut Off Damper	Damper installed	Discretionary	No damper	Damper installed	Retro12Med	0	BoilerCtrl	50,000	3.07	0.16%	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	15	$ 1,536.09	$ 99.12	$ -	1.02	63.00	0.0%	75.0%
Lodging	Existing	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Discretionary	Constant ventilation	DCV enabled	RetroEven20	0	sqft	50,000	50,000.00	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.25	$ -	$ 0.01	1.18	0.02	55.0%	75.0%
Lodging	Existing	Heating	Gas Boiler - Stack Economizer	Economizer installed	Discretionary	None	Economizer installed	Retro12Med	0	BoilerCtrl	50,000	3.07	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 587.69	$ -	$ -	1.18	170.82	15.0%	55.0%
Lodging	Existing	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Discretionary	None	Tube inserts installed	Retro3Slow	0	sqft	50,000	50,000.00	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Lodging	Existing	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Discretionary	No insulation	Lines and condenstate tank insulated	RetroEven20	0	boiler pipe	50,000	894.43	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 12.90	$ -	$ -	1.06	5.99	30.0%	40.0%
Lodging	Existing	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Discretionary	No insulation	Insulated water lines	RetroEven20	0	boiler pipe	50,000	894.43	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 24.10	$ -	$ -	1.06	4.01	30.0%	40.0%
Lodging	Existing	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Discretionary	None	HRV installed	RetroEven20	0	CFM	50,000	10,000.00	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 7.05	$ -	$ -	1.18	0.87	5.0%	20.0%
Lodging	Existing	Heating	Thermostat - Programmable	Programmable thermostat installed	Discretionary	Manual control	Programmable thermostat installed	RetroEven20	0	Stat Unit	50,000	50.00	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 188.67	$ -	$ 6.15	1.04	29.67	10.0%	30.0%
Lodging	Existing	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Discretionary	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	50,000	50,000.00	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.03	1.18	0.07	0.0%	55.0%
Lodging	Existing	Water Heating	Water Heater - Ozone Laundry	Ozone laundry system	Discretionary	Standard laundry machine	Ozone laundry system	Retro12Med	0	perBldg	50,000	1.00	0.16%	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	10	$ 20,798.30	$ 205.79	$ -	1.02	1,833.20	15.0%	45.0%
Lodging	Existing	Water Heating	Water Heater - High MEF Commercial Laundry Washers	ESTAR/High MEF unit installed	Discretionary	Standard laundry machine	ESTAR/High MEF unit installed	Retro3Slow	2	ClothesWashers	50,000	20.00	0.16%	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	11	$ 489.42	$ -	$ 125.05	1.06	35.51	40.0%	100.0%
Lodging	Existing	Water Heating	Water Heater - Motion Control Faucet	Motion activated faucet	Discretionary	Standard faucet	Motion activated faucet	Retro12Med	0	perBldg	50,000	1.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.02	-	25.0%	65.0%
Lodging	Existing	Water Heating	Water Heater - Faucet Aerator	1.5 GPM faucet	Discretionary	2.5 GPM faucet	1.5 GPM faucet	Retro5Med	0	faucet	50,000	12.00	0.16%	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-ILTRM-v5.0-26	10	$ 6.88	$ -	$ 13.76	0.98	1.90	25.0%	65.0%
Lodging	Existing	Water Heating	Water Heater - Drainwater Heat Recovery	Drain HR system installed	Discretionary	None	Drain HR system installed	Retro12Med	0	faucet	50,000	12.00	0.16%	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-MNTRM-v1.0-7	40	$ 880.81	$ -	$ -	1.10	50.86	0.0%	0.0%
Lodging	Existing	Water Heating	Water Heater - Efficient Dishwasher	ESTAR unit	Discretionary	Standard unit	ESTAR unit	Retro3Slow	1	perBldg	50,000	1.00	0.16%	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	10	$ 122.89	$ -	$ 31.72	1.02	71.00	27.5%	50.0%
Lodging	Existing	Water Heating	Water Heater - Pre-Rinse Spray Valve	2 GPM sprayer nozzle	Discretionary	3.5 GPM kitchen sprayer	2 GPM sprayer nozzle	Retro12Med	0	KitchenFaucet	50,000	1.00	0.16%	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	4	$ 127.84	$ -	$ 136.94	1.18	23.08	25.0%	65.0%
Lodging	Existing	Water Heating	Water Heater - Central Controls	Central water boiler controls installed	Discretionary	No central controls	Central water boiler controls installed	Retro12Med	0	perBldg	50,000	1.00	0.16%	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	15	$ 1,410.47	$ -	$ -	1.18	2,962.70	65.0%	65.0%
Lodging	Existing	Water Heating	Water Heater - Solar System	Solar system installed	Discretionary	None	Solar system installed	Retro12Med	0	DHW kbtuh	50,000	7,051.96	0.16%	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-DOE-PTool2014-1	20	$ 326.36	$ 0.81	$ -	1.04	2.11	1.0%	30.0%
Lodging	Existing	Heating	Destratification Fans (HVLS)	Fans Installed	Discretionary	None/Standard ventilation	Fans Installed	RetroEven20	0	Strat Fan	50,000	4.31	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 7,757.57	$ -	$ 115.19	1.18	556.03	15.0%	20.0%
Lodging	Existing	Heating	Kitchen Hood - DCV/MUA	DCV/HUA vent hood	Discretionary	Standard kitchen hood	DCV/HUA vent hood	RetroEven20	0	sqft	50,000	50,000.00	0.16%	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	20	$ 0.11	$ -	$ 0.01	1.02	0.04	10.0%	20.0%
Lodging	Existing	Miscellaneous	Pool Heater - Night Covers	Night cover in place	Discretionary	No cover	Night cover in place	RetroEven20	0	sqft pool	50,000	1,875.00	0.16%	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	5	$ 2.37	$ -	$ -	1.06	0.04	100.0%	100.0%
Lodging	Existing	Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	50,000	50,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.40	$ -	$ 0.02	1.00	0.05	5.0%	15.0%
Lodging	Existing	Water Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	50,000	50,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.40	$ -	$ 0.02	1.00	0.05	5.0%	15.0%
Lodging	Existing	Heating	Steam System Efficiency Improvements	Optimized system	Discretionary	Average system efficiency	Optimized system	Retro1Slow	0	sqft	50,000	50,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Lodging	Existing	Heating	Commissioning - HVAC	Optimized HVAC design and controls	Discretionary	New construction code	Optimized HVAC design and controls	Retro12Med	0	sqft	50,000	50,000.00	0.16%	COM_CX-All-AEG-5	N/A	COM_CX-All-AEG-5	3	$ 1.11	$ -	$ 0.03	1.11	0.06	0.0%	0.0%
Lodging	Existing	Heating	Retrocommissioning - HVAC	Optimized HVAC flow and controls	Discretionary	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	sqft	50,000	50,000.00	0.16%	COM_RCX-Heating-7PLN-v5-16	COM_RCX-Heating-7PLN-v5-16	7th Power Plan Calculation	5	$ 0.16	$ -	$ 0.02	1.18	0.03	25.0%	40.0%
Lodging	Existing	Heating	Strategic Energy Management	Energy management system installed and programmed	Discretionary	No energy management system	Energy management system installed and programmed	RetroEven20	0	sqft	50,000	50,000.00	0.16%	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	5	$ 0.05	$ -	$ 0.01	1.00	0.01	0.0%	0.0%
Lodging	New	Heating	Insulation - Roof/Ceiling	R-38	Discretionary	R-13	R-38	Retro3Slow	2	sqft roof	50,000	16,666.67	0.16%	INS_CLG-Heating-RTF-v2.1-55	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Lodging	New	Heating	Insulation - Wall Cavity	R-21	Discretionary	R-11 or less	R-21	Retro3Slow	2	sqft wall	50,000	19,335.27	0.16%	INS_WC-Heating-RTF-v2.1-1	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Lodging	New	Heating	Insulation - Ducting	50% reduction in thermal losses	Discretionary	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	50,000	50,000.00	0.16%	INS_DCT-All-DEER-1	N/A	Building Energy Simulation Tool	20	$ 1.12	$ -	$ -	1.12	-	0.0%	0.0%
Lodging	New	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Discretionary	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	50,000	50,000.00	0.16%	DCT_RPR-All-DEER-1	N/A	n/a	18	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Lodging	New	Heating	Windows - High Efficiency	U-.22 or better	Discretionary	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft window	50,000	7,734.11	0.16%	WND_HE-Heating-RTF-v2.1-46	N/A	n/a	45	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Lodging	New	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	50,000	1.23	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.88	$ -	$ -	1.06	501.54	5.0%	10.0%
Lodging	New	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	50,000	1.23	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.88	$ -	$ -	1.06	248.07	5.0%	10.0%
Lodging	New	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Discretionary	No control	Reset control installed	Retro5Med	0	BoilerCtrl	50,000	3.07	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 719.34	$ -	$ -	1.18	891.63	100.0%	100.0%
Lodging	New	Heating	Steam Trap Maintenance	Cleaning and maintenance	Discretionary	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	50,000	50,000.00	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 0.01	$ -	$ -	1.08	0.02	100.0%	10.0%
Lodging	New	Heating	Gas Boiler - High Turndown	Turndown control installed	Discretionary	No control	Turndown control installed	Retro12Med	0	kbtuh heat	50,000	1,226.05	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 2.59	$ -	$ -	1.02	0.84	100.0%	100.0%
Lodging	New	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Discretionary	Average performance	Optimized burner controls	Retro3Slow	0	kBtuh heat	50,000	1,226.05	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 0.87	$ -	$ -	1.02	0.24	5.0%	85.0%
Lodging	New	Heating	HVAC - Shut Off Damper	Damper installed	Discretionary	No damper	Damper installed	Retro12Med	0	BoilerCtrl	50,000	3.07	0.16%	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	15	$ 1,536.09	$ 99.67	$ -	1.02	55.13	0.0%	75.0%
Lodging	New	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Discretionary	Constant ventilation	DCV enabled	RetroEven20	0	sqft	50,000	50,000.00	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.16	$ -	$ 0.01	1.18	0.02	100.0%	55.0%
Lodging	New	Heating	Gas Boiler - Stack Economizer	Economizer installed	Discretionary	None	Economizer installed	Retro12Med	0	BoilerCtrl	50,000	3.07	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 587.69	$ -	$ -	1.18	148.60	15.0%	55.0%
Lodging	New	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Discretionary	None	Tube inserts installed	Retro3Slow	0	sqft	50,000	50,000.00	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Lodging	New	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Discretionary	No insulation	Lines and condenstate tank insulated	RetroEven20	0	boiler pipe	50,000	894.43	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 12.90	$ -	$ -	1.06	5.99	100.0%	100.0%
Lodging	New	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Discretionary	No insulation	Insulated water lines	RetroEven20	0	boiler pipe	50,000	894.43	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 24.10	$ -	$ -	1.06	4.01	100.0%	100.0%
Lodging	New	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Discretionary	None	HRV installed	RetroEven20	0	CFM	50,000	10,000.00	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 7.05	$ -	$ -	1.18	0.87	100.0%	100.0%
Lodging	New	Heating	Thermostat - Programmable	Programmable thermostat installed	Discretionary	Manual control	Programmable thermostat installed	RetroEven20	0	Stat Unit	50,000	50.00	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 188.67	$ -	$ 6.25	1.04	32.09	0.0%	0.0%
Lodging	New	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Discretionary	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	50,000	50,000.00	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.03	1.18	0.07	10.0%	85.0%
Lodging	New	Water Heating	Water Heater - Ozone Laundry	Ozone laundry system	Discretionary	Standard laundry machine	Ozone laundry system	Retro12Med	0	perBldg	50,000	1.00	0.16%	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	10	$ 20,798.30	$ 205.79	$ -	1.02	1,833.20	15.0%	45.0%
Lodging	New	Water Heating	Water Heater - High MEF Commercial Laundry Washers	ESTAR/High MEF unit installed	Discretionary	Standard laundry machine	ESTAR/High MEF unit installed	Retro3Slow	2	ClothesWashers	50,000	20.00	0.16%	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	11	$ 489.42	$ -	$ 125.05	1.06	35.51	40.0%	100.0%
Lodging	New	Water Heating	Water Heater - Motion Control Faucet	Motion activated faucet	Discretionary	Standard faucet	Motion activated faucet	Retro12Med	0	perBldg	50,000	1.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.02	-	0.0%	0.0%
Lodging	New	Water Heating	Water Heater - Faucet Aerator	1.5 GPM faucet	Discretionary	2.5 GPM faucet	1.5 GPM faucet	Retro5Med	0	faucet	50,000	12.00	0.16%	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-ILTRM-v5.0-26	10	$ 6.88	$ -	$ 13.76	0.98	1.90	100.0%	100.0%
Lodging	New	Water Heating	Water Heater - Drainwater Heat Recovery	Drain HR system installed	Discretionary	None	Drain HR system installed	Retro12Med	0	faucet	50,000	12.00	0.16%	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-MNTRM-v1.0-7	40	$ 880.81	$ -	$ -	1.10	39.23	0.0%	0.0%
Lodging	New	Water Heating	Water Heater - Efficient Dishwasher	ESTAR unit	Discretionary	Standard unit	ESTAR unit	Retro3Slow	1	perBldg	50,000	1.00	0.16%	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	10	$ 122.89	$ -	$ 31.72	1.02	71.00	27.5%	50.0%
Lodging	New	Water Heating	Water Heater - Pre-Rinse Spray Valve	2 GPM sprayer nozzle	Discretionary	3.5 GPM kitchen sprayer	2 GPM sprayer nozzle	Retro12Med	0	KitchenFaucet	50,000	1.00	0.16%	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	4	$ 127.84	$ -	$ 136.94	1.18	23.08	25.0%	65.0%
Lodging	New	Water Heating	Water Heater - Central Controls	Central water boiler controls installed	Discretionary	No central controls	Central water boiler controls installed	Retro12Med	0	perBldg	50,000	1.00	0.16%	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	15	$ 1,410.47	$ -	$ -	1.18	2,962.70	65.0%	65.0%
Lodging	New	Water Heating	Water Heater - Solar System	Solar system installed	Discretionary	None	Solar system installed	Retro12Med	0	DHW kbtuh	50,000	5,440.28	0.16%	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-DOE-PTool2014-1	20	$ 326.36	$ 0.81	$ -	1.04	2.11	1.0%	30.0%
Lodging	New	Heating	Destratification Fans (HVLS)	Fans Installed	Discretionary	None/Standard ventilation	Fans Installed	RetroEven20	0	Strat Fan	50,000	4.31	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 7,757.57	$ -	$ 100.21	1.18	514.75	15.0%	20.0%
Lodging	New	Heating	Kitchen Hood - DCV/MUA	DCV/HUA vent hood	Discretionary	Standard kitchen hood	DCV/HUA vent hood	RetroEven20	0	sqft	50,000	50,000.00	0.16%	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	20	$ 0.11	$ -	$ 0.01	1.02	0.04	10.0%	20.0%
Lodging	New	Miscellaneous	Pool Heater - Night Covers	Night cover in place	Discretionary	No cover	Night cover in place	RetroEven20	0	sqft pool	50,000	1,875.00	0.16%	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-ILTRM-v4.0-5	5	$ 2.37	$ -	$ -	1.06	0.04	100.0%	100.0%
Lodging	New	Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	50,000	50,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.40	$ -	$ 0.02	1.00	0.05	5.0%	15.0%
Lodging	New	Water Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	50,000	50,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.40	$ -	$ 0.02	1.00	0.04	5.0%	15.0%
Lodging	New	Heating	Steam System Efficiency Improvements	Optimized system	Discretionary	Average system efficiency	Optimized system	Retro1Slow	0	sqft	50,000	50,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Lodging	New	Heating	Commissioning - HVAC	Optimized HVAC design and controls	Discretionary	New construction code	Optimized HVAC design and controls	Retro12Med	0	sqft	50,000	50,000.00	0.16%	COM_CX-All-AEG-5	COM_CX-All-AEG-5	COM_CX-All-AEG-5	3	$ 1.29	$ -	$ 0.03	1.11	0.07	100.0%	100.0%
Lodging	New	Heating	Retrocommissioning - HVAC	Optimized HVAC flow and controls	Discretionary	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	sqft	50,000	50,000.00	0.16%	N/A	N/A	7th Power Plan Calculation	5	$ 1.18	$ -	$ 0.02	1.18	0.04	0.0%	0.0%
Lodging	New	Heating	Strategic Energy Management	Energy management system installed and programmed	Discretionary	No energy management system	Energy management system installed and programmed	RetroEven20	0	sqft	50,000	50,000.00	0.16%	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	5	$ 0.06	$ -	$ 0.01	1.00	0.02	0.0%	0.0%
Warehouse	Existing	Heating	Insulation - Roof/Ceiling	R-38	Discretionary	R-13	R-38	Retro3Slow	2	sqft roof	100,000	100,000.00	0.16%	INS_CLG-Heating-RTF-v2.1-55	INS_CLG-Heating-RTF-v2.1-55	Building Energy Simulation Tool	45	$ 1.02	$ -	$ 0.02	1.18	0.10	60.0%	85.0%
Warehouse	Existing	Heating	Insulation - Wall Cavity	R-21	Discretionary	R-11 or less	R-21	Retro3Slow	2	sqft wall	100,000	18,973.66	0.16%	INS_WC-Heating-RTF-v2.1-1	INS_WC-Heating-RTF-v2.1-1	Building Energy Simulation Tool	45	$ 1.61	$ -	$ 0.07	1.18	0.40	60.0%	85.0%
Warehouse	Existing	Heating	Insulation - Ducting	50% reduction in thermal losses	Discretionary	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	100,000	100,000.00	0.16%	INS_DCT-All-DEER-1	INS_DCT-All-DEER-1	Building Energy Simulation Tool	20	$ 0.86	$ -	$ 0.00	1.12	0.00	40.0%	60.0%
Warehouse	Existing	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Discretionary	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	100,000	100,000.00	0.16%	DCT_RPR-All-DEER-1	DCT_RPR-Cooling-RTF-1	Building Energy Simulation Tool	18	$ 0.59	$ -	$ 0.00	1.18	0.00	15.0%	50.0%
Warehouse	Existing	Heating	Windows - High Efficiency	U-.22 or better	Discretionary	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft window	100,000	948.68	0.16%	WND_HE-Heating-RTF-v2.1-46	WND_HE-Heating-RTF-v2.1-46	Building Energy Simulation Tool	45	$ 24.31	$ -	$ 0.59	1.18	3.38	45.0%	100.0%
Warehouse	Existing	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	100,000	1.78	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.88	$ -	$ -	1.06	1,135.97	20.0%	30.0%
Warehouse	Existing	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	100,000	1.78	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.88	$ -	$ -	1.06	601.17	20.0%	30.0%
Warehouse	Existing	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Discretionary	No control	Reset control installed	Retro5Med	0	BoilerCtrl	100,000	4.44	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 719.34	$ -	$ -	1.18	2,019.51	35.0%	55.0%
Warehouse	Existing	Heating	Steam Trap Maintenance	Cleaning and maintenance	Discretionary	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	100,000	100,000.00	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 0.01	$ -	$ -	1.08	0.04	73.0%	100.0%
Warehouse	Existing	Heating	Gas Boiler - High Turndown	Turndown control installed	Discretionary	No control	Turndown control installed	Retro12Med	0	kbtuh heat	100,000	1,777.78	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 2.59	$ -	$ -	1.02	1.89	25.0%	50.0%
Warehouse	Existing	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Discretionary	Average performance	Optimized burner controls	Retro3Slow	0	kBtuh heat	100,000	1,777.78	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 0.87	$ -	$ -	1.02	0.55	5.0%	85.0%
Warehouse	Existing	Heating	HVAC - Shut Off Damper	Damper installed	Discretionary	No damper	Damper installed	Retro12Med	0	BoilerCtrl	100,000	4.44	0.16%	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	15	$ 1,536.09	$ 89.96	$ -	1.02	133.59	0.0%	75.0%
Warehouse	Existing	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Discretionary	Constant ventilation	DCV enabled	RetroEven20	0	sqft	100,000	100,000.00	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.25	$ -	$ 0.00	1.18	0.02	55.0%	75.0%
Warehouse	Existing	Heating	Gas Boiler - Stack Economizer	Economizer installed	Discretionary	None	Economizer installed	Retro12Med	0	BoilerCtrl	100,000	4.44	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 587.69	$ -	$ -	1.18	336.58	15.0%	55.0%
Warehouse	Existing	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Discretionary	None	Tube inserts installed	Retro3Slow	0	sqft	100,000	100,000.00	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Warehouse	Existing	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Discretionary	No insulation	Lines and condenstate tank insulated	RetroEven20	0	boiler pipe	100,000	1,264.91	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 12.90	$ -	$ -	1.06	5.99	30.0%	40.0%
Warehouse	Existing	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Discretionary	No insulation	Insulated water lines	RetroEven20	0	boiler pipe	100,000	1,264.91	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 24.10	$ -	$ -	1.06	4.01	30.0%	40.0%
Warehouse	Existing	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Discretionary	None	HRV installed	RetroEven20	0	CFM	100,000	6,000.00	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 7.05	$ -	$ -	1.18	0.30	5.0%	10.0%
Warehouse	Existing	Heating	Thermostat - Programmable	Programmable thermostat installed	Discretionary	Manual control	Programmable thermostat installed	RetroEven20	0	Stat Unit	100,000	100.00	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 188.67	$ -	$ 4.69	1.04	26.67	5.0%	10.0%
Warehouse	Existing	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Discretionary	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	100,000	100,000.00	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.02	1.18	0.07	0.0%	25.0%
Warehouse	Existing	Water Heating	Water Heater - Ozone Laundry	Ozone laundry system	Discretionary	Standard laundry machine	Ozone laundry system	Retro12Med	0	perBldg	100,000	1.00	0.16%	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	10	$ 3,885.09	$ 205.79	$ -	1.02	684.75	0.0%	0.0%
Warehouse	Existing	Water Heating	Water Heater - High MEF Commercial Laundry Washers	ESTAR/High MEF unit installed	Discretionary	Standard laundry machine	ESTAR/High MEF unit installed	Retro3Slow	2	ClothesWashers	100,000	1.00	0.16%	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	11	$ 489.42	$ -	$ 125.05	1.06	35.51	0.0%	0.0%
Warehouse	Existing	Water Heating	Water Heater - Motion Control Faucet	Motion activated faucet	Discretionary	Standard faucet	Motion activated faucet	Retro12Med	0	perBldg	100,000	1.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.02	-	25.0%	65.0%
Warehouse	Existing	Water Heating	Water Heater - Faucet Aerator	1.5 GPM faucet	Discretionary	2.5 GPM faucet	1.5 GPM faucet	Retro5Med	0	faucet	100,000	12.00	0.16%	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-ILTRM-v5.0-14	10	$ 6.88	$ -	$ 13.76	0.98	7.43	25.0%	65.0%
Warehouse	Existing	Water Heating	Water Heater - Drainwater Heat Recovery	Drain HR system installed	Discretionary	None	Drain HR system installed	Retro12Med	0	faucet	100,000	12.00	0.16%	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-MNTRM-v1.0-7	40	$ 880.81	$ -	$ -	1.10	19.00	0.0%	0.0%
Warehouse	Existing	Water Heating	Water Heater - Efficient Dishwasher	ESTAR unit	Discretionary	Standard unit	ESTAR unit	Retro3Slow	1	perBldg	100,000	1.00	0.16%	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	10	$ 122.89	$ -	$ 31.72	1.02	71.00	0.0%	0.0%
Warehouse	Existing	Water Heating	Water Heater - Pre-Rinse Spray Valve	2 GPM sprayer nozzle	Discretionary	3.5 GPM kitchen sprayer	2 GPM sprayer nozzle	Retro12Med	0	KitchenFaucet	100,000	1.00	0.16%	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	4	$ 127.84	$ -	$ 136.94	1.18	23.08	25.0%	65.0%
Warehouse	Existing	Water Heating	Water Heater - Central Controls	Central water boiler controls installed	Discretionary	No central controls	Central water boiler controls installed	Retro12Med	0	perBldg	100,000	1.00	0.16%	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	15	$ 1,410.47	$ -	$ -	1.18	1,106.86	5.0%	5.0%
Warehouse	Existing	Water Heating	Water Heater - Solar System	Solar system installed	Discretionary	None	Solar system installed	Retro12Med	0	DHW kbtuh	100,000	2,634.59	0.16%	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-DOE-PTool2014-1	20	$ 326.36	$ 0.81	$ -	1.04	2.11	1.0%	30.0%
Warehouse	Existing	Heating	Destratification Fans (HVLS)	Fans Installed	Discretionary	None/Standard ventilation	Fans Installed	RetroEven20	0	Strat Fan	100,000	8.62	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 7,757.57	$ -	$ 126.55	1.18	718.93	15.0%	55.0%
Warehouse	Existing	Heating	Kitchen Hood - DCV/MUA	DCV/HUA vent hood	Discretionary	Standard kitchen hood	DCV/HUA vent hood	RetroEven20	0	sqft	100,000	100,000.00	0.16%	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	20	$ 0.15	$ -	$ 0.01	1.02	0.05	10.0%	10.0%
Warehouse	Existing	Miscellaneous	Pool Heater - Night Covers	Night cover in place	Discretionary	No cover	Night cover in place	RetroEven20	0	sqft pool	100,000	1,875.00	0.16%	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-ILTRM-v4.0-5	5	$ 2.37	$ -	$ -	1.06	0.05	50.0%	100.0%
Warehouse	Existing	Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	100,000	100,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.30	$ -	$ 0.02	1.00	0.06	15.0%	65.0%
Warehouse	Existing	Water Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	100,000	100,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.30	$ -	$ 0.02	1.00	0.01	15.0%	65.0%
Warehouse	Existing	Heating	Steam System Efficiency Improvements	Optimized system	Discretionary	Average system efficiency	Optimized system	Retro1Slow	0	sqft	100,000	100,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Warehouse	Existing	Heating	Commissioning - HVAC	Optimized HVAC design and controls	Discretionary	New construction code	Optimized HVAC design and controls	Retro12Med	0	sqft	100,000	100,000.00	0.16%	COM_CX-All-AEG-5	N/A	COM_CX-All-AEG-5	3	$ 1.11	$ -	$ 0.03	1.11	0.08	0.0%	0.0%
Warehouse	Existing	Heating	Retrocommissioning - HVAC	Optimized HVAC flow and controls	Discretionary	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	sqft	100,000	100,000.00	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	7th Power Plan Calculation	5	$ 0.14	$ -	$ 0.02	1.18	0.05	20.0%	40.0%
Warehouse	Existing	Heating	Strategic Energy Management	Energy management system installed and programmed	Discretionary	No energy management system	Energy management system installed and programmed	RetroEven20	0	sqft	100,000	100,000.00	0.16%	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	5	$ 0.07	$ -	$ 0.01	1.00	0.02	0.0%	0.0%
Warehouse	New	Heating	Insulation - Roof/Ceiling	R-38	Discretionary	R-13	R-38	Retro3Slow	2	sqft roof	100,000	100,000.00	0.16%	INS_CLG-Heating-RTF-v2.1-55	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Warehouse	New	Heating	Insulation - Wall Cavity	R-21	Discretionary	R-11 or less	R-21	Retro3Slow	2	sqft wall	100,000	18,973.66	0.16%	INS_WC-Heating-RTF-v2.1-1	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Warehouse	New	Heating	Insulation - Ducting	50% reduction in thermal losses	Discretionary	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	100,000	100,000.00	0.16%	INS_DCT-All-DEER-1	N/A	Building Energy Simulation Tool	20	$ 1.12	$ -	$ 0.00	1.12	0.01	0.0%	0.0%
Warehouse	New	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Discretionary	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	100,000	100,000.00	0.16%	DCT_RPR-All-DEER-1	N/A	n/a	18	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Warehouse	New	Heating	Windows - High Efficiency	U-.22 or better	Discretionary	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft window	100,000	948.68	0.16%	WND_HE-Heating-RTF-v2.1-46	N/A	n/a	45	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Warehouse	New	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	100,000	1.78	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.88	$ -	$ -	1.06	1,079.10	5.0%	10.0%
Warehouse	New	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	100,000	1.78	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.88	$ -	$ -	1.06	526.05	5.0%	10.0%
Warehouse	New	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Discretionary	No control	Reset control installed	Retro5Med	0	BoilerCtrl	100,000	4.44	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 719.34	$ -	$ -	1.18	1,918.40	100.0%	100.0%
Warehouse	New	Heating	Steam Trap Maintenance	Cleaning and maintenance	Discretionary	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	100,000	100,000.00	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 0.01	$ -	$ -	1.08	0.04	100.0%	10.0%
Warehouse	New	Heating	Gas Boiler - High Turndown	Turndown control installed	Discretionary	No control	Turndown control installed	Retro12Med	0	kbtuh heat	100,000	1,777.78	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 2.59	$ -	$ -	1.02	1.80	100.0%	100.0%
Warehouse	New	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Discretionary	Average performance	Optimized burner controls	Retro3Slow	0	kBtuh heat	100,000	1,777.78	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 0.87	$ -	$ -	1.02	0.52	5.0%	85.0%
Warehouse	New	Heating	HVAC - Shut Off Damper	Damper installed	Discretionary	No damper	Damper installed	Retro12Med	0	BoilerCtrl	100,000	4.44	0.16%	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	15	$ 1,536.09	$ 91.13	$ -	1.02	116.90	0.0%	75.0%
Warehouse	New	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Discretionary	Constant ventilation	DCV enabled	RetroEven20	0	sqft	100,000	100,000.00	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.16	$ -	$ 0.00	1.18	0.01	100.0%	55.0%
Warehouse	New	Heating	Gas Boiler - Stack Economizer	Economizer installed	Discretionary	None	Economizer installed	Retro12Med	0	BoilerCtrl	100,000	4.44	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 587.69	$ -	$ -	1.18	319.73	15.0%	55.0%
Warehouse	New	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Discretionary	None	Tube inserts installed	Retro3Slow	0	sqft	100,000	100,000.00	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Warehouse	New	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Discretionary	No insulation	Lines and condenstate tank insulated	RetroEven20	0	boiler pipe	100,000	1,264.91	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 12.90	$ -	$ -	1.06	5.99	100.0%	100.0%
Warehouse	New	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Discretionary	No insulation	Insulated water lines	RetroEven20	0	boiler pipe	100,000	1,264.91	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 24.10	$ -	$ -	1.06	4.01	100.0%	100.0%
Warehouse	New	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Discretionary	None	HRV installed	RetroEven20	0	CFM	100,000	6,000.00	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 7.05	$ -	$ -	1.18	0.30	100.0%	100.0%
Warehouse	New	Heating	Thermostat - Programmable	Programmable thermostat installed	Discretionary	Manual control	Programmable thermostat installed	RetroEven20	0	Stat Unit	100,000	100.00	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 188.67	$ -	$ 5.04	1.04	31.68	0.0%	0.0%
Warehouse	New	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Discretionary	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	100,000	100,000.00	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.03	1.18	0.08	10.0%	35.0%
Warehouse	New	Water Heating	Water Heater - Ozone Laundry	Ozone laundry system	Discretionary	Standard laundry machine	Ozone laundry system	Retro12Med	0	perBldg	100,000	1.00	0.16%	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	10	$ 20,798.30	$ 205.79	$ -	1.02	684.75	0.0%	0.0%
Warehouse	New	Water Heating	Water Heater - High MEF Commercial Laundry Washers	ESTAR/High MEF unit installed	Discretionary	Standard laundry machine	ESTAR/High MEF unit installed	Retro3Slow	2	ClothesWashers	100,000	1.00	0.16%	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	11	$ 489.42	$ -	$ 125.05	1.06	35.51	0.0%	0.0%
Warehouse	New	Water Heating	Water Heater - Motion Control Faucet	Motion activated faucet	Discretionary	Standard faucet	Motion activated faucet	Retro12Med	0	perBldg	100,000	1.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.02	-	0.0%	0.0%
Warehouse	New	Water Heating	Water Heater - Faucet Aerator	1.5 GPM faucet	Discretionary	2.5 GPM faucet	1.5 GPM faucet	Retro5Med	0	faucet	100,000	12.00	0.16%	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-ILTRM-v5.0-14	10	$ 6.88	$ -	$ 13.76	0.98	7.43	100.0%	100.0%
Warehouse	New	Water Heating	Water Heater - Drainwater Heat Recovery	Drain HR system installed	Discretionary	None	Drain HR system installed	Retro12Med	0	faucet	100,000	12.00	0.16%	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-MNTRM-v1.0-7	40	$ 880.81	$ -	$ -	1.10	14.65	0.0%	0.0%
Warehouse	New	Water Heating	Water Heater - Efficient Dishwasher	ESTAR unit	Discretionary	Standard unit	ESTAR unit	Retro3Slow	1	perBldg	100,000	1.00	0.16%	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	10	$ 122.89	$ -	$ 31.72	1.02	71.00	0.0%	0.0%
Warehouse	New	Water Heating	Water Heater - Pre-Rinse Spray Valve	2 GPM sprayer nozzle	Discretionary	3.5 GPM kitchen sprayer	2 GPM sprayer nozzle	Retro12Med	0	KitchenFaucet	100,000	1.00	0.16%	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	4	$ 127.84	$ -	$ 136.94	1.18	23.08	25.0%	65.0%
Warehouse	New	Water Heating	Water Heater - Central Controls	Central water boiler controls installed	Discretionary	No central controls	Central water boiler controls installed	Retro12Med	0	perBldg	100,000	1.00	0.16%	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	15	$ 1,410.47	$ -	$ -	1.18	1,106.66	5.0%	5.0%
Warehouse	New	Water Heating	Water Heater - Solar System	Solar system installed	Discretionary	None	Solar system installed	Retro12Med	0	DHW kbtuh	100,000	2,032.11	0.16%	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-DOE-PTool2014-1	20	$ 326.36	$ 0.81	$ -	1.04	2.11	1.0%	30.0%
Warehouse	New	Heating	Destratification Fans (HVLS)	Fans Installed	Discretionary	None/Standard ventilation	Fans Installed	RetroEven20	0	Strat Fan	100,000	8.62	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 7,757.57	$ -	$ 114.46	1.18	718.93	15.0%	55.0%
Warehouse	New	Heating	Kitchen Hood - DCV/MUA	DCV/HUA vent hood	Discretionary	Standard kitchen hood	DCV/HUA vent hood	RetroEven20	0	sqft	100,000	100,000.00	0.16%	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	20	$ 0.15	$ -	$ 0.01	1.02	0.06	10.0%	20.0%
Warehouse	New	Miscellaneous	Pool Heater - Night Covers	Night cover in place	Discretionary	No cover	Night cover in place	RetroEven20	0	sqft pool	100,000	1,875.00	0.16%	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-ILTRM-v4.0-5	5	$ 2.37	$ -	$ -	1.06	0.04	100.0%	100.0%
Warehouse	New	Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	100,000	100,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.34	$ -	$ 0.02	1.00	0.08	15.0%	65.0%
Warehouse	New	Water Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	100,000	100,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.34	$ -	$ 0.02	1.00	0.01	15.0%	65.0%

Commercial Non Equipment

Measure					Characteristics									Sources			Measure Assumptions in 2017							
Segment	Vintage	End Use	Measure	Efficient Definition	Replacement Type	Baseline Definition (NEM Only)	Measure Description	Measure Ramp Rate Name	Ramp Offset	Input Unit of Measure	Bldg Sq Ft	UOM Per Facility	Line Loss	Lifetime Source	Costs Source	Savings Source	Measure Lifetime (Years)	Incremental Measure Cost ($)	Incremental O&M Cost ($)	Incremental Non-Energy Benefits ($)	Cost Scalar	Measure Savings @ generator (kWh) (NEM Only)	Base Saturation	Applicability
Warehouse	New	Heating	Steam System Efficiency Improvements	Optimized system	Discretionary	Average system efficiency	Optimized system	Retro15Slow	0	sqft	100,000	100,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Warehouse	New	Heating	Commissioning - HVAC	Optimized HVAC design and controls	Discretionary	New construction code	Optimized HVAC design and controls	Retro12Med	0	sqft	100,000	100,000.00	0.16%	COM_CX-All-AEG-5	COM_CX-All-AEG-5	COM_CX-All-AEG-5	3	$ 1.29	$ -	$ 0.03	1.11	0.10	100.0%	100.0%
Warehouse	New	Heating	Retrocommissioning - HVAC	Optimized HVAC flow and controls	Discretionary	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	sqft	100,000	100,000.00	0.16%	N/A	N/A	7th Power Plan Calculation	5	$ 1.18	$ -	$ 0.02	1.18	0.05	0.0%	0.0%
Warehouse	New	Heating	Strategic Energy Management	Energy management system installed and programmed	Discretionary	No energy management system	Energy management system installed and programmed	RetroEven20	0	sqft	100,000	100,000.00	0.16%	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	5	$ 0.08	$ -	$ 0.01	1.00	0.02	0.0%	0.0%
Miscellaneous	Existing	Heating	Insulation - Roof/Ceiling	R-38	Discretionary	R-13	R-38	Retro35Slow	2	sqft roof	15,000	15,000.00	0.16%	INS_CLG-Heating-RTF-v2.1-55	INS_CLG-Heating-RTF-v2.1-55	Building Energy Simulation Tool	45	$ 1.02	$ -	$ 0.02	1.18	0.12	60.0%	85.0%
Miscellaneous	Existing	Heating	Insulation - Wall Cavity	R-21	Discretionary	R-11 or less	R-21	Retro35Slow	2	sqft wall	15,000	4,500.00	0.16%	INS_WC-Heating-RTF-v2.1-1	INS_WC-Heating-RTF-v2.1-1	Building Energy Simulation Tool	45	$ 1.61	$ -	$ 0.05	1.18	0.32	60.0%	85.0%
Miscellaneous	Existing	Heating	Insulation - Ducting	50% reduction in thermal losses	Discretionary	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	15,000	15,000.00	0.16%	INS_DCT-All-DEER-1	INS_DCT-All-DEER-1	Building Energy Simulation Tool	20	$ 0.86	$ -	$ -	1.12	-	40.0%	60.0%
Miscellaneous	Existing	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Discretionary	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	15,000	15,000.00	0.16%	DCT_RPR-All-DEER-1	DCT_RPR-Cooling-RTF-1	Building Energy Simulation Tool	18	$ 0.59	$ -	$ -	1.18	-	15.0%	50.0%
Miscellaneous	Existing	Heating	Windows - High Efficiency	U-.22 or better	Discretionary	U-.5 or worse	U-.22 or better	Retro15Slow	0	sqft window	15,000	2,250.00	0.16%	WND_HE-Heating-RTF-v2.1-46	WND_HE-Heating-RTF-v2.1-46	Building Energy Simulation Tool	45	$ 24.31	$ -	$ 0.04	1.18	0.27	45.0%	100.0%
Miscellaneous	Existing	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	15,000	0.76	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.88	$ -	$ -	1.06	454.60	20.0%	30.0%
Miscellaneous	Existing	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	15,000	0.76	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.88	$ -	$ -	1.06	258.38	20.0%	30.0%
Miscellaneous	Existing	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Discretionary	No control	Reset control installed	Retro5Med	0	BoilerCtrl	15,000	1.90	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 719.34	$ -	$ -	1.18	808.18	35.0%	55.0%
Miscellaneous	Existing	Heating	Steam Trap Maintenance	Cleaning and maintenance	Discretionary	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	15,000	15,000.00	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 0.01	$ -	$ -	1.08	0.05	73.0%	100.0%
Miscellaneous	Existing	Heating	Gas Boiler - High Turndown	Turndown control installed	Discretionary	No control	Turndown control installed	Retro12Med	0	kBtuh heat	15,000	761.90	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 2.59	$ -	$ -	1.02	0.76	25.0%	50.0%
Miscellaneous	Existing	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Discretionary	Average performance	Optimized burner controls	Retro15Slow	0	kBtuh heat	15,000	761.90	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 0.87	$ -	$ -	1.02	0.22	5.0%	85.0%
Miscellaneous	Existing	Heating	HVAC - Shut Off Damper	Damper installed	Discretionary	No damper	Damper installed	Retro12Med	0	BoilerCtrl	15,000	1.90	0.16%	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	15	$ 1,536.09	$ 105.29	$ -	1.02	57.42	0.0%	75.0%
Miscellaneous	Existing	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Discretionary	Constant ventilation	DCV enabled	RetroEven20	0	sqft	15,000	15,000.00	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.25	$ -	$ 0.00	1.18	0.02	55.0%	75.0%
Miscellaneous	Existing	Heating	Gas Boiler - Stack Economizer	Economizer installed	Discretionary	None	Economizer installed	Retro12Med	0	BoilerCtrl	15,000	1.90	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 587.69	$ -	$ -	1.18	134.70	15.0%	55.0%
Miscellaneous	Existing	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Discretionary	None	Tube inserts installed	Retro35Slow	0	sqft	15,000	15,000.00	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Miscellaneous	Existing	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Discretionary	No insulation	Lines and condensate tank insulated	RetroEven20	0	boiler pipe	15,000	489.90	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 12.90	$ -	$ -	1.06	5.99	30.0%	40.0%
Miscellaneous	Existing	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Discretionary	No insulation	Insulated water lines	RetroEven20	0	boiler pipe	15,000	489.90	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 24.10	$ -	$ -	1.06	4.01	30.0%	40.0%
Miscellaneous	Existing	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Discretionary	None	HRV installed	RetroEven20	0	CFM	15,000	1,350.00	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 7.05	$ -	$ -	1.18	0.40	5.0%	15.0%
Miscellaneous	Existing	Heating	Thermostat - Programmable	Programmable thermostat installed	Discretionary	Manual control	Programmable thermostat installed	RetroEven20	0	Stat Unit	15,000	15.00	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 188.67	$ -	$ 3.91	1.04	25.52	10.0%	25.0%
Miscellaneous	Existing	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Discretionary	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	15,000	15,000.00	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.03	1.18	0.09	0.0%	35.0%
Miscellaneous	Existing	Water Heating	Water Heater - Ozone Laundry	Ozone laundry system	Discretionary	Standard laundry machine	Ozone laundry system	Retro12Med	0	perBldg	15,000	1.00	0.16%	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	10	$ 15,594.36	$ 205.79	$ -	1.02	412.36	0.0%	0.0%
Miscellaneous	Existing	Water Heating	Water Heater - High MEF Commercial Laundry Washers	ESTAR/High MEF unit installed	Discretionary	Standard laundry machine	ESTAR/High MEF unit installed	Retro35Slow	2	ClothesWashers	15,000	1.00	0.16%	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	11	$ 489.42	$ -	$ 125.05	1.06	35.51	4.0%	10.0%
Miscellaneous	Existing	Water Heating	Water Heater - Motion Control Faucet	Motion activated faucet	Discretionary	Standard faucet	Motion activated faucet	Retro12Med	0	perBldg	15,000	1.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.02	-	25.0%	65.0%
Miscellaneous	Existing	Water Heating	Water Heater - Faucet Aerator	1.5 GPM faucet	Discretionary	2.5 GPM faucet	1.5 GPM faucet	Retro5Med	0	faucet	15,000	12.00	0.16%	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-ILTRM-v5.0-14	10	$ 6.88	$ -	$ 13.76	0.98	7.43	25.0%	65.0%
Miscellaneous	Existing	Water Heating	Water Heater - Drainwater Heat Recovery	Drain HR system installed	Discretionary	None	Drain HR system installed	Retro12Med	0	faucet	15,000	12.00	0.16%	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-MNTRM-v1.0-7	40	$ 880.81	$ -	$ -	1.10	11.44	5.0%	10.0%
Miscellaneous	Existing	Water Heating	Water Heater - Efficient Dishwasher	ESTAR unit	Discretionary	Standard unit	ESTAR unit	Retro35Slow	1	perBldg	15,000	1.00	0.16%	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	10	$ 122.89	$ -	$ 31.72	1.02	71.00	11.0%	20.0%
Miscellaneous	Existing	Water Heating	Water Heater - Pre-Rinse Spray Valve	2 GPM sprayer nozzle	Discretionary	3.5 GPM kitchen sprayer	2 GPM sprayer nozzle	Retro12Med	0	KitchenFaucet	15,000	1.00	0.16%	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	4	$ 127.84	$ -	$ 136.94	1.18	23.08	25.0%	65.0%
Miscellaneous	Existing	Water Heating	Water Heater - Central Controls	Central water boiler controls installed	Discretionary	No central controls	Central water boiler controls installed	Retro12Med	0	perBldg	15,000	1.00	0.16%	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	15	$ 1,410.47	$ -	$ -	1.18	666.42	5.0%	15.0%
Miscellaneous	Existing	Water Heating	Water Heater - Solar System	Solar system installed	Discretionary	None	Solar system installed	Retro12Med	0	DHW kbtuh	15,000	1,586.25	0.16%	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-DOE-PTool2014-1	20	$ 326.36	$ 0.81	$ -	1.04	2.11	1.0%	30.0%
Miscellaneous	Existing	Heating	Destratification Fans (HVLS)	Fans installed	Discretionary	None/Standard ventilation	Fans installed	RetroEven20	0	Strat Fan	15,000	1.29	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 7,757.57	$ -	$ 140.32	1.18	916.37	15.0%	20.0%
Miscellaneous	Existing	Heating	Kitchen Hood - DCV/MUA	DCV/MUA vent hood	Discretionary	Standard kitchen hood	DCV/MUA vent hood	RetroEven20	0	sqft	15,000	15,000.00	0.16%	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	20	$ 0.19	$ -	$ 0.01	1.02	0.07	10.0%	10.0%
Miscellaneous	Existing	Miscellaneous	Pool Heater - Night Covers	Night cover in place	Discretionary	No cover	Night cover in place	RetroEven20	0	sqft pool	15,000	1,875.00	0.16%	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	5	$ 2.37	$ -	$ -	1.06	0.01	50.0%	100.0%
Miscellaneous	Existing	Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro15Slow	0	sqft	15,000	15,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.48	$ -	$ 0.02	1.00	0.08	10.0%	40.0%
Miscellaneous	Existing	Water Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro15Slow	0	sqft	15,000	15,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.48	$ -	$ 0.02	1.00	0.04	10.0%	40.0%
Miscellaneous	Existing	Heating	Steam System Efficiency Improvements	Optimized system	Discretionary	Average system efficiency	Optimized system	Retro15Slow	0	sqft	15,000	15,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Miscellaneous	Existing	Heating	Commissioning - HVAC	Optimized HVAC design and controls	Discretionary	New construction code	Optimized HVAC design and controls	Retro12Med	0	sqft	15,000	15,000.00	0.16%	COM_CX-All-AEG-5	N/A	COM_CX-All-AEG-5	3	$ 1.11	$ -	$ 0.03	1.11	0.11	0.0%	0.0%
Miscellaneous	Existing	Heating	Retrocommissioning - HVAC	Optimized HVAC flow and controls	Discretionary	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	sqft	15,000	15,000.00	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	7th Power Plan Calculation	5	$ 0.14	$ -	$ 0.02	1.18	0.06	25.0%	40.0%
Miscellaneous	Existing	Heating	Strategic Energy Management	Energy management system installed and programmed	Discretionary	No energy management system	Energy management system installed and programmed	RetroEven20	0	sqft	15,000	15,000.00	0.16%	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	5	$ 0.09	$ -	$ 0.01	1.00	0.02	0.0%	0.0%
Miscellaneous	New	Heating	Insulation - Roof/Ceiling	R-38	Discretionary	R-13	R-38	Retro35Slow	2	sqft roof	15,000	15,000.00	0.16%	INS_CLG-Heating-RTF-v2.1-55	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Miscellaneous	New	Heating	Insulation - Wall Cavity	R-21	Discretionary	R-11 or less	R-21	Retro35Slow	2	sqft wall	15,000	4,500.00	0.16%	INS_WC-Heating-RTF-v2.1-1	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Miscellaneous	New	Heating	Insulation - Ducting	50% reduction in thermal losses	Discretionary	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	15,000	15,000.00	0.16%	INS_DCT-All-DEER-1	N/A	Building Energy Simulation Tool	20	$ 1.12	$ -	$ 0.01	1.12	0.03	0.0%	0.0%
Miscellaneous	New	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Discretionary	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	15,000	15,000.00	0.16%	DCT_RPR-All-DEER-1	N/A	n/a	18	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Miscellaneous	New	Heating	Windows - High Efficiency	U-.22 or better	Discretionary	U-.5 or worse	U-.22 or better	Retro15Slow	0	sqft window	15,000	2,250.00	0.16%	WND_HE-Heating-RTF-v2.1-46	N/A	n/a	45	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Miscellaneous	New	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	15,000	0.76	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.88	$ -	$ -	1.06	429.43	5.0%	10.0%
Miscellaneous	New	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Discretionary	Degrade performance	General cleaning and maintenance	Retro20Fast	0	1000 kBtuh Heat	15,000	0.76	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.88	$ -	$ -	1.06	226.13	5.0%	10.0%
Miscellaneous	New	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Discretionary	No control	Reset control installed	Retro5Med	0	BoilerCtrl	15,000	1.90	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 719.34	$ -	$ -	1.18	763.43	100.0%	100.0%
Miscellaneous	New	Heating	Steam Trap Maintenance	Cleaning and maintenance	Discretionary	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	15,000	15,000.00	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 0.01	$ -	$ -	1.08	0.04	0.0%	10.0%
Miscellaneous	New	Heating	Gas Boiler - High Turndown	Turndown control installed	Discretionary	No control	Turndown control installed	Retro12Med	0	kBtuh heat	15,000	761.90	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 2.59	$ -	$ -	1.02	0.72	100.0%	100.0%
Miscellaneous	New	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Discretionary	Average performance	Optimized burner controls	Retro15Slow	0	kBtuh heat	15,000	761.90	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 0.87	$ -	$ -	1.02	0.21	5.0%	85.0%
Miscellaneous	New	Heating	HVAC - Shut Off Damper	Damper installed	Discretionary	No damper	Damper installed	Retro12Med	0	BoilerCtrl	15,000	1.90	0.16%	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	HVAC_DMPROFF-Heating-ILTRM-v4.0-1	15	$ 1,536.09	$ 105.79	$ -	1.02	50.25	0.0%	75.0%
Miscellaneous	New	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Discretionary	Constant ventilation	DCV enabled	RetroEven20	0	sqft	15,000	15,000.00	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.16	$ -	$ 0.00	1.18	0.02	100.0%	100.0%
Miscellaneous	New	Heating	Gas Boiler - Stack Economizer	Economizer installed	Discretionary	None	Economizer installed	Retro12Med	0	BoilerCtrl	15,000	1.90	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 587.69	$ -	$ -	1.18	127.24	15.0%	55.0%
Miscellaneous	New	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Discretionary	None	Tube inserts installed	Retro35Slow	0	sqft	15,000	15,000.00	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Miscellaneous	New	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Discretionary	No insulation	Lines and condensate tank insulated	RetroEven20	0	boiler pipe	15,000	489.90	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 12.90	$ -	$ -	1.06	5.99	100.0%	100.0%
Miscellaneous	New	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Discretionary	No insulation	Insulated water lines	RetroEven20	0	boiler pipe	15,000	489.90	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 24.10	$ -	$ -	1.06	4.01	100.0%	100.0%
Miscellaneous	New	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Discretionary	None	HRV installed	RetroEven20	0	CFM	15,000	1,350.00	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 7.05	$ -	$ -	1.18	0.40	100.0%	100.0%
Miscellaneous	New	Heating	Thermostat - Programmable	Programmable thermostat installed	Discretionary	Manual control	Programmable thermostat installed	RetroEven20	0	Stat Unit	15,000	15.00	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 188.67	$ -	$ 3.47	1.04	24.25	0.0%	0.0%
Miscellaneous	New	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Discretionary	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	15,000	15,000.00	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.03	1.18	0.10	10.0%	60.0%
Miscellaneous	New	Water Heating	Water Heater - Ozone Laundry	Ozone laundry system	Discretionary	Standard laundry machine	Ozone laundry system	Retro12Med	0	perBldg	15,000	1.00	0.16%	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	CW_OZON-Water Heating-ILTRM-v4.0-4	10	$ 20,798.30	$ 205.79	$ -	1.02	412.41	0.0%	0.0%
Miscellaneous	New	Water Heating	Water Heater - High MEF Commercial Laundry Washers	ESTAR/High MEF unit installed	Discretionary	Standard laundry machine	ESTAR/High MEF unit installed	Retro35Slow	2	ClothesWashers	15,000	1.00	0.16%	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	CW-Miscellaneous-RTF-PreQCv5.0-8	11	$ 489.42	$ -	$ 125.05	1.06	35.51	4.0%	10.0%
Miscellaneous	New	Water Heating	Water Heater - Motion Control Faucet	Motion activated faucet	Discretionary	Standard faucet	Motion activated faucet	Retro12Med	0	perBldg	15,000	1.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.02	-	0.0%	0.0%
Miscellaneous	New	Water Heating	Water Heater - Faucet Aerator	1.5 GPM faucet	Discretionary	2.5 GPM faucet	1.5 GPM faucet	Retro5Med	0	faucet	15,000	12.00	0.16%	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-XCELCO-2017-18-6	DHW_AER-Water Heating-ILTRM-v5.0-14	10	$ 6.88	$ -	$ 13.76	0.98	7.43	100.0%	100.0%
Miscellaneous	New	Water Heating	Water Heater - Drainwater Heat Recovery	Drain HR system installed	Discretionary	None	Drain HR system installed	Retro12Med	0	faucet	15,000	12.00	0.16%	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-OPATRM-v1-1	DHW_DWHR-Water Heating-MNTRM-v1.0-7	40	$ 880.81	$ -	$ -	1.10	8.83	5.0%	10.0%
Miscellaneous	New	Water Heating	Water Heater - Efficient Dishwasher	ESTAR unit	Discretionary	Standard unit	ESTAR unit	Retro35Slow	1	perBldg	15,000	1.00	0.16%	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	DW-Food Preparation-CMUATRM-2016-3	10	$ 122.89	$ -	$ 31.72	1.02	71.00	11.0%	20.0%
Miscellaneous	New	Water Heating	Water Heater - Pre-Rinse Spray Valve	2 GPM sprayer nozzle	Discretionary	3.5 GPM kitchen sprayer	2 GPM sprayer nozzle	Retro12Med	0	KitchenFaucet	15,000	1.00	0.16%	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	DHW_SPR-Water Heating-RTF-v2.0-3	4	$ 127.84	$ -	$ 136.94	1.18	23.08	25.0%	65.0%
Miscellaneous	New	Water Heating	Water Heater - Central Controls	Central water boiler controls installed	Discretionary	No central controls	Central water boiler controls installed	Retro12Med	0	perBldg	15,000	1.00	0.16%	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	DHWBLR_CNTRL-Water Heating-ILTRM-v4.0-2	15	$ 1,410.47	$ -	$ -	1.18	666.50	5.0%	15.0%
Miscellaneous	New	Water Heating	Water Heater - Solar System	Solar system installed	Discretionary	None	Solar system installed	Retro12Med	0	DHW kbtuh	15,000	1,223.87	0.16%	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-AEO17-6	DHW_WH-Water Heating-DOE-PTool2014-1	20	$ 326.36	$ 0.81	$ -	1.04	2.11	1.0%	30.0%
Miscellaneous	New	Heating	Destratification Fans (HVLS)	Fans installed	Discretionary	None/Standard ventilation	Fans installed	RetroEven20	0	Strat Fan	15,000	1.29	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 7,757.57	$ -	$ 125.43	1.18	876.23	15.0%	20.0%
Miscellaneous	New	Heating	Kitchen Hood - DCV/MUA	DCV/MUA vent hood	Discretionary	Standard kitchen hood	DCV/MUA vent hood	RetroEven20	0	sqft	15,000	15,000.00	0.16%	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	COOK_EXHD-Ventilation-XCELCO-2017-18-2	20	$ 0.19	$ -	$ 0.01	1.02	0.07	10.0%	10.0%
Miscellaneous	New	Miscellaneous	Pool Heater - Night Covers	Night cover in place	Discretionary	No cover	Night cover in place	RetroEven20	0	sqft pool	15,000	1,875.00	0.16%	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-SCG-R0-1	PL_COV-Water Heating-ILTRM-v4.0-5	5	$ 2.37	$ -	$ -	1.06	0.01	100.0%	100.0%
Miscellaneous	New	Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro15Slow	0	sqft	15,000	15,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.51	$ -	$ 0.02	1.00	0.09	10.0%	40.0%
Miscellaneous	New	Water Heating	Building Automation System	Automation system installed and programmed	Discretionary	No control system	Automation system installed and programmed	Retro15Slow	0	sqft	15,000	15,000.00	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.51	$ -	$ 0.02	1.00	0.03	10.0%	40.0%
Miscellaneous	New	Heating	Steam System Efficiency Improvements	Optimized system	Discretionary	Average system efficiency	Optimized system	Retro15Slow	0	sqft	15,000	15,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Miscellaneous	New	Heating	Commissioning - HVAC	Optimized HVAC design and controls	Discretionary	New construction code	Optimized HVAC design and controls	Retro12Med	0	sqft	15,000	15,000.00	0.16%	COM_CX-All-AEG-5	COM_CX-All-AEG-5	COM_CX-All-AEG-5	3	$ 1.29	$ -	$ 0.03	1.11	0.12	100.0%	100.0%
Miscellaneous	New	Heating	Retrocommissioning - HVAC	Optimized HVAC flow and controls	Discretionary	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	sqft	15,000	15,000.00	0.16%	N/A	N/A	7th Power Plan Calculation	5	$ 1.18	$ -	$ 0.02	1.18	0.07	0.0%	0.0%
Miscellaneous	New	Heating	Strategic Energy Management	Energy management system installed and programmed	Discretionary	No energy management system	Energy management system installed and programmed	RetroEven20	0	sqft	15,000	15,000.00	0.16%	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	BEHAV_SEM-All-CPUC-2018_PG-2	5	$ 0.10	$ -	$ 0.01	1.00	0.03	0.0%	0.0%
Office	Existing	Heating	Condensing RTU	TBD	Discretionary	TBD	TBD	Retro5Med	0	sqft	10,000	10,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Office	New	Heating	Condensing RTU	TBD	Discretionary	TBD	TBD	Retro5Med	0	sqft	10,000	10,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Retail	Existing	Heating	Condensing RTU	TBD	Discretionary	TBD	TBD	Retro5Med	0	sqft	100,000	100,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Retail	New	Heating	Condensing RTU	TBD	Discretionary	TBD	TBD	Retro5Med	0	sqft	100,000	100,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Restaurant	Existing	Heating	Condensing RTU	TBD	Discretionary	TBD	TBD	Retro5Med	0	sqft	5,500	5,500.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Restaurant	New	Heating	Condensing RTU	TBD	Discretionary	TBD	TBD	Retro5Med	0	sqft	5,500	5,500.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Grocery	Existing	Heating	Condensing RTU	TBD	Discretionary	TBD	TBD	Retro5Med	0	sqft	20,000	20,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Grocery	New	Heating	Condensing RTU	TBD	Discretionary	TBD	TBD	Retro5Med	0	sqft	35,000	35,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Education	Existing	Heating	Condensing RTU	TBD	Discretionary	TBD	TBD	Retro5Med	0	sqft	30,000	30,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Education	New	Heating	Condensing RTU	TBD	Discretionary	TBD	TBD	Retro5Med	0	sqft	30,000	30,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Healthcare	Existing	Heating	Condensing RTU	TBD	Discretionary	TBD	TBD	Retro5Med	0	sqft	30,000	30,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Healthcare	New	Heating	Condensing RTU	TBD	Discretionary	TBD	TBD	Retro5Med	0	sqft	30,000	30,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Lodging	Existing	Heating	Condensing RTU	TBD	Discretionary	TBD	TBD	Retro5Med	0	sqft	50,000	50,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Lodging	New	Heating	Condensing RTU	TBD	Discretionary	TBD	TBD	Retro5Med	0	sqft	50,000	50,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Warehouse	Existing	Heating	Condensing RTU	TBD	Discretionary	TBD	TBD	Retro5Med	0	sqft	100,000	100,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Warehouse	New	Heating	Condensing RTU	TBD	Discretionary	TBD	TBD	Retro5Med	0	sqft	100,000	100,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Miscellaneous	Existing	Heating	Condensing RTU	TBD	Discretionary	TBD	TBD	Retro5Med	0	sqft	15,000	15,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Miscellaneous	New	Heating	Condensing RTU	TBD	Discretionary	TBD	TBD	Retro5Med	0	sqft	15,000	15,000.00	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.00	-	0.0%	0.0%

Industrial Equipment

Measure					Characteristics										Sources			Measure Assumptions in 2017					
Segment	Vintage	End Use	Measure	Efficient Definition in 2018	Measure Identifier	Replacement Type	Baseline Definition	Efficient Definition / Measure Description	Measure Ramp Rate Name	Ramp Offset	Input Unit of Measure	Input Units	Units per Square Foot	Transmission Losses	Lifetime Source	Costs Source	Savings Source	Measure Lifetime (Years)	Incremental Measure Cost ($)	Cost Scalar	Measure Savings @ meter (kWh) (NEM Only)	Base Saturation	Applicability
Food Products	Existing	Heating	Furnace	AFUE 95%	IE1	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	7.59	0.20%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	100.0%	3.61	37.0%	30.0%
Food Products	Existing	Heating	Boiler	AFUE 98%	IE2	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	0	1 kBtu/hr	1.00	0.74	0.20%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	104.4%	7.78	52.6%	100.0%
Food Products	Existing	Heating	Unit Heater	Infrared Radiant	IE3	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	18.49	0.20%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	100.0%	3.20	18.0%	100.0%
Food Products	New	Heating	Furnace	AFUE 95%	IE4	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	7.59	0.20%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	100.0%	3.61	37.0%	30.0%
Food Products	New	Heating	Boiler	AFUE 98%	IE5	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	0	1 kBtu/hr	1.00	0.74	0.20%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	104.4%	7.78	52.6%	100.0%
Food Products	New	Heating	Unit Heater	Infrared Radiant	IE6	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	18.49	0.20%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	100.0%	3.20	18.0%	100.0%
Agriculture	Existing	Heating	Furnace	AFUE 95%	IE7	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	2.83	0.20%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	100.0%	3.61	35.1%	30.0%
Agriculture	Existing	Heating	Boiler	AFUE 98%	IE8	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	0	1 kBtu/hr	1.00	1.86	0.20%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	104.4%	7.78	7.4%	100.0%
Agriculture	Existing	Heating	Unit Heater	Infrared Radiant	IE9	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	3.58	0.20%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	100.0%	3.20	32.8%	100.0%
Agriculture	New	Heating	Furnace	AFUE 95%	IE10	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	2.83	0.20%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	100.0%	3.61	35.1%	30.0%
Agriculture	New	Heating	Boiler	AFUE 98%	IE11	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	0	1 kBtu/hr	1.00	1.86	0.20%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	104.4%	7.78	7.4%	100.0%
Agriculture	New	Heating	Unit Heater	Infrared Radiant	IE12	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	3.58	0.20%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	100.0%	3.20	32.8%	100.0%
Primary Metals	Existing	Heating	Furnace	AFUE 95%	IE13	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	6.02	0.20%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	100.0%	3.61	94.3%	30.0%
Primary Metals	Existing	Heating	Boiler	AFUE 98%	IE14	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	0	1 kBtu/hr	1.00	0.79	0.20%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	104.4%	7.78	0.0%	100.0%
Primary Metals	Existing	Heating	Unit Heater	Infrared Radiant	IE15	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	51.23	0.20%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	100.0%	3.20	13.1%	100.0%
Primary Metals	New	Heating	Furnace	AFUE 95%	IE16	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	6.02	0.20%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	100.0%	3.61	94.3%	30.0%
Primary Metals	New	Heating	Boiler	AFUE 98%	IE17	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	0	1 kBtu/hr	1.00	0.79	0.20%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	104.4%	7.78	0.0%	100.0%
Primary Metals	New	Heating	Unit Heater	Infrared Radiant	IE18	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	51.23	0.20%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	100.0%	3.20	13.1%	100.0%
Stone, Clay, and Glass	Existing	Heating	Furnace	AFUE 95%	IE19	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	8.34	0.20%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	100.0%	3.61	54.1%	30.0%
Stone, Clay, and Glass	Existing	Heating	Boiler	AFUE 98%	IE20	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	0	1 kBtu/hr	1.00	8.91	0.20%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	104.4%	7.78	7.0%	100.0%
Stone, Clay, and Glass	Existing	Heating	Unit Heater	Infrared Radiant	IE21	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	16.81	0.20%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	100.0%	3.20	31.7%	100.0%
Stone, Clay, and Glass	New	Heating	Furnace	AFUE 95%	IE22	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	8.34	0.20%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	100.0%	3.61	54.1%	30.0%
Stone, Clay, and Glass	New	Heating	Boiler	AFUE 98%	IE23	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	0	1 kBtu/hr	1.00	8.91	0.20%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	104.4%	7.78	7.0%	100.0%
Stone, Clay, and Glass	New	Heating	Unit Heater	Infrared Radiant	IE24	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	16.81	0.20%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	100.0%	3.20	31.7%	100.0%
Petroleum	Existing	Heating	Furnace	AFUE 95%	IE25	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	293.12	0.20%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	100.0%	3.61	3.2%	30.0%
Petroleum	Existing	Heating	Boiler	AFUE 98%	IE26	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	0	1 kBtu/hr	1.00	33.37	0.20%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	104.4%	7.78	3.9%	100.0%
Petroleum	Existing	Heating	Unit Heater	Infrared Radiant	IE27	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	1,074.92	0.20%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	100.0%	3.20	1.0%	100.0%
Petroleum	New	Heating	Furnace	AFUE 95%	IE28	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	293.12	0.20%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	100.0%	3.61	3.2%	30.0%
Petroleum	New	Heating	Boiler	AFUE 98%	IE29	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	0	1 kBtu/hr	1.00	33.37	0.20%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	104.4%	7.78	3.9%	100.0%
Petroleum	New	Heating	Unit Heater	Infrared Radiant	IE30	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	1,074.92	0.20%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	100.0%	3.20	1.0%	100.0%
Paper and Printing	Existing	Heating	Furnace	AFUE 95%	IE31	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	21.33	0.20%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	100.0%	3.61	83.7%	30.0%
Paper and Printing	Existing	Heating	Boiler	AFUE 98%	IE32	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	0	1 kBtu/hr	1.00	32.62	0.20%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	104.4%	7.78	7.6%	100.0%
Paper and Printing	Existing	Heating	Unit Heater	Infrared Radiant	IE33	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	85.91	0.20%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	100.0%	3.20	24.6%	100.0%
Paper and Printing	New	Heating	Furnace	AFUE 95%	IE34	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	21.33	0.20%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	100.0%	3.61	83.7%	30.0%
Paper and Printing	New	Heating	Boiler	AFUE 98%	IE35	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	0	1 kBtu/hr	1.00	32.62	0.20%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	104.4%	7.78	7.6%	100.0%
Paper and Printing	New	Heating	Unit Heater	Infrared Radiant	IE36	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	85.91	0.20%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	100.0%	3.20	24.6%	100.0%
Instruments	Existing	Heating	Furnace	AFUE 95%	IE37	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	1.41	0.20%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	100.0%	3.61	68.2%	30.0%
Instruments	Existing	Heating	Boiler	AFUE 98%	IE38	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	0	1 kBtu/hr	1.00	1.97	0.20%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	104.4%	7.78	6.8%	100.0%
Instruments	Existing	Heating	Unit Heater	Infrared Radiant	IE39	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	2.60	0.20%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	100.0%	3.20	43.6%	100.0%
Instruments	New	Heating	Furnace	AFUE 95%	IE40	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	1.41	0.20%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	100.0%	3.61	68.2%	30.0%
Instruments	New	Heating	Boiler	AFUE 98%	IE41	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	0	1 kBtu/hr	1.00	1.97	0.20%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	104.4%	7.78	6.8%	100.0%
Instruments	New	Heating	Unit Heater	Infrared Radiant	IE42	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	2.60	0.20%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	100.0%	3.20	43.6%	100.0%
Wood and Lumber Products	Existing	Heating	Furnace	AFUE 95%	IE43	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	3.14	0.20%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	100.0%	3.61	58.5%	30.0%
Wood and Lumber Products	Existing	Heating	Boiler	AFUE 98%	IE44	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	0	1 kBtu/hr	1.00	47.66	0.20%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	104.4%	7.78	0.5%	100.0%
Wood and Lumber Products	Existing	Heating	Unit Heater	Infrared Radiant	IE45	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	4.59	0.20%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	100.0%	3.20	47.2%	100.0%
Wood and Lumber Products	New	Heating	Furnace	AFUE 95%	IE46	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	3.14	0.20%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	100.0%	3.61	58.5%	30.0%
Wood and Lumber Products	New	Heating	Boiler	AFUE 98%	IE47	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	0	1 kBtu/hr	1.00	47.66	0.20%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	104.4%	7.78	0.5%	100.0%
Wood and Lumber Products	New	Heating	Unit Heater	Infrared Radiant	IE48	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	4.59	0.20%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	100.0%	3.20	47.2%	100.0%
Other Industrial	Existing	Heating	Furnace	AFUE 95%	IE49	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	2.32	0.20%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	100.0%	3.61	42.9%	30.0%
Other Industrial	Existing	Heating	Boiler	AFUE 98%	IE50	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	0	1 kBtu/hr	1.00	2.32	0.20%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	104.4%	7.78	6.0%	100.0%
Other Industrial	Existing	Heating	Unit Heater	Infrared Radiant	IE51	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	2.20	0.20%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	100.0%	3.20	53.4%	100.0%
Other Industrial	New	Heating	Furnace	AFUE 95%	IE52	Turnover	AFUE 80% (Standard)	AFUE 95%	LO12Med	0	1 kBtu/hr	1.00	2.32	0.20%	GFURN-Heating-AEO15-178	CNGC Res Program	AEG BEST	18	$ 24.80	100.0%	3.61	42.9%	30.0%
Other Industrial	New	Heating	Boiler	AFUE 98%	IE53	Turnover	AFUE 80% (Standard)	AFUE 98%	LO50Fast	0	1 kBtu/hr	1.00	2.32	0.20%	GBLR-Heating-AEO13-3	GBLR-Heating-EIA14-2014 Ref. Case-6	GBLR-Heating-EIA14-2014 Ref. Case-6	25	$ 6.38	104.4%	7.78	6.0%	100.0%
Other Industrial	New	Heating	Unit Heater	Infrared Radiant	IE54	Turnover	Standard	Infrared Radiant	LO12Med	0	1 kBtu/Hr	1.00	2.20	0.20%	UNITHT-Heating-XCELCO-2017-18-4	CNGC Program Data	UNITHT-Heating-XCELCO-2017-18-4	15	$ 5.54	100.0%	3.20	53.4%	100.0%

Industrial Non-Equipment

Measure					Characteristics									Sources			Measure Assumptions in 2017							
Segment	Vintage	End Use	Measure	Efficient Definition	Replacement Type	Baseline Definition (NEM Only)	Measure Description	Measure Ramp Rate Name	Ramp Offset	Input Unit of Measure	Employees per facility	UOM Per Facility	Line Loss	Lifetime Source	Costs Source	Savings Source	Measure Lifetime (Years)	Incremental Measure Cost ($)	Incremental O&M Cost ($)	Incremental Non-Energy Benefits ($)	Cost Scalar	Measure Savings @ meter (therm) (NEM Only)	Base Saturation	Applicability
Food Products	Existing	Heating	Insulation - Roof/Ceiling	R-38	Retrofit	R-13	R-38	Retro3Slow	2	sqft	1	260	0.16%	INS_CLG-Heating-RTF-v2.1-55	INS_CLG-Heating-RTF-v2.1-55	Building Energy Simulation Tool	45	1.02	-	0.03	1.18	0.10	60.0%	100.0%
Food Products	Existing	Heating	Insulation - Wall Cavity	R-21	Retrofit	R-11 or less	R-21	Retro3Slow	2	sqft	1	260	0.16%	INS_WC-Heating-RTF-v2.1-1	INS_WC-Heating-RTF-v2.1-1	Building Energy Simulation Tool	45	0.31	-	0.02	1.18	0.07	60.0%	100.0%
Food Products	Existing	Heating	Insulation - Ducting	50% reduction in thermal losses	Retrofit	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	1	316	0.16%	INS_DCT-All-DEER-1	INS_DCT-All-DEER-1	Building Energy Simulation Tool	20	0.86	-	0.00	1.12	0.00	40.0%	60.0%
Food Products	Existing	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Retrofit	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	1	316	0.16%	DCT_RPR-All-DEER-1	DCT_RPR-Cooling-RTF-1	Building Energy Simulation Tool	18	0.59	-	0.00	1.18	0.00	15.0%	50.0%
Food Products	Existing	Heating	Windows - High Efficiency	U-.22 or better	Retrofit	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft	1	260	0.16%	WND_HE-Heating-RTF-v2.1-46	WND_HE-Heating-RTF-v2.1-46	Building Energy Simulation Tool	45	0.23	-	0.01	1.18	0.03	45.0%	100.0%
Food Products	Existing	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	employee	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	0.02	-	-	1.06	0.62	20.0%	30.0%
Food Products	Existing	Process	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	0.02	-	-	1.06	28.43	20.0%	30.0%
Food Products	Existing	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	0.00	-	-	1.06	0.01	20.0%	30.0%
Food Products	Existing	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	employee	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	46.00	-	-	1.18	2.78	20.0%	45.0%
Food Products	Existing	Process	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	46.00	-	-	1.18	126.36	20.0%	45.0%
Food Products	Existing	Heating	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	employee	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	15.62	-	-	1.08	1.24	73.0%	85.0%
Food Products	Existing	Process	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	15.62	-	-	1.08	56.66	73.0%	85.0%
Food Products	Existing	Heating	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	employee	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	66.27	-	-	1.02	1.04	35.0%	50.0%
Food Products	Existing	Process	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	66.27	-	-	1.02	47.39	35.0%	50.0%
Food Products	Existing	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	employee	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	22.26	-	-	1.02	0.30	5.0%	85.0%
Food Products	Existing	Process	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	22.26	-	-	1.02	13.74	5.0%	85.0%
Food Products	Existing	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Retrofit	Constant ventilation	DCV enabled	RetroEven20	0	sqft	1	316	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	0.25	-	0.01	1.18	0.02	55.0%	75.0%
Food Products	Existing	Heating	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	employee	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	37.58	-	-	1.18	0.46	15.0%	55.0%
Food Products	Existing	Process	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	37.58	-	-	1.18	21.06	15.0%	55.0%
Food Products	Existing	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Retrofit	None	Tube inserts installed	Retro3Slow	0	sqft	1	316	0.16%	N/A	N/A	N/A	5	1.00	-	-	1.00	-	0.0%	0.0%
Food Products	Existing	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Retrofit	None	HRV installed	RetroEven20	0	sqft	1	260	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	0.42	-	-	1.18	0.02	5.0%	10.0%
Food Products	Existing	Heating	Thermostat - Programmable	Programmable thermostat installed	Retrofit	Manual control	Programmable thermostat installed	RetroEven20	0	sqft	1	260	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	0.19	-	0.01	1.04	0.03	25.0%	40.0%
Food Products	Existing	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Retrofit	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	1	260	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	0.75	-	0.03	1.18	0.07	5.0%	20.0%
Food Products	Existing	Heating	Destratification Fans (HVLS)	Fans installed	Retrofit	None/Standard ventilation	Fans installed	RetroEven20	0	sqft	1	260	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	0.67	-	0.02	1.18	0.06	15.0%	30.0%
Food Products	Existing	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Retrofit	No insulation	Lines and condensate tank insulated	RetroEven20	0	employee	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	117.39	-	-	1.06	1.17	40.0%	50.0%
Food Products	Existing	Process	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Retrofit	No insulation	Lines and condensate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	117.39	-	-	1.06	53.34	40.0%	50.0%
Food Products	Existing	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	employee	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	219.27	-	-	1.06	0.78	40.0%	50.0%
Food Products	Existing	Process	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	219.27	-	-	1.06	35.71	40.0%	50.0%
Food Products	Existing	Process	Process - Insulate Heated Process Fluids	Insulated process fluid lines	Retrofit	No insulation	Insulated process fluid lines	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	1.00	-	-	1.00	-	15.0%	65.0%
Food Products	Existing	Process	Process Heat Recovery	HR system installed	Retrofit	No HR system	HR system installed	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	1.00	-	-	1.00	-	5.0%	50.0%
Food Products	Existing	Heating	Building Automation System	Automation system installed and programmed	Retrofit	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	1	260	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	0.30	-	0.39	1.00	0.06	5.0%	65.0%
Food Products	Existing	Heating	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	31	0.16%	n/a	n/a	n/a	5	-	-	-	1.08	-	30.0%	60.0%
Food Products	Existing	Process	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1	0.16%	n/a	n/a	n/a	5	-	-	-	1.08	-	30.0%	60.0%
Food Products	Existing	Heating	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	54.32	-	41.72	1.00	7.20	5.0%	50.0%
Food Products	Existing	Process	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	54.32	-	41.72	1.00	30.21	5.0%	50.0%
Food Products	Existing	Miscellaneous	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	54.32	-	41.72	1.00	2.79	5.0%	50.0%
Food Products	Existing	Heating	Commissioning	Optimized HVAC design and controls	Retrofit	New construction code	Optimized HVAC design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	-	-	-	1.04	-	0.0%	0.0%
Food Products	Existing	Process	Commissioning	Optimized process design and controls	Retrofit	New construction code	Optimized process design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	-	-	-	1.04	-	0.0%	0.0%
Food Products	Existing	Heating	Retrocommissioning	Optimized HVAC flow and controls	Retrofit	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	AEG Estimate	5	166.04	-	47.94	1.04	7.60	15.0%	50.0%
Food Products	Existing	Process	Retrocommissioning	Optimized process design and controls	Retrofit	Vintage/existing building	Optimized process design and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	AEG Estimate	5	166.04	-	47.94	1.04	118.55	15.0%	50.0%
Food Products	New	Heating	Insulation - Roof/Ceiling	R-38	Retrofit	R-13	R-38	Retro3Slow	2	sqft	1	260	0.16%	INS_CLG-Heating-RTF-v2.1-55	N/A	Building Energy Simulation Tool	45	1.18	-	-	1.18	-	0.0%	0.0%
Food Products	New	Heating	Insulation - Wall Cavity	R-21	Retrofit	R-11 or less	R-21	Retro3Slow	2	sqft	1	260	0.16%	INS_WC-Heating-RTF-v2.1-1	N/A	Building Energy Simulation Tool	45	0.22	-	-	1.18	-	0.0%	0.0%
Food Products	New	Heating	Insulation - Ducting	50% reduction in thermal losses	Retrofit	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	1	316	0.16%	INS_DCT-All-DEER-1	N/A	Building Energy Simulation Tool	20	1.12	-	0.00	1.12	0.00	0.0%	0.0%
Food Products	New	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Retrofit	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	1	316	0.16%	DCT_RPR-All-DEER-1	N/A	Building Energy Simulation Tool	18	-	-	0.00	1.18	0.00	0.0%	0.0%
Food Products	New	Heating	Windows - High Efficiency	U-.22 or better	Retrofit	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft	1	260	0.16%	WND_HE-Heating-RTF-v2.1-46	N/A	Building Energy Simulation Tool	45	-	-	-	1.18	-	0.0%	0.0%
Food Products	New	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	0.02	-	-	1.06	0.59	5.0%	10.0%
Food Products	New	Process	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	0.02	-	-	1.06	28.43	5.0%	10.0%
Food Products	New	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	0.00	-	-	1.06	0.01	5.0%	10.0%
Food Products	New	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	45.95	-	-	1.18	2.64	20.0%	45.0%
Food Products	New	Process	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	45.95	-	-	1.18	126.36	20.0%	45.0%
Food Products	New	Heating	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	14.82	-	-	1.08	1.18	0.0%	0.0%
Food Products	New	Process	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	14.82	-	-	1.08	56.66	0.0%	0.0%
Food Products	New	Heating	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	66.20	-	-	1.02	0.99	35.0%	50.0%
Food Products	New	Process	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	66.20	-	-	1.02	47.39	35.0%	50.0%
Food Products	New	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	22.24	-	-	1.02	0.29	5.0%	85.0%
Food Products	New	Process	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	22.24	-	-	1.02	13.74	5.0%	85.0%
Food Products	New	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Retrofit	Constant ventilation	DCV enabled	RetroEven20	0	sqft	1	316	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	0.16	-	0.01	1.18	0.02	55.0%	75.0%
Food Products	New	Heating	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	37.54	-	-	1.18	0.44	15.0%	55.0%
Food Products	New	Process	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	37.54	-	-	1.18	21.06	15.0%	55.0%
Food Products	New	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Retrofit	None	Tube inserts installed	Retro3Slow	0	sqft	1	316	0.16%	N/A	N/A	N/A	5	1.00	-	-	1.00	-	0.0%	0.0%
Food Products	New	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Retrofit	None	HRV installed	RetroEven20	0	sqft	1	260	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	0.42	-	-	1.18	-	5.0%	10.0%
Food Products	New	Heating	Thermostat - Programmable	Programmable thermostat installed	Retrofit	Manual control	Programmable thermostat installed	RetroEven20	0	sqft	1	260	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	0.19	-	-	1.04	-	25.0%	40.0%
Food Products	New	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Retrofit	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	1	260	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	0.75	-	0.01	1.18	-	5.0%	20.0%
Food Products	New	Heating	Destratification Fans (HVLS)	Fans installed	Retrofit	None/Standard ventilation	Fans installed	RetroEven20	0	sqft	1	260	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	0.67	-	-	1.18	-	15.0%	30.0%
Food Products	New	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Retrofit	No insulation	Lines and condensate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	117.27	-	-	1.06	1.11	45.0%	50.0%
Food Products	New	Process	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Retrofit	No insulation	Lines and condensate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	117.27	-	-	1.06	53.34	45.0%	50.0%
Food Products	New	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	219.04	-	-	1.06	0.75	45.0%	50.0%
Food Products	New	Process	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	219.04	-	-	1.06	35.71	45.0%	50.0%
Food Products	New	Process	Process - Insulate Heated Process Fluids	Insulated process fluid lines	Retrofit	No insulation	Insulated process fluid lines	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	1.00	-	-	1.00	-	15.0%	65.0%
Food Products	New	Process	Process Heat Recovery	HR system installed	Retrofit	No HR system	HR system installed	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	1.00	-	-	1.00	-	5.0%	50.0%
Food Products	New	Heating	Building Automation System	Automation system installed and programmed	Retrofit	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	1	260	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	0.34	-	-	1.00	-	5.0%	65.0%
Food Products	New	Heating	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	31	0.16%	n/a	n/a	n/a	5	-	-	-	1.08	-	30.0%	60.0%
Food Products	New	Process	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1	0.16%	n/a	n/a	n/a	5	-	-	-	1.08	-	30.0%	60.0%
Food Products	New	Heating	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	54.32	1.29	-	1.00	-	5.0%	50.0%
Food Products	New	Process	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	54.32	1.29	-	1.00	-	5.0%	50.0%
Food Products	New	Miscellaneous	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	54.32	1.29	-	1.00	-	5.0%	50.0%
Food Products	New	Heating	Commissioning	Optimized HVAC design and controls	Retrofit	New construction code	Optimized HVAC design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	-	-	-	1.04	-	0.0%	0.0%
Food Products	New	Process	Commissioning	Optimized process design and controls	Retrofit	New construction code	Optimized process design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	-	-	-	1.04	-	0.0%	0.0%
Food Products	New	Heating	Retrocommissioning	Optimized HVAC flow and controls	Retrofit	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	n/a	5	-	-	-	1.04	-	0.0%	0.0%
Food Products	New	Process	Retrocommissioning	Optimized process design and controls	Retrofit	Vintage/existing building	Optimized process design and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	n/a	5	-	-	-	1.04	-	0.0%	0.0%
Agriculture	Existing	Heating	Insulation - Roof/Ceiling	R-38	Retrofit	R-13	R-38	Retro3Slow	2	sqft	1	131	0.16%	INS_CLG-Heating-RTF-v2.1-55	INS_CLG-Heating-RTF-v2.1-55	Building Energy Simulation Tool	45	1.02	-	0.05	1.18	0.10	60.0%	100.0%
Agriculture	Existing	Heating	Insulation - Wall Cavity	R-21	Retrofit	R-11 or less	R-21	Retro3Slow	2	sqft	1	131	0.16%	INS_WC-Heating-RTF-v2.1-1	INS_WC-Heating-RTF-v2.1-1	Building Energy Simulation Tool	45	0.31	-	0.04	1.18	0.07	60.0%	100.0%
Agriculture	Existing	Heating	Insulation - Ducting	50% reduction in thermal losses	Retrofit	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	1	118	0.16%	INS_DCT-All-DEER-1	INS_DCT-All-DEER-1	Building Energy Simulation Tool	20	0.86	-	0.00	1.12	0.00	40.0%	60.0%
Agriculture	Existing	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Retrofit	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	1	118	0.16%	DCT_RPR-All-DEER-1	DCT_RPR-Cooling-RTF-1	Building Energy Simulation Tool	18	0.59	-	0.00	1.18	0.00	15.0%	50.0%
Agriculture	Existing	Heating	Windows - High Efficiency	U-.22 or better	Retrofit	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft	1	131	0.16%	WND_HE-Heating-RTF-v2.1-46	WND_HE-Heating-RTF-v2.1-46	Building Energy Simulation Tool	45	0.23	-	0.02	1.18	0.03	45.0%	100.0%
Agriculture	Existing	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	employee	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	0.00	-	-	1.06	1.56	20.0%	30.0%
Agriculture	Existing	Process	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	0.00	-	-	1.06	1.27	20.0%	30.0%
Agriculture	Existing	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	0.00	-	-	1.06	0.01	20.0%	30.0%
Agriculture	Existing	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	employee	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	4.49	-	-	1.18	6.95	20.0%	45.0%
Agriculture	Existing	Process	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	4.49	-	-	1.18	5.66	20.0%	45.0%
Agriculture	Existing	Heating	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	employee	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	1.52	-	-	1.08	3.12	73.0%	85.0%
Agriculture	Existing	Process	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	1.52	-	-	1.08	2.54	73.0%	85.0%
Agriculture	Existing	Heating	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	employee	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	6.47	-	-	1.02	2.61	35.0%	50.0%
Agriculture	Existing	Process	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	6.47	-	-	1.02	2.12	35.0%	50.0%
Agriculture	Existing	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	employee	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	2.17	-	-	1.02	0.76	5.0%	85.0%
Agriculture	Existing	Process	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	2.17	-	-	1.02	0.62	5.0%	85.0%
Agriculture	Existing	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Retrofit	Constant ventilation	DCV enabled	RetroEven20	0	sqft	1	118	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	0.25	-	0.01	1.18	0.02	55.0%	75.0%
Agriculture	Existing	Heating	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	employee	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	3.67	-	-	1.18	1.16	15.0%	55.0%
Agriculture	Existing	Process	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	3.67	-	-	1.18	0.94	15.0%	55.0%
Agriculture	Existing	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Retrofit	None	Tube inserts installed	Retro3Slow	0	sqft	1	118	0.16%	N/A	N/A	N/A	5	1.00	-	-	1.00	-	0.0%	0.0%
Agriculture	Existing	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Retrofit	None	HRV installed	RetroEven20	0	sqft	1	131	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	0.42	-	-	1.18	0.02	5.0%	10.0%
Agriculture	Existing	Heating	Thermostat - Programmable	Programmable thermostat installed	Retrofit	Manual control	Programmable thermostat installed	RetroEven20	0	sqft	1	131	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	0.19	-	0.02	1.04	0.03	25.0%	40.0%
Agriculture	Existing	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Retrofit	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	1	131	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	0.75	-	0.05	1.18	0.07	5.0%	20.0%
Agriculture	Existing	Heating	Destratification Fans (HVLS)	Fans installed	Retrofit	None/Standard ventilation	Fans installed	RetroEven20	0	sqft	1	131	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	0.67	-	0.03	1.18	0.06	15.0%	30.0%
Agriculture	Existing	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Retrofit	No insulation	Lines and condensate tank insulated	RetroEven20	0	employee	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	11.46	-	-	1.06	2.93	40.0%	50.0%
Agriculture	Existing	Process	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Retrofit	No insulation	Lines and condensate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	11.46	-	-	1.06	2.39	40.0%	50.0%
Agriculture	Existing	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	employee	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	21.40	-	-	1.06	1.96	40.0%	50.0%
Agriculture	Existing	Process	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	21.40	-	-	1.06	1.60	40.0%	50.0%
Agriculture	Existing	Process	Process - Insulate Heated Process Fluids	Insulated process fluid lines	Retrofit	No insulation	Insulated process fluid lines	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	1.00	-	-	1.00	-	15.0%	65.0%
Agriculture	Existing	Process	Process Heat Recovery	HR system installed	Retrofit	No HR system	HR system installed	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	1.00	-	-	1.00	-	5.0%	50.0%
Agriculture	Existing	Heating	Building Automation System	Automation system installed and programmed	Retrofit	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	1	131	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	0.30	-	0.76	1.00	0.06	5.0%	65.0%
Agriculture	Existing	Heating	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	77	0.16%	n/a	n/a	n/a	5	-	-	-	1.08	-	30.0%	60.0%
Agriculture	Existing	Process	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1	0.16%	n/a	n/a	n/a	5	-	-	-	1.08	-	30.0%	60.0%
Agriculture	Existing	Heating	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	8.02	-	42.58	1.00	3.63	5.0%	50.0%
Agriculture	Existing	Process	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	8.02	-	42.58	1.00	1.41	5.0%	50.0%
Agriculture	Existing	Miscellaneous	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	8.02	-	42.58	1.00	0.90	5.0%	50.0%
Agriculture	Existing	Heating	Commissioning	Optimized HVAC design and controls	Retrofit	New construction code	Optimized HVAC design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	-	-	-	1.04	-	0.0%	0.0%
Agriculture	Existing	Process	Commissioning	Optimized process design and controls	Retrofit	New construction code	Optimized process design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	-	-	-	1.04	-	0.0%	0.0%
Agriculture	Existing	Heating	Retrocommissioning	Optimized HVAC flow and controls	Retrofit	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	AEG Estimate	5	10.80	-	47.61	1.04	2.69	15.0%	50.0%
Agriculture	Existing	Process	Retrocommissioning	Optimized process design and controls	Retrofit	Vintage/existing building	Optimized process design and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	AEG Estimate	5	10.80	-	47.61	1.04	5.52	15.0%	50.0%
Agriculture	New	Heating	Insulation - Roof/Ceiling	R-38	Retrofit	R-13	R-38	Retro3Slow	2	sqft	1	131	0.16%	INS_CLG-Heating-RTF-v2.1-55	N/A	Building Energy Simulation Tool	45	1.18	-	-	1.18	-	0.0%	0.0%
Agriculture	New	Heating	Insulation - Wall Cavity	R-21	Retrofit	R-11 or less	R-21	Retro3Slow	2	sqft	1	131	0.16%	INS_WC-Heating-RTF-v2.1-1	N/A	Building Energy Simulation Tool	45	0.22	-	-	1.18	-	0.0%	0.0%
Agriculture	New	Heating	Insulation - Ducting	50% reduction in thermal losses	Retrofit	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	1	118	0.16%	INS_DCT-All-DEER-1	N/A	Building Energy Simulation Tool	20	1.12	-	0.00	1.12	0.00	0.0%	0.0%
Agriculture	New	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Retrofit	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	1	118	0.16%	DCT_RPR-All-DEER-1	N/A	Building Energy Simulation Tool	18	-	-	0.00	1.18	0.00	0.0%	0.0%
Agriculture	New	Heating	Windows - High Efficiency	U-.22 or better	Retrofit	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft	1	131	0.16%	WND_HE-Heating-RTF-v2.1-46	N/A	Building Energy Simulation Tool	45	-	-	-	1.18	-	0.0%	0.0%
Agriculture	New	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	0.00	-	-	1.06	1.48	5.0%	10.0%
Agriculture	New	Process	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	0.00	-	-	1.06	1.27	5.0%	10.0%
Agriculture	New	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	0.00	-	-	1.06	0.01	5.0%	10.0%
Agriculture	New	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	4.37	-	-	1.18	6.60	20.0%	45.0%
Agriculture	New	Process	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	4.37	-	-	1.18	5.66	20.0%	45.0%
Agriculture	New	Heating	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	1.41	-	-	1.08	2.96	0.0%	0.0%
Agriculture	New	Process	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	1.41	-	-	1.08	2.54	0.0%	0.0%
Agriculture	New	Heating	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	6.29	-	-	1.02	2.47	35.0%	50.0%
Agriculture	New	Process	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	6.29	-	-	1.02	2.12	35.0%	50.0%
Agriculture	New	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	2.11	-	-	1.02	0.72	5.0%	85.0%
Agriculture	New	Process	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	2.11	-	-	1.02	0.62	5.0%	85.0%
Agriculture	New	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Retrofit	Constant ventilation	DCV enabled	RetroEven20	0	sqft	1	118	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	0.16	-	0.01	1.18	0.02	55.0%	75.0%
Agriculture	New	Heating	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	3.57	-	-	1.18	1.10	15.0%	55.0%
Agriculture	New	Process	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	3.57	-	-	1.18	0.94	15.0%	55.0%
Agriculture	New	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Retrofit	None	Tube inserts installed	Retro3Slow	0	sqft	1	118	0.16%	N/A	N/A	N/A	5	1.00	-	-	1.00	-	0.0%	0.0%
Agriculture	New	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Retrofit	None	HRV installed	RetroEven20	0	sqft	1	131	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	0.42	-	-	1.18	-	5.0%	10.0%
Agriculture	New	Heating	Thermostat - Programmable	Programmable thermostat installed	Retrofit	Manual control	Programmable thermostat installed	RetroEven20	0	sqft	1	131	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	0.19	-	-	1.04	-	25.0%	40.0%
Agriculture	New	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Retrofit	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	1	131	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	0.75	-	0.01	1.18	-	5.0%	20.0%
Agriculture	New	Heating	Destratification Fans (HVLS)	Fans installed	Retrofit	None/Standard ventilation	Fans installed	RetroEven20	0	sqft	1	131	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	0.67	-	-	1.18	-	15.0%	30.0%
Agriculture	New	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Retrofit	No insulation	Lines and condensate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	11.14	-	-	1.06	2.79	45.0%	50.0%
Agriculture	New	Process	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Retrofit	No insulation	Lines and condensate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	11.14	-	-	1.06	2.39	45.0%	50.0%
Agriculture	New	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	20.81	-	-	1.06	1.86	45.0%	50.0%
Agriculture	New	Process	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	20.81	-	-	1.06	1.60	45.0%	50.0%
Agriculture	New	Process	Process - Insulate Heated Process Fluids	Insulated process fluid lines	Retrofit	No insulation	Insulated process fluid lines	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	1.00	-	-	1.00	-	15.0%	65.0%
Agriculture	New	Process	Process Heat Recovery	HR system installed	Retrofit	No HR system	HR system installed	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	1.00	-	-	1.00	-	5.0%	50.0%
Agriculture	New	Heating	Building Automation System	Automation system installed and programmed	Retrofit	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	1	131	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	0.34	-	-	1.00	-	5.0%	65.0%

Industrial Non-Equipment

Measure					Characteristics									Sources			Measure Assumptions in 2017							
Segment	Vintage	End Use	Measure	Efficient Definition	Replacement Type	Baseline Definition (NEM Only)	Measure Description	Measure Ramp Rate Name	Ramp Offset	Input Unit of Measure	Employees per facility	UOM Per Facility	Line Loss	Lifetime Source	Costs Source	Savings Source	Measure Lifetime (Years)	Incremental Measure Cost ($)	Incremental O&M Cost ($)	Incremental Non-Energy Benefits ($)	Cost Scalar	Measure Savings @ meter (therm) (NEM Only)	Base Saturation	Applicability
Agriculture	New	Heating	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	77	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Agriculture	New	Process	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Agriculture	New	Heating	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 8.02	$ 0.19	$ -	1.00	-	5.0%	50.0%
Agriculture	New	Process	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 8.02	$ 0.19	$ -	1.00	-	5.0%	50.0%
Agriculture	New	Miscellaneous	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 8.02	$ 0.19	$ -	1.00	-	5.0%	50.0%
Agriculture	New	Heating	Commissioning	Optimized HVAC design and controls	Retrofit	New construction code	Optimized HVAC design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Agriculture	New	Process	Commissioning	Optimized process design and controls	Retrofit	New construction code	Optimized process design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Agriculture	New	Heating	Retrocommissioning	Optimized HVAC flow and controls	Retrofit	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	n/a	5	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Agriculture	New	Process	Retrocommissioning	Optimized process design and controls	Retrofit	Vintage/existing building	Optimized process design and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	n/a	5	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Primary Metals	Existing	Heating	Insulation - Roof/Ceiling	R-38	Retrofit	R-13	R-38	Retro3Slow	2	sqft	1	472	0.16%	INS_CLG-Heating-RTF-v2.1-55	INS_CLG-Heating-RTF-v2.1-55	Building Energy Simulation Tool	45	$ 1.02	$ -	$ 0.02	1.18	0.10	60.0%	100.0%
Primary Metals	Existing	Heating	Insulation - Wall Cavity	R-21	Retrofit	R-11 or less	R-21	Retro3Slow	2	sqft	1	472	0.16%	INS_WC-Heating-RTF-v2.1-1	INS_WC-Heating-RTF-v2.1-1	Building Energy Simulation Tool	45	$ 0.31	$ -	$ 0.01	1.18	0.07	60.0%	100.0%
Primary Metals	Existing	Heating	Insulation - Ducting	50% reduction in thermal losses	Retrofit	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	1	251	0.16%	INS_DCT-All-DEER-1	INS_DCT-All-DEER-1	Building Energy Simulation Tool	20	$ 0.86	$ -	$ 0.00	1.12	0.00	40.0%	60.0%
Primary Metals	Existing	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Retrofit	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	1	251	0.16%	DCT_RPR-All-DEER-1	DCT_RPR-Cooling-RTF-1	Building Energy Simulation Tool	18	$ 0.59	$ -	$ 0.00	1.18	0.00	15.0%	50.0%
Primary Metals	Existing	Heating	Windows - High Efficiency	U-.22 or better	Retrofit	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft	1	472	0.16%	WND_HE-Heating-RTF-v2.1-46	WND_HE-Heating-RTF-v2.1-46	Building Energy Simulation Tool	45	$ 0.23	$ -	$ 0.01	1.18	0.03	45.0%	100.0%
Primary Metals	Existing	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	employee	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.02	$ -	$ -	1.06	0.66	20.0%	30.0%
Primary Metals	Existing	Process	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.02	$ -	$ -	1.06	22.94	20.0%	30.0%
Primary Metals	Existing	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.00	$ -	$ -	1.06	0.01	20.0%	30.0%
Primary Metals	Existing	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	employee	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 37.36	$ -	$ -	1.18	2.94	20.0%	45.0%
Primary Metals	Existing	Process	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 37.36	$ -	$ -	1.18	101.93	20.0%	45.0%
Primary Metals	Existing	Heating	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	employee	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 12.68	$ -	$ -	1.08	1.32	73.0%	85.0%
Primary Metals	Existing	Process	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 12.68	$ -	$ -	1.08	45.71	73.0%	85.0%
Primary Metals	Existing	Heating	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	employee	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 53.82	$ -	$ -	1.02	1.10	35.0%	50.0%
Primary Metals	Existing	Process	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 53.82	$ -	$ -	1.02	38.23	35.0%	50.0%
Primary Metals	Existing	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	employee	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 18.08	$ -	$ -	1.02	0.32	5.0%	85.0%
Primary Metals	Existing	Process	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 18.08	$ -	$ -	1.02	11.09	5.0%	85.0%
Primary Metals	Existing	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Retrofit	Constant ventilation	DCV enabled	RetroEven20	0	sqft	1	251	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.25	$ -	$ 0.01	1.18	0.02	55.0%	75.0%
Primary Metals	Existing	Heating	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	employee	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 30.52	$ -	$ -	1.18	0.49	15.0%	55.0%
Primary Metals	Existing	Process	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 30.52	$ -	$ -	1.18	16.99	15.0%	55.0%
Primary Metals	Existing	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Retrofit	None	Tube inserts installed	Retro3Slow	0	sqft	1	251	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Primary Metals	Existing	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Retrofit	None	HRV installed	RetroEven20	0	sqft	1	472	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 0.42	$ -	$ -	1.18	0.02	5.0%	10.0%
Primary Metals	Existing	Heating	Thermostat - Programmable	Programmable thermostat installed	Retrofit	Manual control	Programmable thermostat installed	RetroEven20	0	sqft	1	472	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 0.19	$ -	$ 0.01	1.04	0.03	25.0%	40.0%
Primary Metals	Existing	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Retrofit	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	1	472	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.02	1.18	0.07	5.0%	20.0%
Primary Metals	Existing	Heating	Destratification Fans (HVLS)	Fans installed	Retrofit	None/Standard ventilation	Fans installed	RetroEven20	0	sqft	1	472	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 0.67	$ -	$ 0.01	1.18	0.06	15.0%	30.0%
Primary Metals	Existing	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Retrofit	No insulation	Lines and condensate tank insulated	RetroEven20	0	employee	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 95.34	$ -	$ -	1.06	1.24	40.0%	50.0%
Primary Metals	Existing	Process	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Retrofit	No insulation	Lines and condensate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 95.34	$ -	$ -	1.06	43.02	40.0%	50.0%
Primary Metals	Existing	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	employee	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 178.08	$ -	$ -	1.06	0.83	40.0%	50.0%
Primary Metals	Existing	Process	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 178.08	$ -	$ -	1.06	28.80	40.0%	50.0%
Primary Metals	Existing	Process	Process - Insulate Heated Process Fluids	Insulated process fluid lines	Retrofit	No insulation	Insulated process fluid lines	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	15.0%	65.0%
Primary Metals	Existing	Process	Process Heat Recovery	HR system installed	Retrofit	No HR system	HR system installed	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	5.0%	50.0%
Primary Metals	Existing	Heating	Building Automation System	Automation system installed and programmed	Retrofit	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	1	472	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.30	$ -	$ 0.21	1.00	0.06	5.0%	65.0%
Primary Metals	Existing	Heating	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	33	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Primary Metals	Existing	Process	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Primary Metals	Existing	Heating	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 179.01	$ -	$ 39.17	1.00	13.07	5.0%	50.0%
Primary Metals	Existing	Process	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 179.01	$ -	$ 39.17	1.00	100.79	5.0%	50.0%
Primary Metals	Existing	Miscellaneous	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 179.01	$ -	$ 39.17	1.00	18.60	5.0%	50.0%
Primary Metals	Existing	Heating	Commissioning	Optimized HVAC design and controls	Retrofit	New construction code	Optimized HVAC design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Primary Metals	Existing	Process	Commissioning	Optimized process design and controls	Retrofit	New construction code	Optimized process design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Primary Metals	Existing	Heating	Retrocommissioning	Optimized HVAC flow and controls	Retrofit	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	AEG Estimate	5	$ 538.76	$ -	$ 48.35	1.04	13.78	15.0%	50.0%
Primary Metals	Existing	Process	Retrocommissioning	Optimized process design and controls	Retrofit	Vintage/existing building	Optimized process design and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	AEG Estimate	5	$ 538.76	$ -	$ 48.35	1.04	395.55	15.0%	50.0%
Primary Metals	New	Heating	Insulation - Roof/Ceiling	R-38	Retrofit	R-13	R-38	Retro3Slow	2	sqft	1	472	0.16%	INS_CLG-Heating-RTF-v2.1-55	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Primary Metals	New	Heating	Insulation - Wall Cavity	R-21	Retrofit	R-11 or less	R-21	Retro3Slow	2	sqft	1	472	0.16%	INS_WC-Heating-RTF-v2.1-1	N/A	Building Energy Simulation Tool	45	$ 0.22	$ -	$ -	1.18	-	0.0%	0.0%
Primary Metals	New	Heating	Insulation - Ducting	50% reduction in thermal losses	Retrofit	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	1	251	0.16%	INS_DCT-All-DEER-1	N/A	Building Energy Simulation Tool	20	$ 1.12	$ -	$ 0.00	1.12	0.00	0.0%	0.0%
Primary Metals	New	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Retrofit	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	1	251	0.16%	DCT_RPR-All-DEER-1	N/A	Building Energy Simulation Tool	18	$ -	$ -	$ 0.00	1.18	0.00	0.0%	0.0%
Primary Metals	New	Heating	Windows - High Efficiency	U-.22 or better	Retrofit	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft	1	472	0.16%	WND_HE-Heating-RTF-v2.1-46	N/A	Building Energy Simulation Tool	45	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Primary Metals	New	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.02	$ -	$ -	1.06	0.63	5.0%	10.0%
Primary Metals	New	Process	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.02	$ -	$ -	1.06	22.94	5.0%	10.0%
Primary Metals	New	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.00	$ -	$ -	1.06	0.01	5.0%	10.0%
Primary Metals	New	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 37.30	$ -	$ -	1.18	2.80	20.0%	45.0%
Primary Metals	New	Process	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 37.30	$ -	$ -	1.18	101.93	20.0%	45.0%
Primary Metals	New	Heating	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 12.03	$ -	$ -	1.08	1.25	0.0%	0.0%
Primary Metals	New	Process	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 12.03	$ -	$ -	1.08	45.71	0.0%	0.0%
Primary Metals	New	Heating	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 53.74	$ -	$ -	1.02	1.05	35.0%	50.0%
Primary Metals	New	Process	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 53.74	$ -	$ -	1.02	38.23	35.0%	50.0%
Primary Metals	New	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 18.06	$ -	$ -	1.02	0.30	5.0%	85.0%
Primary Metals	New	Process	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 18.06	$ -	$ -	1.02	11.09	5.0%	85.0%
Primary Metals	New	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Retrofit	Constant ventilation	DCV enabled	RetroEven20	0	sqft	1	251	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.16	$ -	$ 0.01	1.18	0.02	55.0%	75.0%
Primary Metals	New	Heating	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 30.48	$ -	$ -	1.18	0.47	15.0%	55.0%
Primary Metals	New	Process	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 30.48	$ -	$ -	1.18	16.99	15.0%	55.0%
Primary Metals	New	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Retrofit	None	Tube inserts installed	Retro3Slow	0	sqft	1	251	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Primary Metals	New	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Retrofit	None	HRV installed	RetroEven20	0	sqft	1	472	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 0.42	$ -	$ -	1.18	-	5.0%	10.0%
Primary Metals	New	Heating	Thermostat - Programmable	Programmable thermostat installed	Retrofit	Manual control	Programmable thermostat installed	RetroEven20	0	sqft	1	472	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 0.19	$ -	$ -	1.04	-	25.0%	40.0%
Primary Metals	New	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Retrofit	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	1	472	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.01	1.18	-	5.0%	20.0%
Primary Metals	New	Heating	Destratification Fans (HVLS)	Fans installed	Retrofit	None/Standard ventilation	Fans installed	RetroEven20	0	sqft	1	472	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 0.67	$ -	$ -	1.18	-	15.0%	30.0%
Primary Metals	New	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Retrofit	No insulation	Lines and condensate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 95.21	$ -	$ -	1.06	1.18	45.0%	50.0%
Primary Metals	New	Process	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Retrofit	No insulation	Lines and condensate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 95.21	$ -	$ -	1.06	43.02	45.0%	50.0%
Primary Metals	New	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 177.83	$ -	$ -	1.06	0.79	45.0%	50.0%
Primary Metals	New	Process	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 177.83	$ -	$ -	1.06	28.80	45.0%	50.0%
Primary Metals	New	Process	Process - Insulate Heated Process Fluids	Insulated process fluid lines	Retrofit	No insulation	Insulated process fluid lines	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	15.0%	65.0%
Primary Metals	New	Process	Process Heat Recovery	HR system installed	Retrofit	No HR system	HR system installed	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	5.0%	50.0%
Primary Metals	New	Heating	Building Automation System	Automation system installed and programmed	Retrofit	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	1	472	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.34	$ -	$ -	1.00	-	5.0%	65.0%
Primary Metals	New	Heating	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	33	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Primary Metals	New	Process	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Primary Metals	New	Heating	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 179.01	$ 4.26	$ -	1.00	-	5.0%	50.0%
Primary Metals	New	Process	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 179.01	$ 4.26	$ -	1.00	-	5.0%	50.0%
Primary Metals	New	Miscellaneous	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 179.01	$ 4.26	$ -	1.00	-	5.0%	50.0%
Primary Metals	New	Heating	Commissioning	Optimized HVAC design and controls	Retrofit	New construction code	Optimized HVAC design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Primary Metals	New	Process	Commissioning	Optimized process design and controls	Retrofit	New construction code	Optimized process design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Primary Metals	New	Heating	Retrocommissioning	Optimized HVAC flow and controls	Retrofit	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	n/a	5	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Primary Metals	New	Process	Retrocommissioning	Optimized process design and controls	Retrofit	Vintage/existing building	Optimized process design and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	n/a	5	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Stone, Clay, and Glass	Existing	Heating	Insulation - Roof/Ceiling	R-38	Retrofit	R-13	R-38	Retro3Slow	2	sqft	1	483	0.16%	INS_CLG-Heating-RTF-v2.1-55	INS_CLG-Heating-RTF-v2.1-55	Building Energy Simulation Tool	45	$ 1.02	$ -	$ 0.02	1.18	0.10	60.0%	100.0%
Stone, Clay, and Glass	Existing	Heating	Insulation - Wall Cavity	R-21	Retrofit	R-11 or less	R-21	Retro3Slow	2	sqft	1	483	0.16%	INS_WC-Heating-RTF-v2.1-1	INS_WC-Heating-RTF-v2.1-1	Building Energy Simulation Tool	45	$ 0.31	$ -	$ 0.01	1.18	0.07	60.0%	100.0%
Stone, Clay, and Glass	Existing	Heating	Insulation - Ducting	50% reduction in thermal losses	Retrofit	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	1	347	0.16%	INS_DCT-All-DEER-1	INS_DCT-All-DEER-1	Building Energy Simulation Tool	20	$ 0.86	$ -	$ 0.00	1.12	0.00	40.0%	60.0%
Stone, Clay, and Glass	Existing	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Retrofit	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	1	347	0.16%	DCT_RPR-All-DEER-1	DCT_RPR-Cooling-RTF-1	Building Energy Simulation Tool	18	$ 0.59	$ -	$ 0.00	1.18	0.00	15.0%	50.0%
Stone, Clay, and Glass	Existing	Heating	Windows - High Efficiency	U-.22 or better	Retrofit	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft	1	483	0.16%	WND_HE-Heating-RTF-v2.1-46	WND_HE-Heating-RTF-v2.1-46	Building Energy Simulation Tool	45	$ 0.23	$ -	$ 0.01	1.18	0.03	45.0%	100.0%
Stone, Clay, and Glass	Existing	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	employee	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.01	$ -	$ -	1.06	7.50	20.0%	30.0%
Stone, Clay, and Glass	Existing	Process	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.01	$ -	$ -	1.06	3.44	20.0%	30.0%
Stone, Clay, and Glass	Existing	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.01	$ -	$ -	1.06	0.01	20.0%	30.0%
Stone, Clay, and Glass	Existing	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	employee	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 17.33	$ -	$ -	1.18	33.34	20.0%	45.0%
Stone, Clay, and Glass	Existing	Process	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 17.33	$ -	$ -	1.18	15.31	20.0%	45.0%
Stone, Clay, and Glass	Existing	Heating	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	employee	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 5.88	$ -	$ -	1.08	14.95	73.0%	85.0%
Stone, Clay, and Glass	Existing	Process	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 5.88	$ -	$ -	1.08	6.86	73.0%	85.0%
Stone, Clay, and Glass	Existing	Heating	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	employee	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 24.96	$ -	$ -	1.02	12.50	35.0%	50.0%
Stone, Clay, and Glass	Existing	Process	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 24.96	$ -	$ -	1.02	5.74	35.0%	50.0%
Stone, Clay, and Glass	Existing	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	employee	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 8.39	$ -	$ -	1.02	3.63	5.0%	85.0%
Stone, Clay, and Glass	Existing	Process	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 8.39	$ -	$ -	1.02	1.66	5.0%	85.0%
Stone, Clay, and Glass	Existing	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Retrofit	Constant ventilation	DCV enabled	RetroEven20	0	sqft	1	347	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.25	$ -	$ 0.01	1.18	0.02	55.0%	75.0%
Stone, Clay, and Glass	Existing	Heating	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	employee	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 14.16	$ -	$ -	1.18	5.56	15.0%	55.0%
Stone, Clay, and Glass	Existing	Process	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 14.16	$ -	$ -	1.18	2.55	15.0%	55.0%
Stone, Clay, and Glass	Existing	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Retrofit	None	Tube inserts installed	Retro3Slow	0	sqft	1	347	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Stone, Clay, and Glass	Existing	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Retrofit	None	HRV installed	RetroEven20	0	sqft	1	483	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 0.42	$ -	$ -	1.18	0.02	5.0%	10.0%
Stone, Clay, and Glass	Existing	Heating	Thermostat - Programmable	Programmable thermostat installed	Retrofit	Manual control	Programmable thermostat installed	RetroEven20	0	sqft	1	483	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 0.19	$ -	$ 0.01	1.04	0.03	25.0%	40.0%
Stone, Clay, and Glass	Existing	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Retrofit	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	1	483	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.02	1.18	0.07	5.0%	20.0%
Stone, Clay, and Glass	Existing	Heating	Destratification Fans (HVLS)	Fans installed	Retrofit	None/Standard ventilation	Fans installed	RetroEven20	0	sqft	1	483	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 0.67	$ -	$ 0.01	1.18	0.06	15.0%	30.0%
Stone, Clay, and Glass	Existing	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Retrofit	No insulation	Lines and condensate tank insulated	RetroEven20	0	employee	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 44.22	$ -	$ -	1.06	14.07	40.0%	50.0%
Stone, Clay, and Glass	Existing	Process	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condensate tank insulated	Retrofit	No insulation	Lines and condensate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 44.22	$ -	$ -	1.06	6.46	40.0%	50.0%
Stone, Clay, and Glass	Existing	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	employee	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 82.59	$ -	$ -	1.06	9.42	40.0%	50.0%
Stone, Clay, and Glass	Existing	Process	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 82.59	$ -	$ -	1.06	4.33	40.0%	50.0%
Stone, Clay, and Glass	Existing	Process	Process - Insulate Heated Process Fluids	Insulated process fluid lines	Retrofit	No insulation	Insulated process fluid lines	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	15.0%	65.0%
Stone, Clay, and Glass	Existing	Process	Process Heat Recovery	HR system installed	Retrofit	No HR system	HR system installed	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	5.0%	50.0%
Stone, Clay, and Glass	Existing	Heating	Building Automation System	Automation system installed and programmed	Retrofit	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	1	483	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.30	$ -	$ 0.21	1.00	0.06	5.0%	65.0%
Stone, Clay, and Glass	Existing	Heating	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	371	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Stone, Clay, and Glass	Existing	Process	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Stone, Clay, and Glass	Existing	Heating	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 121.86	$ -	$ 40.55	1.00	13.38	5.0%	50.0%
Stone, Clay, and Glass	Existing	Process	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 121.86	$ -	$ 40.55	1.00	60.53	5.0%	50.0%
Stone, Clay, and Glass	Existing	Miscellaneous	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 121.86	$ -	$ 40.55	1.00	16.26	5.0%	50.0%
Stone, Clay, and Glass	Existing	Heating	Commissioning	Optimized HVAC design and controls	Retrofit	New construction code	Optimized HVAC design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Stone, Clay, and Glass	Existing	Process	Commissioning	Optimized process design and controls	Retrofit	New construction code	Optimized process design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Stone, Clay, and Glass	Existing	Heating	Retrocommissioning	Optimized HVAC flow and controls	Retrofit	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	AEG Estimate	5	$ 328.73	$ -	$ 48.24	1.04	12.19	15.0%	50.0%
Stone, Clay, and Glass	Existing	Process	Retrocommissioning	Optimized process design and controls	Retrofit	Vintage/existing building	Optimized process design and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	AEG Estimate	5	$ 328.73	$ -	$ 48.24	1.04	237.57	15.0%	50.0%
Stone, Clay, and Glass	New	Heating	Insulation - Roof/Ceiling	R-38	Retrofit	R-13	R-38	Retro3Slow	2	sqft	1	483	0.16%	INS_CLG-Heating-RTF-v2.1-55	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Stone, Clay, and Glass	New	Heating	Insulation - Wall Cavity	R-21	Retrofit	R-11 or less	R-21	Retro3Slow	2	sqft	1	483	0.16%	INS_WC-Heating-RTF-v2.1-1	N/A	Building Energy Simulation Tool	45	$ 0.22	$ -	$ -	1.18	-	0.0%	0.0%
Stone, Clay, and Glass	New	Heating	Insulation - Ducting	50% reduction in thermal losses	Retrofit	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	1	347	0.16%	INS_DCT-All-DEER-1	N/A	Building Energy Simulation Tool	20	$ 1.12	$ -	$ 0.00	1.12	0.00	0.0%	0.0%
Stone, Clay, and Glass	New	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Retrofit	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	1	347	0.16%	DCT_RPR-All-DEER-1	N/A	Building Energy Simulation Tool	18	$ -	$ -	$ 0.00	1.18	0.00	0.0%	0.0%
Stone, Clay, and Glass	New	Heating	Windows - High Efficiency	U-.22 or better	Retrofit	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft	1	483	0.16%	WND_HE-Heating-RTF-v2.1-46	N/A	Building Energy Simulation Tool	45	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Stone, Clay, and Glass	New	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.01	$ -	$ -	1.06	7.12	5.0%	10.0%
Stone, Clay, and Glass	New	Process	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.01	$ -	$ -	1.06	3.44	5.0%	10.0%
Stone, Clay, and Glass	New	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.00	$ -	$ -	1.06	0.01	5.0%	10.0%
Stone, Clay, and Glass	New	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 16.73	$ -	$ -	1.18	31.67	20.0%	45.0%
Stone, Clay, and Glass	New	Process	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 16.73	$ -	$ -	1.18	15.31	20.0%	45.0%
Stone, Clay, and Glass	New	Heating	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 5.40	$ -	$ -	1.08	14.20	0.0%	0.0%
Stone, Clay, and Glass	New	Process	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 5.40	$ -	$ -	1.08	6.86	0.0%	0.0%
Stone, Clay, and Glass	New	Heating	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 24.11	$ -	$ -	1.02	11.87	35.0%	50.0%
Stone, Clay, and Glass	New	Process	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 24.11	$ -	$ -	1.02	5.74	35.0%	50.0%
Stone, Clay, and Glass	New	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 8.10	$ -	$ -	1.02	3.44	5.0%	85.0%
Stone, Clay, and Glass	New	Process	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 8.10	$ -	$ -	1.02	1.66	5.0%	85.0%
Stone, Clay, and Glass	New	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Retrofit	Constant ventilation	DCV enabled	RetroEven20	0	sqft	1	347	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.16	$ -	$ 0.01	1.18	0.02	55.0%	75.0%
Stone, Clay, and Glass	New	Heating	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 13.67	$ -	$ -	1.18	5.28	15.0%	55.0%
Stone, Clay, and Glass	New	Process	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 13.67	$ -	$ -	1.18	2.55	15.0%	55.0%
Stone, Clay, and Glass	New	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Retrofit	None	Tube inserts installed	Retro3Slow	0	sqft	1	347	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Stone, Clay, and Glass	New	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Retrofit	None	HRV installed	RetroEven20	0	sqft	1	483	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 0.42	$ -	$ -	1.18	-	5.0%	10.0%
Stone, Clay, and Glass	New	Heating	Thermostat - Programmable	Programmable thermostat installed	Retrofit	Manual control	Programmable thermostat installed	RetroEven20	0	sqft	1	483	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 0.19	$ -	$ -	1.04	-	25.0%	40.0%

Industrial Non-Equipment

Measure					Characteristics									Sources			Measure Assumptions in 2017							
Segment	Vintage	End Use	Measure	Efficient Definition	Replacement Type	Baseline Definition (NEM Only)	Measure Description	Measure Ramp Rate Name	Ramp Offset	Input Unit of Measure	Employees per facility	UOM Per Facility	Line Loss	Lifetime Source	Costs Source	Savings Source	Measure Lifetime (Years)	Incremental Measure Cost ($)	Incremental O&M Cost ($)	Incremental Non-Energy Benefits ($)	Cost Scalar	Measure Savings @ meter (therm) (NEM Only)	Base Saturation	Applicability
Stone, Clay, and Glass	New	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Retrofit	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	1	483	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.01	1.18	-	5.0%	20.0%
Stone, Clay, and Glass	New	Heating	Destratification Fans (HVLS)	Fans installed	Retrofit	None/Standard ventilation	Fans installed	RetroEven20	0	sqft	1	483	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 0.67	$ -	$ -	1.18	-	15.0%	30.0%
Stone, Clay, and Glass	New	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Retrofit	No insulation	Lines and condenstate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 42.70	$ -	$ -	1.06	13.37	45.0%	50.0%
Stone, Clay, and Glass	New	Process	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Retrofit	No insulation	Lines and condenstate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 42.70	$ -	$ -	1.06	6.46	45.0%	50.0%
Stone, Clay, and Glass	New	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 79.76	$ -	$ -	1.06	8.95	45.0%	50.0%
Stone, Clay, and Glass	New	Process	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 79.76	$ -	$ -	1.06	4.33	45.0%	50.0%
Stone, Clay, and Glass	New	Process	Process - Insulate Heated Process Fluids	Insulated process fluid lines	Retrofit	No insulation	Insulated process fluid lines	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	15.0%	65.0%
Stone, Clay, and Glass	New	Process	Process Heat Recovery	HR system installed	Retrofit	No HR system	HR system installed	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	5.0%	50.0%
Stone, Clay, and Glass	New	Heating	Building Automation System	Automation system installed and programmed	Retrofit	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	1	483	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.34	$ -	$ -	1.00	-	5.0%	65.0%
Stone, Clay, and Glass	New	Heating	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	371	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Stone, Clay, and Glass	New	Process	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Stone, Clay, and Glass	New	Heating	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 121.86	$ 2.90	$ -	1.00	-	5.0%	50.0%
Stone, Clay, and Glass	New	Process	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 121.86	$ 2.90	$ -	1.00	-	5.0%	50.0%
Stone, Clay, and Glass	New	Miscellaneous	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 121.86	$ 2.90	$ -	1.00	-	5.0%	50.0%
Stone, Clay, and Glass	New	Heating	Commissioning	Optimized HVAC design and controls	Retrofit	New construction code	Optimized HVAC design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Stone, Clay, and Glass	New	Process	Commissioning	Optimized process design and controls	Retrofit	New construction code	Optimized process design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Stone, Clay, and Glass	New	Heating	Retrocommissioning	Optimized HVAC flow and controls	Retrofit	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	n/a	5	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Stone, Clay, and Glass	New	Process	Retrocommissioning	Optimized process design and controls	Retrofit	Vintage/existing building	Optimized process design and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	n/a	5	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Petroleum	Existing	Heating	Insulation - Roof/Ceiling	R-38	Retrofit	R-13	R-38	Retro3Slow	2	sqft	1	11,459	0.16%	INS_CLG-Heating-RTF-v2.1-55	INS_CLG-Heating-RTF-v2.1-55	Building Energy Simulation Tool	45	$ 1.02	$ -	$ 0.01	1.18	0.10	60.0%	100.0%
Petroleum	Existing	Heating	Insulation - Wall Cavity	R-21	Retrofit	R-11 or less	R-21	Retro3Slow	2	sqft	1	11,459	0.16%	INS_WC-Heating-RTF-v2.1-1	INS_WC-Heating-RTF-v2.1-1	Building Energy Simulation Tool	45	$ 0.31	$ -	$ 0.00	1.18	0.07	60.0%	100.0%
Petroleum	Existing	Heating	Insulation - Ducting	50% reduction in thermal losses	Retrofit	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	1	12,213	0.16%	INS_DCT-All-DEER-1	INS_DCT-All-DEER-1	Building Energy Simulation Tool	20	$ 0.86	$ -	$ 0.00	1.12	0.00	40.0%	60.0%
Petroleum	Existing	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Retrofit	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	1	12,213	0.16%	DCT_RPR-All-DEER-1	DCT_RPR-Cooling-RTF-1	Building Energy Simulation Tool	18	$ 0.59	$ -	$ 0.00	1.18	0.00	15.0%	50.0%
Petroleum	Existing	Heating	Windows - High Efficiency	U-.22 or better	Retrofit	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft	1	11,459	0.16%	WND_HE-Heating-RTF-v2.1-46	WND_HE-Heating-RTF-v2.1-46	Building Energy Simulation Tool	45	$ 0.23	$ -	$ 0.00	1.18	0.03	45.0%	100.0%
Petroleum	Existing	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	employee	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.36	$ -	$ -	1.06	28.08	20.0%	30.0%
Petroleum	Existing	Process	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.36	$ -	$ -	1.06	439.17	20.0%	30.0%
Petroleum	Existing	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.19	$ -	$ -	1.06	0.01	20.0%	30.0%
Petroleum	Existing	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	employee	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 739.70	$ -	$ -	1.18	124.81	20.0%	45.0%
Petroleum	Existing	Process	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 739.70	$ -	$ -	1.18	1,951.87	20.0%	45.0%
Petroleum	Existing	Heating	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	employee	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 251.13	$ -	$ -	1.08	55.97	73.0%	85.0%
Petroleum	Existing	Process	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 251.13	$ -	$ -	1.08	875.23	73.0%	85.0%
Petroleum	Existing	Heating	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	employee	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 1,065.68	$ -	$ -	1.02	46.80	35.0%	50.0%
Petroleum	Existing	Process	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 1,065.68	$ -	$ -	1.02	731.95	35.0%	50.0%
Petroleum	Existing	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	employee	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 358.04	$ -	$ -	1.02	13.57	5.0%	85.0%
Petroleum	Existing	Process	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 358.04	$ -	$ -	1.02	212.27	5.0%	85.0%
Petroleum	Existing	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Retrofit	Constant ventilation	DCV enabled	RetroEven20	0	sqft	1	12,213	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.25	$ -	$ 0.00	1.18	0.02	55.0%	75.0%
Petroleum	Existing	Heating	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	employee	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 604.33	$ -	$ -	1.18	20.80	15.0%	55.0%
Petroleum	Existing	Process	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 604.33	$ -	$ -	1.18	325.31	15.0%	55.0%
Petroleum	Existing	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Retrofit	None	Tube inserts installed	Retro3Slow	0	sqft	1	12,213	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Petroleum	Existing	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Retrofit	None	HRV installed	RetroEven20	0	sqft	1	11,459	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 0.42	$ -	$ -	1.18	0.02	5.0%	10.0%
Petroleum	Existing	Heating	Thermostat - Programmable	Programmable thermostat installed	Retrofit	Manual control	Programmable thermostat installed	RetroEven20	0	sqft	1	11,459	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 0.19	$ -	$ 0.00	1.04	0.03	25.0%	40.0%
Petroleum	Existing	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Retrofit	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	1	11,459	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.02	1.18	0.07	5.0%	20.0%
Petroleum	Existing	Heating	Destratification Fans (HVLS)	Fans installed	Retrofit	None/Standard ventilation	Fans installed	RetroEven20	0	sqft	1	11,459	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 0.67	$ -	$ 0.00	1.18	0.06	15.0%	30.0%
Petroleum	Existing	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Retrofit	No insulation	Lines and condenstate tank insulated	RetroEven20	0	employee	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 1,887.81	$ -	$ -	1.06	52.68	40.0%	50.0%
Petroleum	Existing	Process	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Retrofit	No insulation	Lines and condenstate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 1,887.81	$ -	$ -	1.06	823.84	40.0%	50.0%
Petroleum	Existing	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	employee	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 3,526.09	$ -	$ -	1.06	35.27	40.0%	50.0%
Petroleum	Existing	Process	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 3,526.09	$ -	$ -	1.06	551.52	40.0%	50.0%
Petroleum	Existing	Process	Process - Insulate Heated Process Fluids	Insulated process fluid lines	Retrofit	No insulation	Insulated process fluid lines	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	15.0%	65.0%
Petroleum	Existing	Process	Process Heat Recovery	HR system installed	Retrofit	No HR system	HR system installed	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	5.0%	50.0%
Petroleum	Existing	Heating	Building Automation System	Automation system installed and programmed	Retrofit	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	1	11,459	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.30	$ -	$ 0.01	1.00	0.06	5.0%	65.0%
Petroleum	Existing	Heating	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1,391	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Petroleum	Existing	Process	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Petroleum	Existing	Heating	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 1,667.82	$ -	$ 24.96	1.00	317.64	5.0%	50.0%
Petroleum	Existing	Process	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 1,667.82	$ -	$ 24.96	1.00	769.04	5.0%	50.0%
Petroleum	Existing	Miscellaneous	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 1,667.82	$ -	$ 24.96	1.00	147.44	5.0%	50.0%
Petroleum	Existing	Heating	Commissioning	Optimized HVAC design and controls	Retrofit	New construction code	Optimized HVAC design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Petroleum	Existing	Process	Commissioning	Optimized process design and controls	Retrofit	New construction code	Optimized process design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Petroleum	Existing	Heating	Retrocommissioning	Optimized HVAC flow and controls	Retrofit	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	AEG Estimate	5	$ 4,006.09	$ -	$ 49.14	1.04	25.54	15.0%	50.0%
Petroleum	Existing	Process	Retrocommissioning	Optimized process design and controls	Retrofit	Vintage/existing building	Optimized process design and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	AEG Estimate	5	$ 4,006.09	$ -	$ 49.14	1.04	3,018.11	15.0%	50.0%
Petroleum	New	Heating	Insulation - Roof/Ceiling	R-38	Retrofit	R-13	R-38	Retro3Slow	2	sqft	1	11,459	0.16%	INS_CLG-Heating-RTF-v2.1-55	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Petroleum	New	Heating	Insulation - Wall Cavity	R-21	Retrofit	R-11 or less	R-21	Retro3Slow	2	sqft	1	11,459	0.16%	INS_WC-Heating-RTF-v2.1-1	N/A	Building Energy Simulation Tool	45	$ 0.22	$ -	$ -	1.18	-	0.0%	0.0%
Petroleum	New	Heating	Insulation - Ducting	50% reduction in thermal losses	Retrofit	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	1	12,213	0.16%	INS_DCT-All-DEER-1	N/A	Building Energy Simulation Tool	20	$ 1.12	$ -	$ 0.00	1.12	0.00	0.0%	0.0%
Petroleum	New	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Retrofit	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	1	12,213	0.16%	DCT_RPR-All-DEER-1	N/A	Building Energy Simulation Tool	18	$ -	$ -	$ 0.00	1.18	0.00	0.0%	0.0%
Petroleum	New	Heating	Windows - High Efficiency	U-.22 or better	Retrofit	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft	1	11,459	0.16%	WND_HE-Heating-RTF-v2.1-46	N/A	Building Energy Simulation Tool	45	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Petroleum	New	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.36	$ -	$ -	1.06	26.68	5.0%	10.0%
Petroleum	New	Process	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.36	$ -	$ -	1.06	439.17	5.0%	10.0%
Petroleum	New	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.17	$ -	$ -	1.06	0.01	5.0%	10.0%
Petroleum	New	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 737.48	$ -	$ -	1.18	118.56	20.0%	45.0%
Petroleum	New	Process	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 737.48	$ -	$ -	1.18	1,951.87	20.0%	45.0%
Petroleum	New	Heating	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 237.84	$ -	$ -	1.08	53.16	0.0%	0.0%
Petroleum	New	Process	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 237.84	$ -	$ -	1.08	875.23	0.0%	0.0%
Petroleum	New	Heating	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 1,062.48	$ -	$ -	1.02	44.46	35.0%	50.0%
Petroleum	New	Process	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 1,062.48	$ -	$ -	1.02	731.95	35.0%	50.0%
Petroleum	New	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 356.96	$ -	$ -	1.02	12.89	5.0%	85.0%
Petroleum	New	Process	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 356.96	$ -	$ -	1.02	212.27	5.0%	85.0%
Petroleum	New	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Retrofit	Constant ventilation	DCV enabled	RetroEven20	0	sqft	1	12,213	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.16	$ -	$ 0.00	1.18	0.02	55.0%	75.0%
Petroleum	New	Heating	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 602.51	$ -	$ -	1.18	19.76	15.0%	55.0%
Petroleum	New	Process	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 602.51	$ -	$ -	1.18	325.31	15.0%	55.0%
Petroleum	New	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Retrofit	None	Tube inserts installed	Retro3Slow	0	sqft	1	12,213	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Petroleum	New	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Retrofit	None	HRV installed	RetroEven20	0	sqft	1	11,459	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 0.42	$ -	$ -	1.18	-	5.0%	10.0%
Petroleum	New	Heating	Thermostat - Programmable	Programmable thermostat installed	Retrofit	Manual control	Programmable thermostat installed	RetroEven20	0	sqft	1	11,459	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 0.19	$ -	$ -	1.04	-	25.0%	40.0%
Petroleum	New	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Retrofit	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	1	11,459	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.01	1.18	-	5.0%	20.0%
Petroleum	New	Heating	Destratification Fans (HVLS)	Fans installed	Retrofit	None/Standard ventilation	Fans installed	RetroEven20	0	sqft	1	11,459	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 0.67	$ -	$ -	1.18	-	15.0%	30.0%
Petroleum	New	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Retrofit	No insulation	Lines and condenstate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 1,882.13	$ -	$ -	1.06	50.04	45.0%	50.0%
Petroleum	New	Process	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Retrofit	No insulation	Lines and condenstate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 1,882.13	$ -	$ -	1.06	823.84	45.0%	50.0%
Petroleum	New	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 3,515.48	$ -	$ -	1.06	33.50	45.0%	50.0%
Petroleum	New	Process	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 3,515.48	$ -	$ -	1.06	551.52	45.0%	50.0%
Petroleum	New	Process	Process - Insulate Heated Process Fluids	Insulated process fluid lines	Retrofit	No insulation	Insulated process fluid lines	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	15.0%	65.0%
Petroleum	New	Process	Process Heat Recovery	HR system installed	Retrofit	No HR system	HR system installed	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	5.0%	50.0%
Petroleum	New	Heating	Building Automation System	Automation system installed and programmed	Retrofit	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	1	11,459	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.34	$ -	$ -	1.00	-	5.0%	65.0%
Petroleum	New	Heating	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1,391	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Petroleum	New	Process	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Petroleum	New	Heating	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 1,667.82	$ 39.72	$ -	1.00	-	5.0%	50.0%
Petroleum	New	Process	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 1,667.82	$ 39.72	$ -	1.00	-	5.0%	50.0%
Petroleum	New	Miscellaneous	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 1,667.82	$ 39.72	$ -	1.00	-	5.0%	50.0%
Petroleum	New	Heating	Commissioning	Optimized HVAC design and controls	Retrofit	New construction code	Optimized HVAC design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Petroleum	New	Process	Commissioning	Optimized process design and controls	Retrofit	New construction code	Optimized process design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Petroleum	New	Heating	Retrocommissioning	Optimized HVAC flow and controls	Retrofit	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	n/a	5	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Petroleum	New	Process	Retrocommissioning	Optimized process design and controls	Retrofit	Vintage/existing building	Optimized process design and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	n/a	5	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Paper and Printing	Existing	Heating	Insulation - Roof/Ceiling	R-38	Retrofit	R-13	R-38	Retro3Slow	2	sqft	1	1,531	0.16%	INS_CLG-Heating-RTF-v2.1-55	INS_CLG-Heating-RTF-v2.1-55	Building Energy Simulation Tool	45	$ 1.02	$ -	$ 0.01	1.18	0.10	60.0%	100.0%
Paper and Printing	Existing	Heating	Insulation - Wall Cavity	R-21	Retrofit	R-11 or less	R-21	Retro3Slow	2	sqft	1	1,531	0.16%	INS_WC-Heating-RTF-v2.1-1	INS_WC-Heating-RTF-v2.1-1	Building Energy Simulation Tool	45	$ 0.31	$ -	$ 0.01	1.18	0.07	60.0%	100.0%
Paper and Printing	Existing	Heating	Insulation - Ducting	50% reduction in thermal losses	Retrofit	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	1	889	0.16%	INS_DCT-All-DEER-1	INS_DCT-All-DEER-1	Building Energy Simulation Tool	20	$ 0.86	$ -	$ 0.00	1.12	0.00	40.0%	60.0%
Paper and Printing	Existing	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Retrofit	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	1	889	0.16%	DCT_RPR-All-DEER-1	DCT_RPR-Cooling-RTF-1	Building Energy Simulation Tool	18	$ 0.59	$ -	$ 0.00	1.18	0.00	15.0%	50.0%
Paper and Printing	Existing	Heating	Windows - High Efficiency	U-.22 or better	Retrofit	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft	1	1,531	0.16%	WND_HE-Heating-RTF-v2.1-46	WND_HE-Heating-RTF-v2.1-46	Building Energy Simulation Tool	45	$ 0.23	$ -	$ 0.00	1.18	0.03	45.0%	100.0%
Paper and Printing	Existing	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	employee	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.06	$ -	$ -	1.06	27.45	20.0%	30.0%
Paper and Printing	Existing	Process	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.06	$ -	$ -	1.06	45.66	20.0%	30.0%
Paper and Printing	Existing	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.01	$ -	$ -	1.06	0.01	20.0%	30.0%
Paper and Printing	Existing	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	employee	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 115.73	$ -	$ -	1.18	121.99	20.0%	45.0%
Paper and Printing	Existing	Process	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 115.73	$ -	$ -	1.18	202.91	20.0%	45.0%
Paper and Printing	Existing	Heating	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	employee	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 39.29	$ -	$ -	1.08	54.70	73.0%	85.0%
Paper and Printing	Existing	Process	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 39.29	$ -	$ -	1.08	90.99	73.0%	85.0%
Paper and Printing	Existing	Heating	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	employee	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 166.73	$ -	$ -	1.02	45.75	35.0%	50.0%
Paper and Printing	Existing	Process	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 166.73	$ -	$ -	1.02	76.09	35.0%	50.0%
Paper and Printing	Existing	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	employee	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 56.02	$ -	$ -	1.02	13.27	5.0%	85.0%
Paper and Printing	Existing	Process	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 56.02	$ -	$ -	1.02	22.07	5.0%	85.0%
Paper and Printing	Existing	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Retrofit	Constant ventilation	DCV enabled	RetroEven20	0	sqft	1	889	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.25	$ -	$ 0.00	1.18	0.02	55.0%	75.0%
Paper and Printing	Existing	Heating	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	employee	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 94.55	$ -	$ -	1.18	20.33	15.0%	55.0%
Paper and Printing	Existing	Process	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 94.55	$ -	$ -	1.18	33.82	15.0%	55.0%
Paper and Printing	Existing	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Retrofit	None	Tube inserts installed	Retro3Slow	0	sqft	1	889	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Paper and Printing	Existing	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Retrofit	None	HRV installed	RetroEven20	0	sqft	1	1,531	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 0.42	$ -	$ -	1.18	0.02	5.0%	10.0%
Paper and Printing	Existing	Heating	Thermostat - Programmable	Programmable thermostat installed	Retrofit	Manual control	Programmable thermostat installed	RetroEven20	0	sqft	1	1,531	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 0.19	$ -	$ 0.00	1.04	0.03	25.0%	40.0%
Paper and Printing	Existing	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Retrofit	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	1	1,531	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.02	1.18	0.07	5.0%	20.0%
Paper and Printing	Existing	Heating	Destratification Fans (HVLS)	Fans installed	Retrofit	None/Standard ventilation	Fans installed	RetroEven20	0	sqft	1	1,531	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 0.67	$ -	$ 0.01	1.18	0.06	15.0%	30.0%
Paper and Printing	Existing	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Retrofit	No insulation	Lines and condenstate tank insulated	RetroEven20	0	employee	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 295.35	$ -	$ -	1.06	51.49	40.0%	50.0%
Paper and Printing	Existing	Process	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Retrofit	No insulation	Lines and condenstate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 295.35	$ -	$ -	1.06	85.65	40.0%	50.0%
Paper and Printing	Existing	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	employee	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 551.67	$ -	$ -	1.06	34.47	40.0%	50.0%
Paper and Printing	Existing	Process	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 551.67	$ -	$ -	1.06	57.34	40.0%	50.0%
Paper and Printing	Existing	Process	Process - Insulate Heated Process Fluids	Insulated process fluid lines	Retrofit	No insulation	Insulated process fluid lines	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	15.0%	65.0%
Paper and Printing	Existing	Process	Process Heat Recovery	HR system installed	Retrofit	No HR system	HR system installed	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	5.0%	50.0%
Paper and Printing	Existing	Heating	Building Automation System	Automation system installed and programmed	Retrofit	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	1	1,531	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.30	$ -	$ 0.07	1.00	0.06	5.0%	65.0%
Paper and Printing	Existing	Heating	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1,359	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Paper and Printing	Existing	Process	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Paper and Printing	Existing	Heating	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 158.57	$ -	$ 41.70	1.00	42.43	5.0%	50.0%
Paper and Printing	Existing	Process	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 158.57	$ -	$ 41.70	1.00	56.89	5.0%	50.0%
Paper and Printing	Existing	Miscellaneous	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 158.57	$ -	$ 41.70	1.00	18.02	5.0%	50.0%
Paper and Printing	Existing	Heating	Commissioning	Optimized HVAC design and controls	Retrofit	New construction code	Optimized HVAC design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Paper and Printing	Existing	Process	Commissioning	Optimized process design and controls	Retrofit	New construction code	Optimized process design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Paper and Printing	Existing	Heating	Retrocommissioning	Optimized HVAC flow and controls	Retrofit	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	AEG Estimate	5	$ 357.32	$ -	$ 50.65	1.04	48.22	15.0%	50.0%
Paper and Printing	Existing	Process	Retrocommissioning	Optimized process design and controls	Retrofit	Vintage/existing building	Optimized process design and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	AEG Estimate	5	$ 357.32	$ -	$ 50.65	1.04	223.26	15.0%	50.0%
Paper and Printing	New	Heating	Insulation - Roof/Ceiling	R-38	Retrofit	R-13	R-38	Retro3Slow	2	sqft	1	1,531	0.16%	INS_CLG-Heating-RTF-v2.1-55	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Paper and Printing	New	Heating	Insulation - Wall Cavity	R-21	Retrofit	R-11 or less	R-21	Retro3Slow	2	sqft	1	1,531	0.16%	INS_WC-Heating-RTF-v2.1-1	N/A	Building Energy Simulation Tool	45	$ 0.22	$ -	$ -	1.18	-	0.0%	0.0%
Paper and Printing	New	Heating	Insulation - Ducting	50% reduction in thermal losses	Retrofit	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	1	889	0.16%	INS_DCT-All-DEER-1	N/A	Building Energy Simulation Tool	20	$ 1.12	$ -	$ 0.00	1.12	0.00	0.0%	0.0%
Paper and Printing	New	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Retrofit	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	1	889	0.16%	DCT_RPR-All-DEER-1	N/A	Building Energy Simulation Tool	18	$ -	$ -	$ 0.00	1.18	0.00	0.0%	0.0%
Paper and Printing	New	Heating	Windows - High Efficiency	U-.22 or better	Retrofit	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft	1	1,531	0.16%	WND_HE-Heating-RTF-v2.1-46	N/A	Building Energy Simulation Tool	45	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Paper and Printing	New	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.06	$ -	$ -	1.06	26.07	5.0%	10.0%
Paper and Printing	New	Process	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.06	$ -	$ -	1.06	45.66	5.0%	10.0%
Paper and Printing	New	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.01	$ -	$ -	1.06	0.01	5.0%	10.0%
Paper and Printing	New	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 113.55	$ -	$ -	1.18	115.88	20.0%	45.0%
Paper and Printing	New	Process	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 113.55	$ -	$ -	1.18	202.91	20.0%	45.0%
Paper and Printing	New	Heating	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 36.62	$ -	$ -	1.08	51.96	0.0%	0.0%
Paper and Printing	New	Process	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 36.62	$ -	$ -	1.08	90.99	0.0%	0.0%
Paper and Printing	New	Heating	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 163.60	$ -	$ -	1.02	43.46	35.0%	50.0%

Industrial Non-Equipment

Measure					Characteristics									Sources			Measure Assumptions in 2017							
Segment	Vintage	End Use	Measure	Efficient Definition	Replacement Type	Baseline Definition (NEM Only)	Measure Description	Measure Ramp Rate Name	Ramp Offset	Input Unit of Measure	Employees per facility	UOM Per Facility	Line Loss	Lifetime Source	Costs Source	Savings Source	Measure Lifetime (Years)	Incremental Measure Cost ($)	Incremental O&M Cost ($)	Incremental Non-Energy Benefits ($)	Cost Scalar	Measure Savings @ meter (therm) (NEM Only)	Base Saturation	Applicability
Paper and Printing	New	Process	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 163.60	$ -	$ -	1.02	76.09	35.0%	50.0%
Paper and Printing	New	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 54.96	$ -	$ -	1.02	12.60	5.0%	85.0%
Paper and Printing	New	Process	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 54.96	$ -	$ -	1.02	22.07	5.0%	85.0%
Paper and Printing	New	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Retrofit	Constant ventilation	DCV enabled	RetroEven20	0	sqft	1	889	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.16	$ -	$ 0.00	1.18	0.02	55.0%	75.0%
Paper and Printing	New	Heating	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 92.77	$ -	$ -	1.18	19.31	15.0%	55.0%
Paper and Printing	New	Process	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 92.77	$ -	$ -	1.18	33.82	15.0%	55.0%
Paper and Printing	New	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Retrofit	None	Tube inserts installed	Retro3Slow	0	sqft	1	889	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Paper and Printing	New	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Retrofit	None	HRV installed	RetroEven20	0	sqft	1	1,531	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 0.42	$ -	$ -	1.18	-	5.0%	10.0%
Paper and Printing	New	Heating	Thermostat - Programmable	Programmable thermostat installed	Retrofit	Manual control	Programmable thermostat installed	RetroEven20	0	sqft	1	1,531	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 0.19	$ -	$ -	1.04	-	25.0%	40.0%
Paper and Printing	New	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Retrofit	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	1	1,531	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.01	1.18	-	5.0%	20.0%
Paper and Printing	New	Heating	Destratification Fans (HVLS)	Fans installed	Retrofit	None/Standard ventilation	Fans installed	RetroEven20	0	sqft	1	1,531	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 0.67	$ -	$ -	1.18	-	15.0%	30.0%
Paper and Printing	New	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Retrofit	No insulation	Lines and condenstate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 289.80	$ -	$ -	1.06	48.91	45.0%	50.0%
Paper and Printing	New	Process	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Retrofit	No insulation	Lines and condenstate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 289.80	$ -	$ -	1.06	85.65	45.0%	50.0%
Paper and Printing	New	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 541.30	$ -	$ -	1.06	32.74	45.0%	50.0%
Paper and Printing	New	Process	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 541.30	$ -	$ -	1.06	57.34	45.0%	50.0%
Paper and Printing	New	Process	Process - Insulate Heated Process Fluids	Insulated process fluid lines	Retrofit	No insulation	Insulated process fluid lines	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	15.0%	65.0%
Paper and Printing	New	Process	Process Heat Recovery	HR system installed	Retrofit	No HR system	HR system installed	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	5.0%	50.0%
Paper and Printing	New	Heating	Building Automation System	Automation system installed and programmed	Retrofit	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	1	1,531	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.34	$ -	$ -	1.00	-	5.0%	65.0%
Paper and Printing	New	Heating	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1,359	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Paper and Printing	New	Process	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Paper and Printing	New	Heating	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 158.57	$ 3.78	$ -	1.00	-	5.0%	50.0%
Paper and Printing	New	Process	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 158.57	$ 3.78	$ -	1.00	-	5.0%	50.0%
Paper and Printing	New	Miscellaneous	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 158.57	$ 3.78	$ -	1.00	-	5.0%	50.0%
Paper and Printing	New	Heating	Commissioning	Optimized HVAC design and controls	Retrofit	New construction code	Optimized HVAC design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Paper and Printing	New	Process	Commissioning	Optimized process design and controls	Retrofit	New construction code	Optimized process design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Paper and Printing	New	Heating	Retrocommissioning	Optimized HVAC flow and controls	Retrofit	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	n/a	5	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Paper and Printing	New	Process	Retrocommissioning	Optimized process design and controls	Retrofit	Vintage/existing building	Optimized process design and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	n/a	5	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Instruments	Existing	Heating	Insulation - Roof/Ceiling	R-38	Retrofit	R-13	R-38	Retro3Slow	2	sqft	1	80	0.16%	INS_CLG-Heating-RTF-v2.1-55	INS_CLG-Heating-RTF-v2.1-55	Building Energy Simulation Tool	45	$ 1.02	$ -	$ 0.08	1.18	0.10	60.0%	100.0%
Instruments	Existing	Heating	Insulation - Wall Cavity	R-21	Retrofit	R-11 or less	R-21	Retro3Slow	2	sqft	1	80	0.16%	INS_WC-Heating-RTF-v2.1-1	INS_WC-Heating-RTF-v2.1-1	Building Energy Simulation Tool	45	$ 0.31	$ -	$ 0.06	1.18	0.07	60.0%	100.0%
Instruments	Existing	Heating	Insulation - Ducting	50% reduction in thermal losses	Retrofit	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	1	59	0.16%	INS_DCT-All-DEER-1	INS_DCT-All-DEER-1	Building Energy Simulation Tool	20	$ 0.86	$ -	$ 0.00	1.12	0.00	40.0%	60.0%
Instruments	Existing	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Retrofit	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	1	59	0.16%	DCT_RPR-All-DEER-1	DCT_RPR-Cooling-RTF-1	Building Energy Simulation Tool	18	$ 0.59	$ -	$ 0.00	1.18	0.00	15.0%	50.0%
Instruments	Existing	Heating	Windows - High Efficiency	U-.22 or better	Retrofit	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft	1	80	0.16%	WND_HE-Heating-RTF-v2.1-46	WND_HE-Heating-RTF-v2.1-46	Building Energy Simulation Tool	45	$ 0.23	$ -	$ 0.03	1.18	0.03	45.0%	100.0%
Instruments	Existing	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	employee	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.00	$ -	$ -	1.06	1.66	20.0%	30.0%
Instruments	Existing	Process	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.00	$ -	$ -	1.06	2.11	20.0%	30.0%
Instruments	Existing	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.00	$ -	$ -	1.06	0.01	20.0%	30.0%
Instruments	Existing	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	employee	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 5.96	$ -	$ -	1.18	7.36	20.0%	45.0%
Instruments	Existing	Process	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 5.96	$ -	$ -	1.18	9.38	20.0%	45.0%
Instruments	Existing	Heating	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	employee	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 2.02	$ -	$ -	1.08	3.30	73.0%	85.0%
Instruments	Existing	Process	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 2.02	$ -	$ -	1.08	4.21	73.0%	85.0%
Instruments	Existing	Heating	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	employee	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 8.59	$ -	$ -	1.02	2.76	35.0%	50.0%
Instruments	Existing	Process	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 8.59	$ -	$ -	1.02	3.52	35.0%	50.0%
Instruments	Existing	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	employee	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 2.89	$ -	$ -	1.02	0.80	5.0%	85.0%
Instruments	Existing	Process	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 2.89	$ -	$ -	1.02	1.02	5.0%	85.0%
Instruments	Existing	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Retrofit	Constant ventilation	DCV enabled	RetroEven20	0	sqft	1	59	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.25	$ -	$ 0.03	1.18	0.02	55.0%	75.0%
Instruments	Existing	Heating	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	employee	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 4.87	$ -	$ -	1.18	1.23	15.0%	55.0%
Instruments	Existing	Process	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 4.87	$ -	$ -	1.18	1.56	15.0%	55.0%
Instruments	Existing	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Retrofit	None	Tube inserts installed	Retro3Slow	0	sqft	1	59	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Instruments	Existing	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Retrofit	None	HRV installed	RetroEven20	0	sqft	1	80	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 0.42	$ -	$ -	1.18	0.02	5.0%	10.0%
Instruments	Existing	Heating	Thermostat - Programmable	Programmable thermostat installed	Retrofit	Manual control	Programmable thermostat installed	RetroEven20	0	sqft	1	80	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 0.19	$ -	$ 0.02	1.04	0.03	25.0%	40.0%
Instruments	Existing	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Retrofit	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	1	80	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.07	1.18	0.07	5.0%	20.0%
Instruments	Existing	Heating	Destratification Fans (HVLS)	Fans installed	Retrofit	None/Standard ventilation	Fans installed	RetroEven20	0	sqft	1	80	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 0.67	$ -	$ 0.05	1.18	0.06	15.0%	30.0%
Instruments	Existing	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Retrofit	No insulation	Lines and condenstate tank insulated	RetroEven20	0	employee	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 15.22	$ -	$ -	1.06	3.11	40.0%	50.0%
Instruments	Existing	Process	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Retrofit	No insulation	Lines and condenstate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 15.22	$ -	$ -	1.06	3.96	40.0%	50.0%
Instruments	Existing	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	employee	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 28.42	$ -	$ -	1.06	2.08	40.0%	50.0%
Instruments	Existing	Process	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 28.42	$ -	$ -	1.06	2.65	40.0%	50.0%
Instruments	Existing	Process	Process - Insulate Heated Process Fluids	Insulated process fluid lines	Retrofit	No insulation	Insulated process fluid lines	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	15.0%	65.0%
Instruments	Existing	Process	Process Heat Recovery	HR system installed	Retrofit	No HR system	HR system installed	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	5.0%	50.0%
Instruments	Existing	Heating	Building Automation System	Automation system installed and programmed	Retrofit	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	1	80	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.30	$ -	$ 1.23	1.00	0.06	5.0%	65.0%
Instruments	Existing	Heating	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	82	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Instruments	Existing	Process	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Instruments	Existing	Heating	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 6.81	$ -	$ 42.51	1.00	2.23	5.0%	50.0%
Instruments	Existing	Process	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 6.81	$ -	$ 42.51	1.00	1.70	5.0%	50.0%
Instruments	Existing	Miscellaneous	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 6.81	$ -	$ 42.51	1.00	1.12	5.0%	50.0%
Instruments	Existing	Heating	Commissioning	Optimized HVAC design and controls	Retrofit	New construction code	Optimized HVAC design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Instruments	Existing	Process	Commissioning	Optimized process design and controls	Retrofit	New construction code	Optimized process design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Instruments	Existing	Heating	Retrocommissioning	Optimized HVAC flow and controls	Retrofit	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	AEG Estimate	5	$ 12.19	$ -	$ 47.60	1.04	2.59	15.0%	50.0%
Instruments	Existing	Process	Retrocommissioning	Optimized process design and controls	Retrofit	Vintage/existing building	Optimized process design and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	AEG Estimate	5	$ 12.19	$ -	$ 47.60	1.04	6.67	15.0%	50.0%
Instruments	New	Heating	Insulation - Roof/Ceiling	R-38	Retrofit	R-13	R-38	Retro3Slow	2	sqft	1	80	0.16%	INS_CLG-Heating-RTF-v2.1-55	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Instruments	New	Heating	Insulation - Wall Cavity	R-21	Retrofit	R-11 or less	R-21	Retro3Slow	2	sqft	1	80	0.16%	INS_WC-Heating-RTF-v2.1-1	N/A	Building Energy Simulation Tool	45	$ 0.22	$ -	$ -	1.18	-	0.0%	0.0%
Instruments	New	Heating	Insulation - Ducting	50% reduction in thermal losses	Retrofit	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	1	59	0.16%	INS_DCT-All-DEER-1	N/A	Building Energy Simulation Tool	20	$ 1.12	$ -	$ 0.00	1.12	0.00	0.0%	0.0%
Instruments	New	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Retrofit	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	1	59	0.16%	DCT_RPR-All-DEER-1	N/A	Building Energy Simulation Tool	18	$ -	$ -	$ 0.00	1.18	0.00	0.0%	0.0%
Instruments	New	Heating	Windows - High Efficiency	U-.22 or better	Retrofit	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft	1	80	0.16%	WND_HE-Heating-RTF-v2.1-46	N/A	Building Energy Simulation Tool	45	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Instruments	New	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.00	$ -	$ -	1.06	1.57	5.0%	10.0%
Instruments	New	Process	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.00	$ -	$ -	1.06	2.11	5.0%	10.0%
Instruments	New	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.00	$ -	$ -	1.06	0.01	5.0%	10.0%
Instruments	New	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 5.83	$ -	$ -	1.18	6.99	20.0%	45.0%
Instruments	New	Process	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 5.83	$ -	$ -	1.18	9.38	20.0%	45.0%
Instruments	New	Heating	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 1.88	$ -	$ -	1.08	3.13	0.0%	0.0%
Instruments	New	Process	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 1.88	$ -	$ -	1.08	4.21	0.0%	0.0%
Instruments	New	Heating	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 8.40	$ -	$ -	1.02	2.62	35.0%	50.0%
Instruments	New	Process	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 8.40	$ -	$ -	1.02	3.52	35.0%	50.0%
Instruments	New	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 2.82	$ -	$ -	1.02	0.76	5.0%	85.0%
Instruments	New	Process	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 2.82	$ -	$ -	1.02	1.02	5.0%	85.0%
Instruments	New	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Retrofit	Constant ventilation	DCV enabled	RetroEven20	0	sqft	1	59	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.16	$ -	$ 0.03	1.18	0.02	55.0%	75.0%
Instruments	New	Heating	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 4.76	$ -	$ -	1.18	1.16	15.0%	55.0%
Instruments	New	Process	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 4.76	$ -	$ -	1.18	1.56	15.0%	55.0%
Instruments	New	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Retrofit	None	Tube inserts installed	Retro3Slow	0	sqft	1	59	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Instruments	New	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Retrofit	None	HRV installed	RetroEven20	0	sqft	1	80	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 0.42	$ -	$ -	1.18	-	5.0%	10.0%
Instruments	New	Heating	Thermostat - Programmable	Programmable thermostat installed	Retrofit	Manual control	Programmable thermostat installed	RetroEven20	0	sqft	1	80	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 0.19	$ -	$ -	1.04	-	25.0%	40.0%
Instruments	New	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Retrofit	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	1	80	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.01	1.18	-	5.0%	20.0%
Instruments	New	Heating	Destratification Fans (HVLS)	Fans installed	Retrofit	None/Standard ventilation	Fans installed	RetroEven20	0	sqft	1	80	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 0.67	$ -	$ -	1.18	-	15.0%	30.0%
Instruments	New	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Retrofit	No insulation	Lines and condenstate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 14.88	$ -	$ -	1.06	2.95	45.0%	50.0%
Instruments	New	Process	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Retrofit	No insulation	Lines and condenstate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 14.88	$ -	$ -	1.06	3.96	45.0%	50.0%
Instruments	New	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 27.80	$ -	$ -	1.06	1.98	45.0%	50.0%
Instruments	New	Process	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 27.80	$ -	$ -	1.06	2.65	45.0%	50.0%
Instruments	New	Process	Process - Insulate Heated Process Fluids	Insulated process fluid lines	Retrofit	No insulation	Insulated process fluid lines	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	15.0%	65.0%
Instruments	New	Process	Process Heat Recovery	HR system installed	Retrofit	No HR system	HR system installed	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	5.0%	50.0%
Instruments	New	Heating	Building Automation System	Automation system installed and programmed	Retrofit	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	1	80	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.34	$ -	$ -	1.00	-	5.0%	65.0%
Instruments	New	Heating	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	82	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Instruments	New	Process	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Instruments	New	Heating	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 6.81	$ 0.16	$ -	1.00	-	5.0%	50.0%
Instruments	New	Process	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 6.81	$ 0.16	$ -	1.00	-	5.0%	50.0%
Instruments	New	Miscellaneous	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 6.81	$ 0.16	$ -	1.00	-	5.0%	50.0%
Instruments	New	Heating	Commissioning	Optimized HVAC design and controls	Retrofit	New construction code	Optimized HVAC design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Instruments	New	Process	Commissioning	Optimized process design and controls	Retrofit	New construction code	Optimized process design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Instruments	New	Heating	Retrocommissioning	Optimized HVAC flow and controls	Retrofit	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	n/a	5	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Instruments	New	Process	Retrocommissioning	Optimized process design and controls	Retrofit	Vintage/existing building	Optimized process design and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	n/a	5	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Wood and Lumber Products	Existing	Heating	Insulation - Roof/Ceiling	R-38	Retrofit	R-13	R-38	Retro3Slow	2	sqft	1	171	0.16%	INS_CLG-Heating-RTF-v2.1-55	INS_CLG-Heating-RTF-v2.1-55	Building Energy Simulation Tool	45	$ 1.02	$ -	$ 0.04	1.18	0.10	60.0%	100.0%
Wood and Lumber Products	Existing	Heating	Insulation - Wall Cavity	R-21	Retrofit	R-11 or less	R-21	Retro3Slow	2	sqft	1	171	0.16%	INS_WC-Heating-RTF-v2.1-1	INS_WC-Heating-RTF-v2.1-1	Building Energy Simulation Tool	45	$ 0.31	$ -	$ 0.03	1.18	0.07	60.0%	100.0%
Wood and Lumber Products	Existing	Heating	Insulation - Ducting	50% reduction in thermal losses	Retrofit	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	1	131	0.16%	INS_DCT-All-DEER-1	INS_DCT-All-DEER-1	Building Energy Simulation Tool	20	$ 0.86	$ -	$ 0.00	1.12	0.00	40.0%	60.0%
Wood and Lumber Products	Existing	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Retrofit	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	1	131	0.16%	DCT_RPR-All-DEER-1	DCT_RPR-Cooling-RTF-1	Building Energy Simulation Tool	18	$ 0.59	$ -	$ 0.00	1.18	0.00	15.0%	50.0%
Wood and Lumber Products	Existing	Heating	Windows - High Efficiency	U-.22 or better	Retrofit	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft	1	171	0.16%	WND_HE-Heating-RTF-v2.1-46	WND_HE-Heating-RTF-v2.1-46	Building Energy Simulation Tool	45	$ 0.23	$ -	$ 0.01	1.18	0.03	45.0%	100.0%
Wood and Lumber Products	Existing	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	employee	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.04	$ -	$ -	1.06	40.10	20.0%	30.0%
Wood and Lumber Products	Existing	Process	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.04	$ -	$ -	1.06	5.18	20.0%	30.0%
Wood and Lumber Products	Existing	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.00	$ -	$ -	1.06	0.01	20.0%	30.0%
Wood and Lumber Products	Existing	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	employee	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 71.68	$ -	$ -	1.18	178.24	20.0%	45.0%
Wood and Lumber Products	Existing	Process	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 71.68	$ -	$ -	1.18	23.01	20.0%	45.0%
Wood and Lumber Products	Existing	Heating	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	employee	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 24.34	$ -	$ -	1.08	79.92	73.0%	85.0%
Wood and Lumber Products	Existing	Process	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 24.34	$ -	$ -	1.08	10.32	73.0%	85.0%
Wood and Lumber Products	Existing	Heating	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	employee	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 103.27	$ -	$ -	1.02	66.84	35.0%	50.0%
Wood and Lumber Products	Existing	Process	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 103.27	$ -	$ -	1.02	8.63	35.0%	50.0%
Wood and Lumber Products	Existing	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	employee	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 34.70	$ -	$ -	1.02	19.38	5.0%	85.0%
Wood and Lumber Products	Existing	Process	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 34.70	$ -	$ -	1.02	2.50	5.0%	85.0%
Wood and Lumber Products	Existing	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Retrofit	Constant ventilation	DCV enabled	RetroEven20	0	sqft	1	131	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.25	$ -	$ 0.01	1.18	0.02	55.0%	75.0%
Wood and Lumber Products	Existing	Heating	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	employee	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 58.56	$ -	$ -	1.18	29.71	15.0%	55.0%
Wood and Lumber Products	Existing	Process	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 58.56	$ -	$ -	1.18	3.83	15.0%	55.0%
Wood and Lumber Products	Existing	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Retrofit	None	Tube inserts installed	Retro3Slow	0	sqft	1	131	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Wood and Lumber Products	Existing	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Retrofit	None	HRV installed	RetroEven20	0	sqft	1	171	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 0.42	$ -	$ -	1.18	0.02	5.0%	10.0%
Wood and Lumber Products	Existing	Heating	Thermostat - Programmable	Programmable thermostat installed	Retrofit	Manual control	Programmable thermostat installed	RetroEven20	0	sqft	1	171	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 0.19	$ -	$ 0.01	1.04	0.03	25.0%	40.0%
Wood and Lumber Products	Existing	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Retrofit	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	1	171	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.04	1.18	0.07	5.0%	20.0%
Wood and Lumber Products	Existing	Heating	Destratification Fans (HVLS)	Fans installed	Retrofit	None/Standard ventilation	Fans installed	RetroEven20	0	sqft	1	171	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 0.67	$ -	$ 0.03	1.18	0.06	15.0%	75.0%
Wood and Lumber Products	Existing	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Retrofit	No insulation	Lines and condenstate tank insulated	RetroEven20	0	employee	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 182.94	$ -	$ -	1.06	75.23	40.0%	50.0%
Wood and Lumber Products	Existing	Process	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Retrofit	No insulation	Lines and condenstate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 182.94	$ -	$ -	1.06	9.71	40.0%	50.0%
Wood and Lumber Products	Existing	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	employee	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 341.70	$ -	$ -	1.06	50.36	40.0%	50.0%
Wood and Lumber Products	Existing	Process	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 341.70	$ -	$ -	1.06	6.50	40.0%	50.0%
Wood and Lumber Products	Existing	Process	Process - Insulate Heated Process Fluids	Insulated process fluid lines	Retrofit	No insulation	Insulated process fluid lines	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	15.0%	65.0%
Wood and Lumber Products	Existing	Process	Process Heat Recovery	HR system installed	Retrofit	No HR system	HR system installed	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	5.0%	50.0%
Wood and Lumber Products	Existing	Heating	Building Automation System	Automation system installed and programmed	Retrofit	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	1	171	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.30	$ -	$ 0.58	1.00	0.06	5.0%	65.0%
Wood and Lumber Products	Existing	Heating	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1,986	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Wood and Lumber Products	Existing	Process	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Wood and Lumber Products	Existing	Heating	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 23.11	$ -	$ 42.30	1.00	4.75	5.0%	50.0%
Wood and Lumber Products	Existing	Process	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 23.11	$ -	$ 42.30	1.00	8.95	5.0%	50.0%
Wood and Lumber Products	Existing	Miscellaneous	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 23.11	$ -	$ 42.30	1.00	3.40	5.0%	50.0%
Wood and Lumber Products	Existing	Heating	Commissioning	Optimized HVAC design and controls	Retrofit	New construction code	Optimized HVAC design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Wood and Lumber Products	Existing	Process	Commissioning	Optimized process design and controls	Retrofit	New construction code	Optimized process design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Wood and Lumber Products	Existing	Heating	Retrocommissioning	Optimized HVAC flow and controls	Retrofit	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	AEG Estimate	5	$ 52.73	$ -	$ 47.76	1.04	4.95	15.0%	50.0%
Wood and Lumber Products	Existing	Process	Retrocommissioning	Optimized process design and controls	Retrofit	Vintage/existing building	Optimized process design and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	AEG Estimate	5	$ 52.73	$ -	$ 47.76	1.04	35.11	15.0%	50.0%
Wood and Lumber Products	New	Heating	Insulation - Roof/Ceiling	R-38	Retrofit	R-13	R-38	Retro3Slow	2	sqft	1	171	0.16%	INS_CLG-Heating-RTF-v2.1-55	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Wood and Lumber Products	New	Heating	Insulation - Wall Cavity	R-21	Retrofit	R-11 or less	R-21	Retro3Slow	2	sqft	1	171	0.16%	INS_WC-Heating-RTF-v2.1-1	N/A	Building Energy Simulation Tool	45	$ 0.22	$ -	$ -	1.18	-	0.0%	0.0%
Wood and Lumber Products	New	Heating	Insulation - Ducting	50% reduction in thermal losses	Retrofit	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	1	131	0.16%	INS_DCT-All-DEER-1	N/A	Building Energy Simulation Tool	20	$ 1.12	$ -	$ 0.00	1.12	0.00	0.0%	0.0%
Wood and Lumber Products	New	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Retrofit	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	1	131	0.16%	DCT_RPR-All-DEER-1	N/A	Building Energy Simulation Tool	18	$ -	$ -	$ 0.00	1.18	0.00	0.0%	0.0%

Industrial Non-Equipment

Measure					Characteristics									Sources			Measure Assumptions in 2017							
Segment	Vintage	End Use	Measure	Efficient Definition	Replacement Type	Baseline Definition (NEM Only)	Measure Description	Measure Ramp Rate Name	Ramp Offset	Input Unit of Measure	Employees per facility	UOM Per Facility	Line Loss	Lifetime Source	Costs Source	Savings Source	Measure Lifetime (Years)	Incremental Measure Cost ($)	Incremental O&M Cost ($)	Incremental Non-Energy Benefits ($)	Cost Scalar	Measure Savings @ meter (therm) (NEM Only)	Base Saturation	Applicability
Wood and Lumber Products	New	Heating	Windows - High Efficiency	U-.22 or better	Retrofit	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft	1	171	0.16%	WND_HE-Heating-RTF-v2.1-46	N/A	Building Energy Simulation Tool	45	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Wood and Lumber Products	New	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.03	$ -	$ -	1.06	38.10	5.0%	10.0%
Wood and Lumber Products	New	Process	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.03	$ -	$ -	1.06	5.18	5.0%	10.0%
Wood and Lumber Products	New	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.00	$ -	$ -	1.06	0.01	5.0%	10.0%
Wood and Lumber Products	New	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 68.50	$ -	$ -	1.18	169.32	20.0%	45.0%
Wood and Lumber Products	New	Process	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 68.50	$ -	$ -	1.18	23.01	20.0%	45.0%
Wood and Lumber Products	New	Heating	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 22.09	$ -	$ -	1.08	75.92	0.0%	0.0%
Wood and Lumber Products	New	Process	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 22.09	$ -	$ -	1.08	10.32	0.0%	0.0%
Wood and Lumber Products	New	Heating	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 98.69	$ -	$ -	1.02	63.49	35.0%	50.0%
Wood and Lumber Products	New	Process	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 98.69	$ -	$ -	1.02	8.63	35.0%	50.0%
Wood and Lumber Products	New	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 33.16	$ -	$ -	1.02	18.41	5.0%	85.0%
Wood and Lumber Products	New	Process	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 33.16	$ -	$ -	1.02	2.50	5.0%	85.0%
Wood and Lumber Products	New	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Retrofit	Constant ventilation	DCV enabled	RetroEven20	0	sqft	1	131	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.16	$ -	$ 0.01	1.18	0.02	55.0%	75.0%
Wood and Lumber Products	New	Heating	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 55.97	$ -	$ -	1.18	28.22	15.0%	55.0%
Wood and Lumber Products	New	Process	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 55.97	$ -	$ -	1.18	3.83	15.0%	55.0%
Wood and Lumber Products	New	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Retrofit	None	Tube inserts installed	Retro3Slow	0	sqft	1	131	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Wood and Lumber Products	New	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Retrofit	None	HRV installed	RetroEven20	0	sqft	1	171	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 0.42	$ -	$ -	1.18	-	5.0%	10.0%
Wood and Lumber Products	New	Heating	Thermostat - Programmable	Programmable thermostat installed	Retrofit	Manual control	Programmable thermostat installed	RetroEven20	0	sqft	1	171	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 0.19	$ -	$ -	1.04	-	25.0%	40.0%
Wood and Lumber Products	New	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Retrofit	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	1	171	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.01	1.18	-	5.0%	20.0%
Wood and Lumber Products	New	Heating	Destratification Fans (HVLS)	Fans installed	Retrofit	None/Standard ventilation	Fans installed	RetroEven20	0	sqft	1	171	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 0.67	$ -	$ -	1.18	-	15.0%	75.0%
Wood and Lumber Products	New	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Retrofit	No insulation	Lines and condenstate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 174.83	$ -	$ -	1.06	71.47	45.0%	50.0%
Wood and Lumber Products	New	Process	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Retrofit	No insulation	Lines and condenstate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 174.83	$ -	$ -	1.06	9.71	45.0%	50.0%
Wood and Lumber Products	New	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 326.55	$ -	$ -	1.06	47.84	45.0%	50.0%
Wood and Lumber Products	New	Process	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 326.55	$ -	$ -	1.06	6.50	45.0%	50.0%
Wood and Lumber Products	New	Process	Process - Insulate Heated Process Fluids	Insulated process fluid lines	Retrofit	No insulation	Insulated process fluid lines	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	15.0%	65.0%
Wood and Lumber Products	New	Process	Process Heat Recovery	HR system installed	Retrofit	No HR system	HR system installed	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	5.0%	50.0%
Wood and Lumber Products	New	Heating	Building Automation System	Automation system installed and programmed	Retrofit	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	1	171	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.34	$ -	$ -	1.00	-	5.0%	65.0%
Wood and Lumber Products	New	Heating	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1,986	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Wood and Lumber Products	New	Process	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Wood and Lumber Products	New	Heating	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 23.11	$ 0.55	$ -	1.00	-	5.0%	50.0%
Wood and Lumber Products	New	Process	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 23.11	$ 0.55	$ -	1.00	-	5.0%	50.0%
Wood and Lumber Products	New	Miscellaneous	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 23.11	$ 0.55	$ -	1.00	-	5.0%	50.0%
Wood and Lumber Products	New	Heating	Commissioning	Optimized HVAC design and controls	Retrofit	New construction code	Optimized HVAC design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Wood and Lumber Products	New	Process	Commissioning	Optimized process design and controls	Retrofit	New construction code	Optimized process design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Wood and Lumber Products	New	Heating	Retrocommissioning	Optimized HVAC flow and controls	Retrofit	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	n/a	5	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Wood and Lumber Products	New	Process	Retrocommissioning	Optimized process design and controls	Retrofit	Vintage/existing building	Optimized process design and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	n/a	5	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Other Industrial	Existing	Heating	Insulation - Roof/Ceiling	R-38	Retrofit	R-13	R-38	Retro3Slow	2	sqft	1	97	0.16%	INS_CLG-Heating-RTF-v2.1-55	INS_CLG-Heating-RTF-v2.1-55	Building Energy Simulation Tool	45	$ 1.02	$ -	$ 0.07	1.18	0.10	60.0%	100.0%
Other Industrial	Existing	Heating	Insulation - Wall Cavity	R-21	Retrofit	R-11 or less	R-21	Retro3Slow	2	sqft	1	97	0.16%	INS_WC-Heating-RTF-v2.1-1	INS_WC-Heating-RTF-v2.1-1	Building Energy Simulation Tool	45	$ 0.31	$ -	$ 0.05	1.18	0.07	60.0%	100.0%
Other Industrial	Existing	Heating	Insulation - Ducting	50% reduction in thermal losses	Retrofit	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	1	97	0.16%	INS_DCT-All-DEER-1	INS_DCT-All-DEER-1	Building Energy Simulation Tool	20	$ 0.86	$ -	$ 0.00	1.12	0.00	40.0%	60.0%
Other Industrial	Existing	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Retrofit	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	1	97	0.16%	DCT_RPR-All-DEER-1	DCT_RPR-Cooling-RTF-1	Building Energy Simulation Tool	18	$ 0.59	$ -	$ 0.00	1.18	0.00	15.0%	50.0%
Other Industrial	Existing	Heating	Windows - High Efficiency	U-.22 or better	Retrofit	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft	1	97	0.16%	WND_HE-Heating-RTF-v2.1-46	WND_HE-Heating-RTF-v2.1-46	Building Energy Simulation Tool	45	$ 0.23	$ -	$ 0.02	1.18	0.03	45.0%	100.0%
Other Industrial	Existing	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	employee	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.00	$ -	$ -	1.06	1.95	20.0%	30.0%
Other Industrial	Existing	Process	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.00	$ -	$ -	1.06	1.27	20.0%	30.0%
Other Industrial	Existing	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.00	$ -	$ -	1.06	0.01	20.0%	30.0%
Other Industrial	Existing	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	employee	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 5.10	$ -	$ -	1.18	8.67	20.0%	45.0%
Other Industrial	Existing	Process	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 5.10	$ -	$ -	1.18	5.66	20.0%	45.0%
Other Industrial	Existing	Heating	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	employee	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 1.73	$ -	$ -	1.08	3.89	73.0%	85.0%
Other Industrial	Existing	Process	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 1.73	$ -	$ -	1.08	2.54	73.0%	85.0%
Other Industrial	Existing	Heating	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	employee	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 7.35	$ -	$ -	1.02	3.25	35.0%	50.0%
Other Industrial	Existing	Process	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 7.35	$ -	$ -	1.02	2.12	35.0%	50.0%
Other Industrial	Existing	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	employee	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 2.47	$ -	$ -	1.02	0.94	5.0%	85.0%
Other Industrial	Existing	Process	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 2.47	$ -	$ -	1.02	0.62	5.0%	85.0%
Other Industrial	Existing	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Retrofit	Constant ventilation	DCV enabled	RetroEven20	0	sqft	1	97	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.25	$ -	$ 0.02	1.18	0.02	55.0%	75.0%
Other Industrial	Existing	Heating	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	employee	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 4.17	$ -	$ -	1.18	1.44	15.0%	55.0%
Other Industrial	Existing	Process	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 4.17	$ -	$ -	1.18	0.94	15.0%	55.0%
Other Industrial	Existing	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Retrofit	None	Tube inserts installed	Retro3Slow	0	sqft	1	97	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Other Industrial	Existing	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Retrofit	None	HRV installed	RetroEven20	0	sqft	1	97	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 0.42	$ -	$ -	1.18	0.02	5.0%	10.0%
Other Industrial	Existing	Heating	Thermostat - Programmable	Programmable thermostat installed	Retrofit	Manual control	Programmable thermostat installed	RetroEven20	0	sqft	1	97	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 0.19	$ -	$ 0.02	1.04	0.03	25.0%	40.0%
Other Industrial	Existing	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Retrofit	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	1	97	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.06	1.18	0.07	5.0%	20.0%
Other Industrial	Existing	Heating	Destratification Fans (HVLS)	Fans installed	Retrofit	None/Standard ventilation	Fans installed	RetroEven20	0	sqft	1	97	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 0.67	$ -	$ 0.04	1.18	0.06	15.0%	30.0%
Other Industrial	Existing	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Retrofit	No insulation	Lines and condenstate tank insulated	RetroEven20	0	employee	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 13.02	$ -	$ -	1.06	3.66	40.0%	50.0%
Other Industrial	Existing	Process	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Retrofit	No insulation	Lines and condenstate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 13.02	$ -	$ -	1.06	2.39	40.0%	50.0%
Other Industrial	Existing	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	employee	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 24.32	$ -	$ -	1.06	2.45	40.0%	50.0%
Other Industrial	Existing	Process	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 24.32	$ -	$ -	1.06	1.60	40.0%	50.0%
Other Industrial	Existing	Process	Process - Insulate Heated Process Fluids	Insulated process fluid lines	Retrofit	No insulation	Insulated process fluid lines	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	15.0%	65.0%
Other Industrial	Existing	Process	Process Heat Recovery	HR system installed	Retrofit	No HR system	HR system installed	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	5.0%	50.0%
Other Industrial	Existing	Heating	Building Automation System	Automation system installed and programmed	Retrofit	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	1	97	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.30	$ -	$ 1.03	1.00	0.06	5.0%	65.0%
Other Industrial	Existing	Heating	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	97	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Other Industrial	Existing	Process	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Other Industrial	Existing	Heating	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 6.73	$ -	$ 42.54	1.00	2.68	5.0%	50.0%
Other Industrial	Existing	Process	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 6.73	$ -	$ 42.54	1.00	1.41	5.0%	50.0%
Other Industrial	Existing	Miscellaneous	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 6.73	$ -	$ 42.54	1.00	0.90	5.0%	50.0%
Other Industrial	Existing	Heating	Commissioning	Optimized HVAC design and controls	Retrofit	New construction code	Optimized HVAC design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Other Industrial	Existing	Process	Commissioning	Optimized process design and controls	Retrofit	New construction code	Optimized process design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Other Industrial	Existing	Heating	Retrocommissioning	Optimized HVAC flow and controls	Retrofit	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	AEG Estimate	5	$ 10.80	$ -	$ 47.61	1.04	2.69	15.0%	50.0%
Other Industrial	Existing	Process	Retrocommissioning	Optimized process design and controls	Retrofit	Vintage/existing building	Optimized process design and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	AEG Estimate	5	$ 10.80	$ -	$ 47.61	1.04	5.52	15.0%	50.0%
Other Industrial	New	Heating	Insulation - Roof/Ceiling	R-38	Retrofit	R-13	R-38	Retro3Slow	2	sqft	1	97	0.16%	INS_CLG-Heating-RTF-v2.1-55	N/A	Building Energy Simulation Tool	45	$ 1.18	$ -	$ -	1.18	-	0.0%	0.0%
Other Industrial	New	Heating	Insulation - Wall Cavity	R-21	Retrofit	R-11 or less	R-21	Retro3Slow	2	sqft	1	97	0.16%	INS_WC-Heating-RTF-v2.1-1	N/A	Building Energy Simulation Tool	45	$ 0.22	$ -	$ -	1.18	-	0.0%	0.0%
Other Industrial	New	Heating	Insulation - Ducting	50% reduction in thermal losses	Retrofit	~2°F thermal losses	50% reduction in thermal losses	Retro5Med	0	sqft	1	97	0.16%	INS_DCT-All-DEER-1	N/A	Building Energy Simulation Tool	20	$ 1.12	$ -	$ 0.00	1.12	0.00	0.0%	0.0%
Other Industrial	New	Heating	HVAC - Duct Repair and Sealing	30% reduced duct leaking	Retrofit	Poorly sealed/leaky ducts	30% reduced duct leaking	RetroEven20	0	sqft	1	97	0.16%	DCT_RPR-All-DEER-1	N/A	Building Energy Simulation Tool	18	$ -	$ -	$ 0.00	1.18	0.00	0.0%	0.0%
Other Industrial	New	Heating	Windows - High Efficiency	U-.22 or better	Retrofit	U-.5 or worse	U-.22 or better	Retro1Slow	0	sqft	1	97	0.16%	WND_HE-Heating-RTF-v2.1-46	N/A	Building Energy Simulation Tool	45	$ -	$ -	$ -	1.18	-	0.0%	0.0%
Other Industrial	New	Heating	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.00	$ -	$ -	1.06	1.85	5.0%	10.0%
Other Industrial	New	Process	Gas Boiler - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	GBLR_MNT-Heating-ILTRM-v4.0-1	3	$ 0.00	$ -	$ -	1.06	1.27	5.0%	10.0%
Other Industrial	New	Heating	Gas Furnace - Maintenance	General cleaning and maintenance	Retrofit	Degrade performance	General cleaning and maintenance	Retro20Fast	0	sqft	1	1	0.16%	GFURN_MNT-Heating-ILTRM-v4.0-1	GFURN_MNT-Heating-MNTRM-v2.1-1	GFURN_MNT-Heating-MNTRM-v2.1-1	2	$ 0.00	$ -	$ -	1.06	0.01	5.0%	10.0%
Other Industrial	New	Heating	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 4.95	$ -	$ -	1.18	8.23	20.0%	45.0%
Other Industrial	New	Process	Gas Boiler - Hot Water Reset	Reset control installed	Retrofit	No control	Reset control installed	Retro5Med	0	sqft	1	1	0.16%	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	GBLR_HWRST-Heating-ILTRM-v4.0-1	20	$ 4.95	$ -	$ -	1.18	5.66	20.0%	45.0%
Other Industrial	New	Heating	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 1.60	$ -	$ -	1.08	3.69	0.0%	0.0%
Other Industrial	New	Process	Steam Trap Maintenance	Cleaning and maintenance	Retrofit	Degrade performance	Cleaning and maintenance	RetroEven20	0	sqft	1	1	0.16%	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	GBLR_MNT_ST-Heating-XCELCO-2017-18-2	4	$ 1.60	$ -	$ -	1.08	2.54	0.0%	0.0%
Other Industrial	New	Heating	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 7.13	$ -	$ -	1.02	3.09	35.0%	50.0%
Other Industrial	New	Process	Gas Boiler - High Turndown	Turndown control installed	Retrofit	No control	Turndown control installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	GBLR_TRN-Heating-MNTRM-v2.1-1	15	$ 7.13	$ -	$ -	1.02	2.12	35.0%	50.0%
Other Industrial	New	Heating	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 2.39	$ -	$ -	1.02	0.90	5.0%	85.0%
Other Industrial	New	Process	Gas Boiler - Burner Control Optimization	Optimized burner controls	Retrofit	Average performance	Optimized burner controls	Retro3Slow	0	sqft	1	1	0.16%	GBLR_O2TRM-Heating-ILTRM-v4.0-1	GBLR_O2TRM-Heating-MEMD-2018-1	GBLR_O2TRM-Heating-ILTRM-v4.0-1	18	$ 2.39	$ -	$ -	1.02	0.62	5.0%	85.0%
Other Industrial	New	Heating	HVAC - Demand Controlled Ventilation	DCV enabled	Retrofit	Constant ventilation	DCV enabled	RetroEven20	0	sqft	1	97	0.16%	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	VENT_DCV-Heating-7PLN-v5-8	15	$ 0.16	$ -	$ 0.02	1.18	0.02	55.0%	75.0%
Other Industrial	New	Heating	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 4.04	$ -	$ -	1.18	1.37	15.0%	55.0%
Other Industrial	New	Process	Gas Boiler - Stack Economizer	Economizer installed	Retrofit	None	Economizer installed	Retro12Med	0	sqft	1	1	0.16%	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	GBLR_ECON-Heating-XCELCO-2017-18-1	12	$ 4.04	$ -	$ -	1.18	0.94	15.0%	55.0%
Other Industrial	New	Heating	Gas Furnace Tube Inserts	Tube inserts installed	Retrofit	None	Tube inserts installed	Retro3Slow	0	sqft	1	97	0.16%	N/A	N/A	N/A	5	$ 1.00	$ -	$ -	1.00	-	0.0%	0.0%
Other Industrial	New	Heating	Space Heating - Heat Recovery Ventilator	HRV installed	Retrofit	None	HRV installed	RetroEven20	0	sqft	1	97	0.16%	HRV-Heating-ILTRM-v5.0-1	HRV-Heating-ILTRM-v5.0-3	HRV-Heating-ILTRM-v5.0-3	15	$ 0.42	$ -	$ -	1.18	-	5.0%	10.0%
Other Industrial	New	Heating	Thermostat - Programmable	Programmable thermostat installed	Retrofit	Manual control	Programmable thermostat installed	RetroEven20	0	sqft	1	97	0.16%	STAT-Cooling/Heating-ILTRM-v4.0-6	STAT-Cooling/Heating-ILTRM-v4.0-6	BEST	4	$ 0.19	$ -	$ -	1.04	-	25.0%	40.0%
Other Industrial	New	Heating	Thermostat - WiFi Enabled	Wi-Fi/interactive thermostat installed	Retrofit	Manual control	Wi-Fi/interactive thermostat installed	RetroEven20	0	sqft	1	97	0.16%	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	STAT_WIFI-All-7PLN-v2-1	5	$ 0.75	$ -	$ 0.01	1.18	-	5.0%	20.0%
Other Industrial	New	Heating	Destratification Fans (HVLS)	Fans installed	Retrofit	None/Standard ventilation	Fans installed	RetroEven20	0	sqft	1	97	0.16%	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	HVLS-Heating-AEG-v5.0-121	10	$ 0.67	$ -	$ -	1.18	-	15.0%	30.0%
Other Industrial	New	Heating	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Retrofit	No insulation	Lines and condenstate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 12.63	$ -	$ -	1.06	3.47	45.0%	50.0%
Other Industrial	New	Process	Gas Boiler - Insulate Steam Lines/Condensate Tank	Lines and condenstate tank insulated	Retrofit	No insulation	Lines and condenstate tank insulated	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	GBLR_PINS_STM-Heating-PGE-R7-1	11	$ 12.63	$ -	$ -	1.06	2.39	45.0%	50.0%
Other Industrial	New	Heating	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 23.59	$ -	$ -	1.06	2.33	45.0%	50.0%
Other Industrial	New	Process	Gas Boiler - Insulate Hot Water Lines	Insulated water lines	Retrofit	No insulation	Insulated water lines	RetroEven20	0	sqft	1	1	0.16%	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	GBLR_PINS_HW-Heating-PGE-R7-1	11	$ 23.59	$ -	$ -	1.06	1.60	45.0%	50.0%
Other Industrial	New	Process	Process - Insulate Heated Process Fluids	Insulated process fluid lines	Retrofit	No insulation	Insulated process fluid lines	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	15.0%	65.0%
Other Industrial	New	Process	Process Heat Recovery	HR system installed	Retrofit	No HR system	HR system installed	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	5	$ 1.00	$ -	$ -	1.00	-	5.0%	50.0%
Other Industrial	New	Heating	Building Automation System	Automation system installed and programmed	Retrofit	No control system	Automation system installed and programmed	Retro1Slow	0	sqft	1	97	0.16%	COM_EMS-All-XCELCO-2017-18-3	BEHAV_EIS-All-CPUC-2018_PG-10	COM_EMS-All-XCELCO-2017-18-3	15	$ 0.34	$ -	$ -	1.00	-	5.0%	65.0%
Other Industrial	New	Heating	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	97	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Other Industrial	New	Process	Steam System Efficiency Improvements	Optimized system	Retrofit	Average system efficiency	Optimized system	Retro1Slow	0	sqft	1	1	0.16%	n/a	n/a	n/a	5	$ -	$ -	$ -	1.08	-	30.0%	60.0%
Other Industrial	New	Heating	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 6.73	$ 0.16	$ -	1.00	-	5.0%	50.0%
Other Industrial	New	Process	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 6.73	$ 0.16	$ -	1.00	-	5.0%	50.0%
Other Industrial	New	Miscellaneous	Strategic Energy Management	Energy management system installed and programmed	Retrofit	No energy management system	Energy management system installed and programmed	RetroEven20	0	employee	1	1	0.16%	BEHAV_SEM-All-CPUC-2018_PG-26	BEHAV_SEM-All-CPUC-2018_PG-26	AEG Research	5	$ 6.73	$ 0.16	$ -	1.00	-	5.0%	50.0%
Other Industrial	New	Heating	Commissioning	Optimized HVAC design and controls	Retrofit	New construction code	Optimized HVAC design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Other Industrial	New	Process	Commissioning	Optimized process design and controls	Retrofit	New construction code	Optimized process design and controls	Retro12Med	0	employee	1	1	0.16%	TBD	TBD	TBD	3	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Other Industrial	New	Heating	Retrocommissioning	Optimized HVAC flow and controls	Retrofit	Vintage/existing building	Optimized HVAC flow and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	n/a	5	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Other Industrial	New	Process	Retrocommissioning	Optimized process design and controls	Retrofit	Vintage/existing building	Optimized process design and controls	RetroEven20	0	employee	1	1	0.16%	COM_RCX-Heating-7PLN-v5-18	COM_RCX-Heating-7PLN-v5-18	n/a	5	$ -	$ -	$ -	1.04	-	0.0%	0.0%
Food Products	Existing	Heating	Condensing RTU	tbd	Retrofit	tbd	tbd	Retro5Med	0	employee	1	1	0.16%	tbd	tbd	tbd	1	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Food Products	New	Heating	Condensing RTU	tbd	Retrofit	tbd	tbd	Retro5Med	0	employee	1	1	0.16%	tbd	tbd	tbd	1	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Agriculture	Existing	Heating	Condensing RTU	tbd	Retrofit	tbd	tbd	Retro5Med	0	employee	1	1	0.16%	tbd	tbd	tbd	1	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Agriculture	New	Heating	Condensing RTU	tbd	Retrofit	tbd	tbd	Retro5Med	0	employee	1	1	0.16%	tbd	tbd	tbd	1	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Primary Metals	Existing	Heating	Condensing RTU	tbd	Retrofit	tbd	tbd	Retro5Med	0	employee	1	1	0.16%	tbd	tbd	tbd	1	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Primary Metals	New	Heating	Condensing RTU	tbd	Retrofit	tbd	tbd	Retro5Med	0	employee	1	1	0.16%	tbd	tbd	tbd	1	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Stone, Clay, and Glass	Existing	Heating	Condensing RTU	tbd	Retrofit	tbd	tbd	Retro5Med	0	employee	1	1	0.16%	tbd	tbd	tbd	1	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Stone, Clay, and Glass	New	Heating	Condensing RTU	tbd	Retrofit	tbd	tbd	Retro5Med	0	employee	1	1	0.16%	tbd	tbd	tbd	1	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Petroleum	Existing	Heating	Condensing RTU	tbd	Retrofit	tbd	tbd	Retro5Med	0	employee	1	1	0.16%	tbd	tbd	tbd	1	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Petroleum	New	Heating	Condensing RTU	tbd	Retrofit	tbd	tbd	Retro5Med	0	employee	1	1	0.16%	tbd	tbd	tbd	1	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Paper and Printing	Existing	Heating	Condensing RTU	tbd	Retrofit	tbd	tbd	Retro5Med	0	employee	1	1	0.16%	tbd	tbd	tbd	1	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Paper and Printing	New	Heating	Condensing RTU	tbd	Retrofit	tbd	tbd	Retro5Med	0	employee	1	1	0.16%	tbd	tbd	tbd	1	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Instruments	Existing	Heating	Condensing RTU	tbd	Retrofit	tbd	tbd	Retro5Med	0	employee	1	1	0.16%	tbd	tbd	tbd	1	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Instruments	New	Heating	Condensing RTU	tbd	Retrofit	tbd	tbd	Retro5Med	0	employee	1	1	0.16%	tbd	tbd	tbd	1	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Wood and Lumber Products	Existing	Heating	Condensing RTU	tbd	Retrofit	tbd	tbd	Retro5Med	0	employee	1	1	0.16%	tbd	tbd	tbd	1	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Wood and Lumber Products	New	Heating	Condensing RTU	tbd	Retrofit	tbd	tbd	Retro5Med	0	employee	1	1	0.16%	tbd	tbd	tbd	1	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Other Industrial	Existing	Heating	Condensing RTU	tbd	Retrofit	tbd	tbd	Retro5Med	0	employee	1	1	0.16%	tbd	tbd	tbd	1	$ -	$ -	$ -	1.00	-	0.0%	0.0%
Other Industrial	New	Heating	Condensing RTU	tbd	Retrofit	tbd	tbd	Retro5Med	0	employee	1	1	0.16%	tbd	tbd	tbd	1	$ -	$ -	$ -	1.00	-	0.0%	0.0%

AEG
Applied Energy Group

2017 CASCADE NATURAL GAS CONSERVATION POTENTIAL ASSESSMENT

Volume 1, Final Report

April 16, 2018

Report prepared for:
CASCADE NATURAL GAS CORPORATION

Energy Solutions. Delivered.

This work was performed by:

Applied Energy Group, Inc.
500 Ygnacio Valley Road, Suite 250
Walnut Creek, CA 94596

Project Director: I. Rohmund
Project Manager: K. Kolnowski
Lead Analyst: K. Walter

AEG would also like to acknowledge the valuable contributions of

Cascade Natural Gas Corporation
1600 Iowa Street
Bellingham, WA 98229

Project Team: M. Cowlishaw
K. Burin
A. Sargent
K. Crouse
J. Napolitano
S. McElhinney
R. White

EXECUTIVE SUMMARY

In the fall of 2017, Cascade Natural Gas Corporation (Cascade) contracted with Applied Energy Group (AEG) to conduct this Conservation Potential Assessment (CPA) in support of their conservation and resource planning activities. This report documents this effort and provides estimates of the potential reductions in annual energy usage for natural gas customers in the Cascade service territory from energy conservation efforts in the time period of 2018 to 2038. To produce a reliable and transparent estimate of energy efficiency (EE) resource potential, the AEG team performed the following tasks to meet Cascade's key objectives:

- Used information and data from Cascade, as well as secondary data sources, to describe how customers currently use gas by sector, segment, end use and technology.
- Developed a baseline projection of how customers are likely to use gas in absence of future EE programs. This defines the metric against which future program savings are measured. This projection used up-to-date technology data, modeling assumptions, and energy baselines that reflect both current and anticipated federal, state, and local energy efficiency legislation that will impact energy EE potential.
- Estimated the technical, achievable technical, and achievable economic potential at the measure level for energy efficiency within Cascade's service territory over the 2018 to 2038 planning horizon.
- Deliver a fully configured end-use conservation planning model, LoadMAP, for Cascade to use in future potential and resource planning initiatives

In summary, the potential study provided a solid foundation for the development of Cascade's energy savings targets. Table ES-1 summarizes the results of this study at a high level. AEG analyzed potential for the residential, commercial, and industrial market sectors. First-year utility cost test (UCT) achievable economic potential is 658 thousand therms. This increases to a cumulative total of 1,286 thousand therms in the second year and 28,932 thousand therms by the eleventh year. As part of this study, we also estimated total resource cost (TRC) potential, with the focus of fully balancing non-energy impacts. This includes the use of full measure costs as well as quantified and monetizable non-energy impacts and non-gas fuel impacts (e.g. electric cooling or wood secondary heating) consistent with methodology within the Seventh Northwest Conservation and Electric Power Plan (Seventh Plan). We have also built a framework for estimating potential under the Resource Value Test (RVT) in the event that jurisdictional goals are defined.

Table ES-1 Conservation Potential by Case, Selected Years (thousand therms)

Scenario	2018	2019	2020	2022	2028	2038
Baseline Projection (thousand therms)	253,869	256,413	259,098	264,884	282,830	319,800
Cumulative Savings (thousand therms)						
UCT Achievable Economic Potential	658	1,404	2,382	6,758	29,035	63,358
Achievable Technical Potential	1,314	2,691	4,316	10,667	39,459	75,884
Technical Potential	3,361	6,560	9,945	19,760	52,882	88,728
Cumulative Savings (% of Baseline)						
UCT Achievable Economic Potential	0.3%	0.5%	0.9%	2.6%	10.3%	19.8%
Achievable Technical Potential	0.5%	1.0%	1.7%	4.0%	14.0%	23.7%
Technical Potential	1.3%	2.6%	3.8%	7.5%	18.7%	27.7%

Key opportunities for savings include residential furnace and water heating equipment upgrades and weatherization as well as Built Green savings in later years.

CONTENTS

Executive Summary i

1 INTRODUCTION 1
Goals of the Conservation Potential Assessment 1
Summary of Report Contents 2
Abbreviations and Acronyms 4

2 ANALYSIS APPROACH AND DATA DEVELOPMENT 5
Overview of Analysis Approach 5
Comparison with Northwest Power & Conservation Council Methodology 5
Definitions of Potential 7
Market Characterization 9
Baseline Projection 10
Energy Efficiency Measure Development 11
Calculation of Energy Conservation Potential 14
Data Development 16
Data Sources 16
Application of Data to the Analysis 19

3 MARKET CHARACTERIZATION AND MARKET PROFILES 25
Overall Energy Use Summary 25
Residential Sector 26
Commercial Sector 29
Industrial Sector 32

4 BASELINE PROJECTION 35
Summary of Overall Baseline Projection 36
Residential Sector Baseline Projection 37
Commercial Sector Baseline Projection 38
Industrial Sector Baseline Projection 39

5 OVERALL ENERGY EFFICIENCY POTENTIAL 40
Summary of Overall Energy Efficiency Potential 40
Summary of Overall UCT Achievable Economic Potential 42

6 SECTOR-LEVEL ENERGY EFFICIENCY POTENTIAL 44
Residential Sector Potential 44
Commercial Sector Potential 47
Industrial Sector Potential 50

7 COMPARISON WITH CURRENT PROGRAMS AND RAMP RATE ADJUSTMENTS 53
Residential Comparison with 2017 Programs 53
Commercial and Industrial Comparison with 2017 Programs 55
Application of Electricity Ramp Rates to Natural Gas Measures 56

8 FUTURE RECOMMENDATIONS 60

Future Updates to the CPA....60
Updating Ramp Rates in Later Years....61
Incorporating the Total Resource Cost Test....62
Options for Savings Outside Standard Utility Rebate Offerings....63

LIST OF FIGURES

Figure 1-1 Cascade's Washington Service Territory (courtesy Cascade) 2
Figure 2-1 LoadMAP Analysis Framework 7
Figure 2-2 Approach for ECM Assessment 12
Figure 3-1 Sector-Level Natural Gas Use in Base Year 2016 (annual therms, percent) 25
Figure 3-2 Residential Natural Gas Use by Segment, 2016 27
Figure 3-3 Residential Natural Gas Use by End Use, 2016 27
Figure 3-4 Residential Energy Intensity by End Use and Segment, 2016 (Annual Therms/HH) 28
Figure 3-5 Commercial Natural Gas Use by Segment, 2016 30
Figure 3-6 Commercial Sector Natural Gas Use by End Use, 2016 30
Figure 3-7 Commercial Energy Usage Intensity by End Use and Segment, 2016 (Annual Therms/Sq. Ft) 31
Figure 3-8 Industrial Natural Gas Use by Segment, 2016 32
Figure 3-9 Industrial Natural Gas Use by End Use, 2016, All Industries 33
Figure 3-10 Industrial Energy Usage Intensity by End Use and Segment, 2016 (Annual Therms/Employee) 34
Figure 4-1 Baseline Projection Summary by Sector (thousand therms) 36
Figure 4-2 Residential Baseline Projection by End Use (thousand therms) 37
Figure 4-3 Commercial Baseline Projection by End Use (thousand therms) 38
Figure 4-4 Industrial Baseline Projection by End Use (thousand therms) 39
Figure 5-1 Summary of Energy Efficiency Potential as % of Baseline Projection (thousand therms) 42
Figure 5-2 Baseline Projection and Energy Efficiency Forecasts (thousand therms) 42
Figure 5-3 Cumulative UCT Achievable Economic Potential by Sector (% of Total) 43
Figure 6-1 Residential Energy Conservation by Case (thousand therms) 44
Figure 6-2 Residential UCT Achievable Economic Potential – Cumulative Savings by End Use (thousand therms, % of total) 45
Figure 6-3 Commercial Energy Conservation by Case (thousand therms) 47
Figure 6-4 Commercial UCT Achievable Economic Potential – Cumulative Savings by End Use (thousand therms, % of total) 48
Figure 6-5 Industrial Energy Conservation Potential (thousand therms) 50
Figure 6-6 Industrial UCT Achievable Economic Potential – Cumulative Savings by End Use (thousand therms, % of total) 51
Figure 7-1 Example Power Council Ramp Rates 56
Figure 7-2 Example of Ramp Rate Reassignment 57
Figure 7-3 Example of Ramp Rate Acceleration/Deceleration 58
Figure 7-4 Example of Ramp Rate Dampening 58

LIST OF TABLES

Table ES-1 Conservation Potential by Case, Selected Years (thousand therms) i
Table 1-1 Explanation of Abbreviations and Acronyms 4
Table 2-1 Overview of Cascade Analysis Segmentation Scheme 9
Table 2-2 Example Equipment Measures for Direct Fuel Furnace – Single-Family Home, Climate Zone 1 13
Table 2-3 Example Non-Equipment Measures – Existing Single Family Home, Climate Zone.14
Table 2-4 Number of Measures Evaluated 14
Table 2-5 Data Applied for the Market Profiles 20
Table 2-6 Data Applied for the Baseline Projection in LoadMAP 21
Table 2-7 Residential Natural Gas Equipment Federal Standards...22
Table 2-8 Commercial and Industrial Natural Gas Equipment Standards..............................22
Table 2-9 Data Inputs for the Measure Characteristics in LoadMAP 23
Table 3-1 Cascade Sector Control Totals, 2016 25
Table 3-2 Residential Sector Control Totals, 2016..26
Table 3-3 Average Market Profile for the Residential Sector, 2016 28
Table 3-4 Commercial Sector Control Totals, 2016 29
Table 3-5 Average Market Profile for the Commercial Sector, 2016.......................................31
Table 3-6 Industrial Sector Control Totals, 2016 32
Table 3-7 Average Natural Gas Market Profile for the Industrial Sector, 2016 34
Table 4-1 Baseline Projection Summary by Sector, Selected Years (thousand therms) 36
Table 4-2 Residential Baseline Projection by End Use (thousand therms) 37
Table 4-3 Commercial Baseline Projection by End Use (thousand therms) 38
Table 4-4 Industrial Baseline Projection by End Use (thousand therms)..................................39
Table 5-1 Summary of Energy Efficiency Potential (thousand therms) 41
Table 5-2 Cumulative UCT Achievable Economic Potential by Sector, Selected Years (thousand therms)..43
Table 6-1 Residential Energy Conservation Potential Summary (thousand therms) 44
Table 6-2 Residential Top Measures in 2018 and 2019, UCT Achievable Economic Potential (thousand therms) 46
Table 6-3 Commercial Energy Conservation Potential Summary..47
Table 6-4 Commercial Top Measures in 2018 and 2019, UCT Achievable Economic Potential (thousand therms) 49
Table 6-5 Industrial Energy Conservation Potential Summary (thousand therms) 50
Table 6-6 Industrial Top Measures in 2018 and 2019, UCT Achievable Economic Potential (thousand therms) 52
Table 7-1 Comparison of Cascade’s 2017 Residential Accomplishments with 2018 UCT Achievable Economic Potential (thousand therms) 53
Table 7-2 Comparison of Cascade’s 2017 Commercial and Industrial Accomplishments with 2018 UCT Achievable Economic Potential (thousand therms)................................55

1

INTRODUCTION

This report documents the results of the Cascade Natural Gas Corporation 2018-2037 Conservation Potential Assessment (CPA) as well as the steps followed in its completion. Throughout this study, AEG worked with Cascade to understand the baseline characteristics of their service territory, including a detailed understanding of energy consumption in the territory, the assumptions and methodologies used in Cascade's official load forecast, and recent programmatic accomplishments. Adapting methodologies consistent with the Northwest Power and Conservation Council's (Council's) Seventh Conservation and Electric Power Plan[1] for natural gas studies, AEG then developed an independent estimate of achievable, cost-effective EE potential within Cascade's service territory between 2018 and 2038.

Goals of the Conservation Potential Assessment

The first primary objective of this study was to develop independent and credible estimates of EE potential achievably available within Cascade's service territory using accepted regional inputs and methodologies. This included estimating technical, achievable technical, then achievable economic potential, using the Council's ramp rates as the starting point for all achievability assumptions, leveraging Northwest Energy Efficiency Alliance's (NEEA's) market research initiatives, and utilizing assumptions consistent with Seventh Plan supply curves and RTF measure workbooks when appropriate for use in natural gas planning studies.

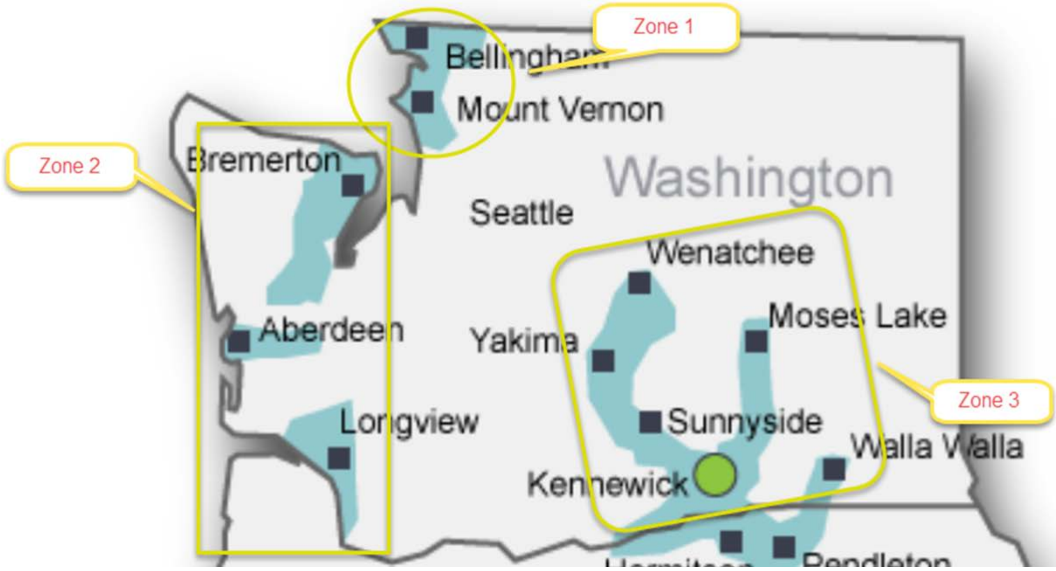
The second primary objective was to deliver a fully configured end-use model for Cascade to use in future EE planning initiatives. AEG has customized its LoadMAP end-use planning tool with data specific to Cascade's territory and the Northwest. This includes a detailed snapshot of how Cascade's customers use energy in the base year of the study, 2016, assumptions on future customer growth from Cascade's load forecasting team, and measure assumptions using Cascade primary data, regional research, and well-vetted sources from around the nation. AEG has also facilitated training sessions with the Cascade team to ensure a smooth handoff of the model.

Additionally, the CPA is intended to support the design of programs to be implemented by Cascade during the upcoming years. One output of the LoadMAP model is a comprehensive summary of measures. This summary documents input assumptions and sources on a per-unit value, program applicability and achievability (ramp rates), and potential results (units, incremental potential, and cumulative potential) as well as cost-effectiveness at the TRC, UCT, and RVT levels. This summary was developed in collaboration with Cascade and refined throughout the project.

Finally, this study was developed to provide EE inputs into Cascade's Integrated Resource Planning (IRP) process. To this end, AEG developed detailed achievable economic EE inputs by measure for input into Cascade's SENDOUT planning model. These inputs are highly customizable and provide potential estimates at the Washington-territory level, Cascade climate zone, and city-gate level. We present a map of Cascade's Washington climate zones and city gates in Figure 1-1, to summarize the terms we reference throughout this study.

[1] "Seventh Northwest Conservation and Electric Power Plan." Northwest Power & Conservation Council, February 10, 2016. http://www.nwcouncil.org/energy/powerplan/7/plan/

Figure 1-1 Cascade's Washington Service Territory (courtesy Cascade)



Summary of Report Contents

The document is divided into six additional chapters, summarizing the approach, assumptions, and results of the EE potential analysis. We describe each section below:

Volume 1, Final Report:

- **Analysis Approach and Data Development.** Detailed description of AEG's approach to conducting Cascade's 2018-2038 CPA and documentation of primary and secondary sources used.
- **Market Characterization and Market Profiles.** Characterization of Cascade's service territory in the base year of the study, 2016, including total consumption, number of customers and market units, and energy intensity. This also includes a breakdown of the energy consumption for residential, commercial, and core industrial customers by end use and technology.
- **Baseline Projection.** Projection of baseline energy consumption under a naturally occurring efficiency case, described at the end-use level. The LoadMAP models were first aligned with actual sales and Cascade's official, weather-normalized econometric forecast and then varied to include the impacts of future federal standards, ongoing impacts of the 2015 Washington State Energy Code on new construction, and future technology purchasing decisions.
- **Overall Energy Efficiency Potential.** Summary of EE potential for Cascade's entire service territory for selected years between 2018 and 2038.
- **Sector-Level Energy Efficiency Potential.** Summary of EE potential for each market sector within Cascade's service territory, including residential, commercial, core industrial customers. This section includes a more detailed breakdown of potential by measure type, vintage, market segment, end use, and Cascade climate zone in the case of residential.
- **Comparison with Current Programs and Ramp Rate Adjustments** Detailed comparison of potential with current Cascade programs, including new opportunities for potential. Also describes AEG's

recommended process for adapting the Council's Seventh Plan ramp rates for use with natural gas EE measures.

- **Recommendations:** Discussion of recommendations for future analysis or research by Cascade. Includes notes on updating the CPA in future years, refinements on primary natural gas data, adjustment of participation rates in future years, and additional options for savings outside of standard rebate offerings.

Volume 2, Appendices:

- **Alignment with the Council's Seventh Plan Methodology.** Discussion on how this study aligns with Council electric-centric methodologies, including ramp rates, regional data, and measure assumptions.
- **Data Dictionary.** Defines terms commonly used within the potential study process and LoadMAP models. This covers all phases of the potential study from market characterization through potential estimation and resource planning.
- **Resource Value Test Potential.** Preliminary estimate of EE potential using the recently released Resource Value Test rather than UCT or TRC for cost-effectiveness.
- **Market Profiles.** Detailed market profiles for each market segment. Includes equipment saturation, unit energy consumption or energy usage index, energy intensity, and total consumption.
- **Customer Adoption Factors.** Documentation of the ramp rates used in this analysis. These were adapted from the Seventh Plan electrical power conservation supply curve workbooks for use in the estimation of achievable natural gas potential.
- **Measure List.** Contained in a separate spreadsheet accompanying delivery of this report. List of measures, along with example baseline definitions and efficiency options by market sector analyzed.
- **Detailed Measure Assumptions.** Contained in a separate spreadsheet accompanying delivery of this report. This dataset provides input assumptions, measure characteristics, cost-effectiveness results, and potential estimates for each measure permutation analyzed within the study.
- **LoadMAP Process Manual.** Contained within a separate document and delivered alongside this report, the process manual is intended to serve as a guide to updating and running the LoadMAP model. It also contains recommendations on how to update key data and assumptions relevant to future planning efforts undertaken by Cascade.

Abbreviations and Acronyms

Throughout the report we use several abbreviations and acronyms. Table 1-1 shows the abbreviation or acronym, along with an explanation.

Table 1-1 Explanation of Abbreviations and Acronyms

Acronym	Explanation
AEO	Annual Energy Outlook forecast developed by EIA
B/C Ratio	Benefit to Cost Ratio
BEST	AEG's Building Energy Simulation Tool
BPA	Bonneville Power Administration
C&I	Commercial and Industrial
CBSA	NEEA's 2014 Commercial Building Stock Assessment
Council	Northwest Power and Conservation Council (NWPCC)
DHW	Domestic Hot Water
DSM	Demand Side Management
EE	Energy Efficiency
EIA	Energy Information Administration
EUL	Estimated Useful Life
EUI	Energy Usage Intensity
HVAC	Heating Ventilation and Air Conditioning
IFSA	NEEA's 2014 Industrial Facilities Site Assessment
IRP	Integrated Resource Plan
LoadMAP	AEG's Load Management Analysis and Planning™ tool
NEEA	Northwest Energy Efficiency Alliance
O&M	Operations and Maintenance
RBSA	NEEA's 2012 Residential Building Stock Assessment
RTF	Regional Technical Forum
RVT	Resource Value Test
TRC	Total Resource Cost test
UCT	Utility Cost Test
UEC	Unit Energy Consumption
UES	Unit Energy Savings
WSEC	2015 Washington State Energy Code

2

ANALYSIS APPROACH AND DATA DEVELOPMENT

This section describes the analysis approach taken for the study and the data sources used to develop the potential estimates.

Overview of Analysis Approach

To perform the potential analysis, AEG used a bottom-up approach following the major steps listed below. We describe these analysis steps in more detail throughout the remainder of this chapter.

1. Performed a market characterization to describe sector-level natural gas use for the residential, commercial, and industrial sectors for the base year, 2016. This included extensive use of Cascade data and other secondary data sources from NEEA and the Energy Information Administration (EIA).
2. Developed a baseline projection of energy consumption by sector, segment, end use, and technology for 2018 through 2038.
3. Defined and characterized several hundred EE measures to be applied to all sectors, segments, and end uses.
4. Estimated technical, achievable technical, and achievable economic energy savings at the measure level for 2018-2038. Achievable economic potential was assessed using both the UCT and TRC screens as well as preliminarily estimated using the RVT.

Comparison with Northwest Power & Conservation Council Methodology

Cascade's WA Conservation Advisory Group (CAG) strongly recommended the Council's methodology to assess potential and develop ramp rates. It is important to note the Council's methodology was developed for, and used, in electric CPAs. Natural gas impacts are typically assessed when they overlap with electricity measures (e.g. gas water heating impacts in an electrically heated "Built Green Washington" home). The Council's ramp rates were also developed with electric utility DSM programs in mind. Electricity is the primary focus of the regionwide potential assessed in the Council's Plans. For these reasons, AEG adapted Council methodologies in some cases, rather than using them directly from the source. This is especially relevant in the development of ramp rates when achievability was determined to not be applicable to a specific natural gas measure or program. We discuss this in Section 7 of this report.

A primary objective of the study was to estimate natural gas potential consistent with the Northwest Power & Conservation Council's (NWPCC) analytical methodologies and procedures for electric utilities. While developing Cascade's 2018-2038 CPA, the AEG team relied on an approach vetted and adapted through the successful completion of CPAs under the Council's Fifth, Sixth, and now Seventh Power Plans. Among other aspects, this approach involves using consistent:

- **Data sources**: regional surveys, market research, and assumptions
- **Measures and assumptions**: Seventh Plan supply curves and RTF work products
- **Potential factors**: Seventh Plan ramp rates
- **Levels of potential**: technical, achievable technical, and achievable economic

- **Cost-effectiveness approaches:** assessed potential under the UCT as well as Council's TRC method, including non-energy impacts which may be quantified and monetized and O&M impacts within the TRC
- **Conservation credits:** applied a 10% conservation credit to avoided energy costs for energy benefits

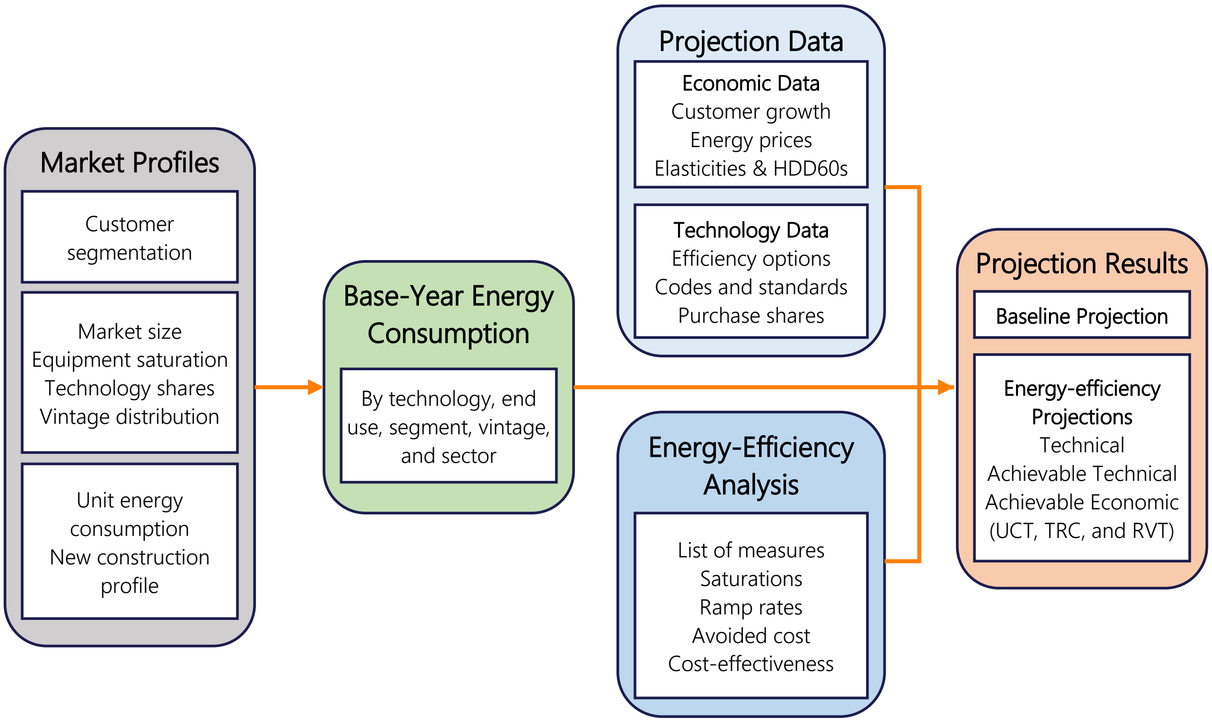
LoadMAP Model

For this analysis, AEG used its Load Management Analysis and Planning tool (LoadMAP™) version 5.0 to develop both the baseline projection and the estimates of potential. AEG developed LoadMAP in 2007 and has enhanced it over time, using it for the EPRI National Potential Study and numerous utility-specific forecasting and potential studies since. Built in Excel, the LoadMAP framework (see Figure 2-1) is both accessible and transparent and has the following key features.

- Embodies the basic principles of rigorous end-use models (such as EPRI's Residential End-Use Energy Planning System (REEPS) and Commercial End-Use Planning System (COMMEND)) but in a more simplified, accessible form.
- Includes stock-accounting algorithms that treat older, less efficient appliance/equipment stock separately from newer, more efficient equipment. Equipment is replaced according to the measure life and appliance vintage distributions defined by the user.
- Balances the competing needs of simplicity and robustness by incorporating important modeling details related to equipment saturations, efficiencies, vintage, and the like, where market data are available, and treats end uses separately to account for varying importance and availability of data resources.
- Isolates new construction from existing equipment and buildings and treats purchase decisions for new construction and existing buildings separately. This is especially relevant in the state of Washington where the 2015 WSEC substantially enhances the efficiency of the new construction market.
- Uses a simple logic for appliance and equipment decisions. Other models available for this purpose embody complex customer choice algorithms or diffusion assumptions, and the model parameters tend to be difficult to estimate or observe and sometimes produce anomalous results that require calibration or even overriding. The LoadMAP approach allows the user to drive the appliance and equipment choices year by year directly in the model. This flexible approach allows users to import the results from diffusion models or to input individual assumptions. The framework also facilitates sensitivity analysis.
- Includes appliance and equipment models customized by end use. For example, the logic for water heating is distinct from furnaces and fireplaces.
- Can accommodate various levels of segmentation. Analysis can be performed at the sector level (e.g., total residential) or for customized segments within sectors (e.g., housing type, climate zone, or income level).
- Natively outputs model results in a detailed line-by-line summary file, allowing for review of input assumptions, cost-effectiveness results, and potential estimates at a granular level. Also allows for the development of IRP supply curves, both at the achievable technical and achievable economic potential levels.

Consistent with the segmentation scheme and the market profiles we describe below, the LoadMAP model provides projections of baseline energy use by sector, segment, end use, and technology for existing and new buildings. It also provides forecasts of total energy use and energy-efficiency savings associated with the various types of potential. [2]

Figure 2-1 LoadMAP Analysis Framework



Definitions of Potential

Before we delve into the details of the analysis approach, it is important to define what we mean when discussing energy efficiency (EE) potential. In this study, the savings estimates are developed for three types of potential: technical potential, economic potential, and achievable potential. These are developed at the measure level, and results are provided as savings impacts over the 21-year forecasting horizon. The various levels are described below.

- **Technical Potential** is defined as the *theoretical* upper limit of EE potential. It assumes customers adopt all feasible measures regardless of their cost. At the time of existing equipment failure, customers replace their equipment with the most efficient option available. In new construction, customers and developers also choose the most efficient equipment option.

  Technical potential also assumes the adoption of every other available measure, where technically feasible. For example, it includes installation of high-efficiency windows in all new construction opportunities and furnace maintenance in all existing buildings with installed furnaces. These retrofit measures are phased in over a number of years to align with the stock turnover of related equipment units, rather than modeled as immediately available all at once.

[2] The model computes energy forecasts for each type of potential for each end use as an intermediate calculation. Annual-energy savings are calculated as the difference between the value in the baseline projection and the value in the potential forecast (e.g., the technical potential forecast).

- **Achievable Technical Potential** refines technical potential by applying customer participation rates that account for market barriers, customer awareness and attitudes, program maturity, and other factors that affect market penetration of conservation measures. The customer adoption rates used in this study were the ramp rates developed for the Northwest Power & Conservation Council's Seventh Plan based on the electric-utility model, tailored for use in natural gas EE programs.
- **UCT Achievable Economic Potential** further refines achievable technical potential by applying an economic cost-effectiveness screen. In this analysis, primary cost-effectiveness is measured by the utility cost test (UCT), which assesses cost-effectiveness from the utility's perspective. This test compares lifetime energy benefits to the costs of delivering the measure through a utility program, excluding monetized non-energy impacts. These costs are the incentive, as a percent of incremental cost of the given efficiency measure, relative to the relevant baseline course of action (e.g. federal standard for lost opportunity and no action for retrofits), plus any administrative costs that are incurred by the program to deliver and implement the measure. If the benefits outweigh the costs (that is, if the UCT ratio is greater than 0.9), a given measure is included in the economic potential. Note that we set the measure-level cost-effectiveness threshold at 0.9 for this analysis since Cascade is allowed to include non-cost-effective measures as long as the entire portfolio is cost effective. This is important because a portfolio considers more than just energy savings. Cascade may include popular measures that are on the cusp of cost-effectiveness, accommodate variance between climate zones, maintain a robust portfolio, or include a measure that improves customer outreach and communication.
- **TRC Achievable Economic Potential** is similar to UCT achievable economic potential in that it refines achievable technical potential through cost-effectiveness analysis. The total resource cost (TRC) test assesses cost-effectiveness from a combined utility and participant perspective. As such, this test includes full measure costs but also includes non-energy impacts realized by the customer if quantifiable and monetized. In addition to non-energy impacts, we assessed the impacts of non-gas impacts following Council methodology. This includes a calibration credit for space heating equipment consumption to account for secondary heating equipment present in an average home as well as other electric end-use impacts such as cooling and interior lighting as applicable on a measure-by-measure basis. As a secondary screen, we include TRC results for comparative purposes.
- **RVT Achievable Economic Potential** is similar to the UCT and TRC achievable economic potential but assesses cost-effectiveness from a regional perspective. The resource value test (RVT) reframes the analysis around accomplishing a jurisdiction's regional policy goals and includes hard-to-quantify impacts through quantitative or qualitative approaches. This test allows jurisdictions to define policy goals which may include additional impacts beyond the traditional utility-customer TRC approach. In May of 2017, the National Efficiency Screening Project (NESP) released a National Standard Practice Manual[3] (2017 NSPM) which details an approach for conducting screening measures under the RVT. AEG assessed preliminary estimates of potential under the RVT as part of this study, but since policy goals are defined at the regional level under this test, we are awaiting recommendations on non-energy impacts and values from the Washington Utilities and Transportation Commission (WUTC). The model has been configured to accommodate these future updates as they become available.

[3] National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources, May 18, 2017
https://nationalefficiencyscreening.org/wp-content/uploads/2017/05/NSPM_May-2017_final.pdf

Market Characterization

Now that we have described the modeling tool and provided the definitions of the potential cases, the first step in the actual analysis approach is market characterization. To estimate the savings potential from energy-efficient measures, it is necessary to understand how much energy is used today and what equipment is currently in service. This characterization begins with a segmentation of Cascade's natural gas footprint to quantify energy use by sector, segment, end-use application, and the current set of technologies in use. For this we rely primarily on information from Cascade, augmenting with secondary sources as necessary.

Segmentation for Modeling Purposes

This assessment first defined the market segments (climate zones, building types, end uses, and other dimensions) that are relevant in Cascade's service territory. The segmentation scheme for this project is presented in Table 2-1.

Table 2-1 Overview of Cascade Analysis Segmentation Scheme

Dimension	Segmentation Variable	Description
1	Sector	Residential, Commercial, Industrial (core customers only)
2	Segment	Residential: Climate Zones 1 through 3 Single Family, Climate Zones 1 through 3 Multifamily Commercial: Office, Retail, Restaurant, Grocery, Education, Healthcare, Lodging, Warehouse, Miscellaneous Industrial: Food Products, Agriculture, Primary Metals, Stone Clay & Glass, Petroleum, Paper & Printing, Instruments, Wood & Lumber Products, Other Industrial
3	Vintage	Existing and new construction
4	End uses	Heating, secondary heating, water heating, food preparation, process, and miscellaneous (as appropriate by sector)
5	Appliances/end uses and technologies	Technologies such as furnaces, water heaters, and process heating by application, etc.
6	Equipment efficiency levels for new purchases	Baseline and higher-efficiency options as appropriate for each technology

With the segmentation scheme defined, we then performed a high-level market characterization of natural gas sales in the base year, 2016. We used detailed Cascade billing and customer data with minimal augmentation from secondary sources to allocate energy use and customers to the various sectors and segments such that the total customer count and energy consumption matched Cascade's system totals in 2016. This information provided control totals at a sector level for calibrating the LoadMAP model to known data for the base-year. Please note that due to a very low number of mobile homes with natural gas service in Cascade's territory, as identified from billing data and supported by the 2011 RBSA, we included consumption for these dwellings within the single-family market segment.

Market Profiles

The next step was to develop market profiles for each sector, customer segment, end use, and technology. A market profile includes the following elements:

- **Market size** is a representation of the number of customers in the segment. For the residential sector, the unit we use is number of households. In the commercial sector, it is floor space measured in square feet. For the industrial sector, it is number of employees.
- **Saturations** indicate the share of the market that is served by a particular end-use technology. Three types of saturation definitions are commonly used:
  - The conditioned space approach accounts for the fraction of each building that is conditioned by the end use. This applies to cooling and heating end uses.
  - The whole-building approach measures shares of space in a building with an end use regardless of the portion of each building that is served by the end use. Examples are commercial refrigeration and food service, and domestic water heating and appliances.
  - The 100% saturation approach applies to end uses that are generally present in every building or home and are simply set to 100% in the base year.
- **UEC (Unit Energy Consumption) or EUI (Energy Usage Index)** define consumption for a given technology. UEC represents the amount of energy a given piece of equipment is expected to use in one year. EUI is a UEC indexed to a non-building market unit, such as per square foot or per employee)
  - These are indices that refer to a measure of average annual energy use per market unit (home, floor space, or employee in the residential, commercial, and industrial sector, respectively) that are served by an end-use technology. UECs and EUIs embody an average level of service and average equipment efficiency for the market segment.
- **Annual energy intensity** for the residential sector represents the average energy use for the technology across all homes in 2016. It is computed as the product of the saturation and the UEC and is defined as therms/household for natural gas. For the commercial and industrial sectors, intensity, computed as the product of the saturation and the EUI, represents the average use for the technology across all floor space or all employees in the base year.
- **Annual usage** is the annual energy used by each end-use technology in the segment. It is the product of the market size and intensity and is quantified in therms or thousand therms.

The market characterization results and the market profiles are presented in Section 3 and Appendix D.

Baseline Projection

The next step was to develop the baseline projection of annual natural gas use for 2017 through 2038 by customer segment and end use in the absence of new utility energy efficiency programs.

We first aligned with Cascade's official forecast. AEG worked with Cascade's load forecasting group to incorporate assumptions and data utilized in the official utility forecast. Cascade's heating degree days (base 60°F) were incorporated into the LoadMAP model to align the baseline projection with the official utility forecast. We also calibrated to 2017 actual sales and will provide Cascade with an approach for calibrating to actual sales in future years once data becomes available.

The end-use projection includes impacts of future federal standards that were effective as of December 2017, which drive energy consumption down through the study period.

Naturally occurring energy conservation, that is, energy conservation that is realized within the service area independent of utility-sponsored programs, is incorporated into the baseline projection consistent with the US Energy Information Administration's Annual Energy Outlook for the Pacific region. Results of the primary market research were used to calibrate these assumptions to ensure the secondary sources were relevant to Cascade customers. For example, some customers will purchase and install energy conservation measures that are available in the market without a utility incentive. Please note this is not the "Frozen Efficiency" case defined by the Council, which is used for comparison with electricity savings from the Seventh Plan. After discussions with the Cascade team and review of the load forecast, AEG determined that a naturally occurring baseline is appropriate and would align better with the official forecast, whose econometric approach includes impacts of naturally occurring efficiency embedded within natural gas sales for the last few years.

As such, the baseline projection is the foundation for the analysis of savings in future conservation cases and scenarios as well as the metric against which potential savings are measured.

Inputs to the baseline projection include:

- Current economic growth forecasts (i.e., customer growth, changes in weather (Heating Degree Day, base-60°F (HDD60) normalization))
- Trends in fuel shares and equipment saturations
- Existing and approved changes to building codes and equipment standards

We present the baseline projection results for the system as a whole, and for each sector in Section 4.

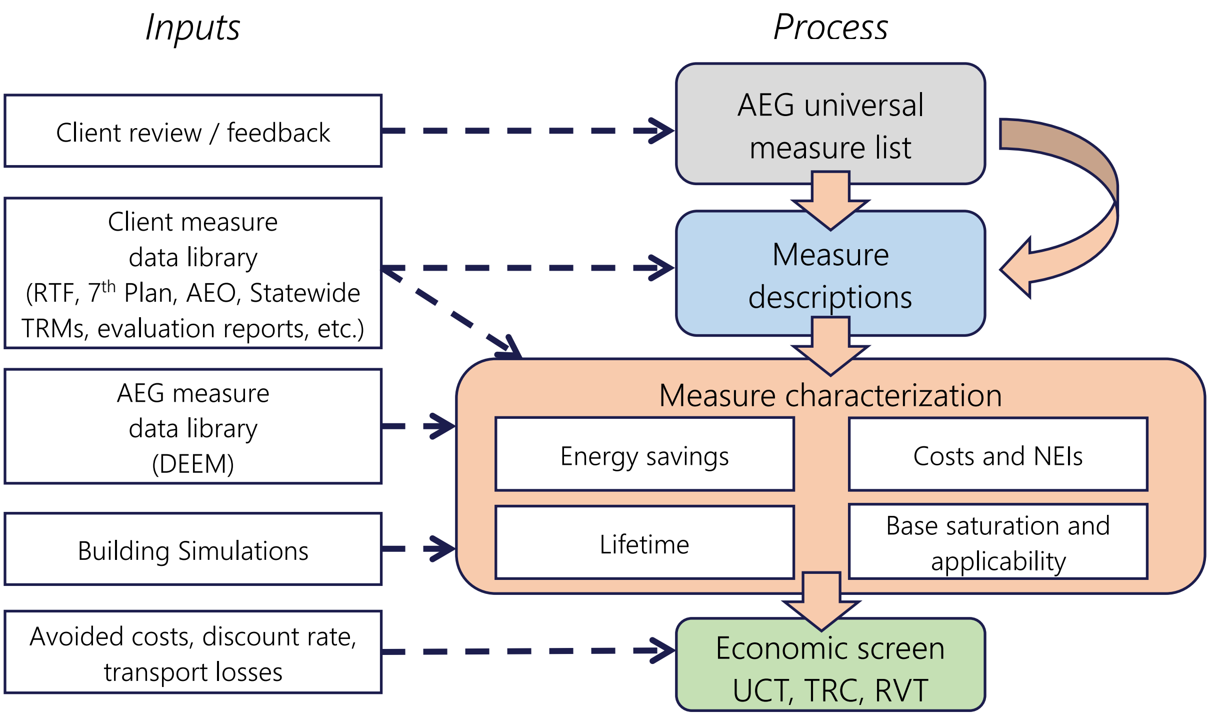
Energy Efficiency Measure Development

This section describes the framework used to assess the savings, costs, and other attributes of energy efficiency measures. These characteristics form the basis for measure-level cost-effectiveness analyses as well as for determining measure-level savings. For all measures, AEG assembled information to reflect equipment performance, incremental costs, and equipment lifetimes. This information combined with Cascade's avoided cost data informs the economic screens that determine economically feasible measures. In this section, AEG would like to acknowledge the work of the Cascade team in analyzing actual implementation data to provide territory-specific costs for many of the measures assessed within this CPA.

Figure 2-2 outlines the framework for measure characterization analysis. First, the list of measures is identified; each measure is then assigned an applicability for each market sector and segment and characterized with appropriate savings, costs and other attributes; then the cost-effectiveness screening is performed. Cascade provided feedback during each step of the process to ensure measure assumptions and results lined up with programmatic experience.

We compiled a robust list of conservation measures for each customer sector, drawing upon Cascade's program experience, AEG's own measure databases and building simulation models, and secondary sources, primarily the Regional Technical Forum's (RTF) UES measure workbooks and the Seventh Plan's electric power conservation supply curves. This universal list of measures covers all major types of end-use equipment, as well as devices and actions to reduce energy consumption.

Figure 2-2 Approach for ECM Assessment



The selected measures are categorized into two types according to the LoadMAP modeling taxonomy: equipment measures and non-equipment measures.

- **Equipment measures** are efficient energy-consuming pieces of equipment that save energy by providing the same service with a lower energy requirement than a standard unit. An example is an ENERGY STAR® residential water heater (UEF 0.64) that replaces a standard efficiency water heater (UEF 0.58). For equipment measures, many efficiency levels may be available for a given technology, ranging from the baseline unit (often determined by a code or standard) up to the most efficient product commercially available. These measures are applied on a stock-turnover basis, and in general, are referred to as lost opportunity (LO) measures by the Council because once a purchase decision is made, there will not be another opportunity to improve the efficiency of that equipment item until its end of useful life (EUL) is reached once again.
- **Non-equipment measures** save energy by reducing the need for delivered energy, but do not involve replacement or purchase of major end-use equipment (such as a furnace or water heater). Measure installation is not tied to a piece of equipment reaching end of useful life, so these are generally categorized as "retrofit" measures. An example would be low-flow showerheads that modify a household's hot water consumption. The existing showerheads can be achievably replaced without waiting for the existing showerhead to malfunction, and saves energy used by the water heating equipment. Non-equipment measures typically fall into one of the following categories:
    - Building shell (windows, insulation, roofing material)
    - Equipment controls (smart thermostats, water heater setback)
    - Whole-building design (Built Green homes)

- Retrocommissioning

We developed a preliminary list of efficient measures, which was distributed to Cascade's project team for review as well as Cascade's nonresidential implementer, Lockheed Martin. The list was also provided to the CAG for review. Once we assembled the list of measures, the AEG team assessed their energy-saving characteristics. For each measure, we also characterized incremental cost, service life, non-energy impacts, and other performance factors. Following the measure characterization, we performed an economic screening of each measure, which serves as the basis for developing the economic and achievable potential scenarios.

Representative Measure Data Inputs

To provide an example of measure data, Table 2-2 and Table 2-3 present examples of the detailed data inputs behind both equipment and non-equipment measures, respectively, for the case of residential direct-fuel furnaces in single-family homes in Climate Zone 1. Table 2-2 displays the various efficiency levels available as equipment measures, as well as the corresponding effective useful life, energy usage, and cost estimates. The columns labeled "On Market" and "Off Market" reflect equipment availability due to codes and standards or the entry of new products to the market.

Table 2-2 Example Equipment Measures for Direct Fuel Furnace – Single-Family Home, Climate Zone 1

Efficiency Level	Useful Life (years)	Equipment Cost	Energy Usage (therms/yr)	On Market	Off Market
AFUE 80%	18	$3,288	579	2016	2023
AFUE 90%	18	$3,451	520	2016	2023
AFUE 92%	18	$3,510	508	2016	n/a
AFUE 95%	18	$4,776	490	2016	n/a
AFUE 98%	18	$6,220	474	2016	n/a
Convert to NG Heat Pump	21	$11,507	415	2016	n/a

Table 2-3 lists some of the non-equipment measures applicable to a direct-fuel furnace in an existing single-family home. All measures are evaluated for cost effectiveness based on the lifetime benefits relative to the cost of the measure. The total savings, costs, and monetized non-energy impacts are calculated for each year of the study and depend on the base year saturation of the measure, the applicability of the measure, and the savings as a percentage of the relevant energy end uses. We model two flavors of most shell insulations measures. The first is the installation of insulation where there is none (or very little). This applies to a small subset of the population (roughly 6% of the population is eligible for this measure per RBSA 2011) but has large savings impacts. This percentage is low due to the impacts of current Cascade programs, strict Washington building codes, and naturally occurring efficiency. The second is an insulation upgrade measure where homes with existing insulation below the threshold but not classified as no insulation, may be upgraded to higher R-values. This applies to a much larger percentage of the market.

Table 2-3 Example Non-Equipment Measures – Existing Single Family Home, Climate Zone[4]

End Use	Measure	Saturation in 2016[5]	Applicability	Lifetime (yrs)	Measure Installed Cost	Energy Savings (%)
Heating	Insulation - Ceiling Installation	0%	6%	45	$1,739	29.9%
Heating	Insulation – Ceiling Upgrade	20%	88%	45	$1,739	7.6%
Heating	Ducting Repair and Sealing	15%	50%	20	$794	5.5%
Heating	Windows - High Efficiency/ENERGY STAR	89%	100%	45	$4,689	25.3%

Table 2-4 summarizes the number of measures evaluated for each segment within each sector.

Table 2-4 Number of Measures Evaluated

Sector	Total Measures	Measure Permutations w/ 2 Vintages	Measure Permutations w/ All Segments
Residential	44	88	792
Commercial	53	106	954
Industrial	43	86	774
Total Measures Evaluated	**140**	**280**	**2,520**

Calculation of Energy Conservation Potential

The approach we used for this study to calculate the energy conservation potential adheres to the approaches and conventions outlined in the National Action Plan for Energy-Efficiency (NAPEE) Guide for Conducting Potential Studies.[6] This document represents credible and comprehensive industry best practices for specifying energy conservation potential. Three types of potential were developed as part of this effort: technical potential, achievable technical potential, and achievable economic potential (using UCT, TRC, and RVT). The calculation of technical potential is a straightforward algorithm which, as described above, assumes that customers adopt all feasible measures regardless of their cost.

Stacking of Measures and Interactive Effects

An important factor when estimating potential is to consider interactions between measures when they are applied within the same space. This is important to avoid double counting and could feasibly result in savings at greater than 100% of equipment consumption if not properly accounted for.

This occurs at the population or system level, where multiple DSM actions must be stacked or layered on top of each other in succession, rather than simply summed arithmetically. These interactions are automatically handled within the LoadMAP models where measure impacts are stacked on top of each other, modifying the baseline for each subsequent measure. We first compute the total savings of each measure on a standalone basis, then also assign a stacking priority, based on levelized cost, to the

[4] The applicability factors consider whether the measure is applicable to a particular building type and whether it is feasible to install the measure. For instance, duct repair and sealing is not applicable to homes with zonal heating systems since there is no ductwork present to repair.

[5] Note that saturation levels reflected increase from their base year saturation as more measures are adopted.

[6] National Action Plan for Energy Efficiency (2007). *National Action Plan for Energy Efficiency Vision for 2025: Developing a Framework for Change*. www.epa.gov/eeactionplan.

measures such that "integrated" or "stacked" savings will be calculated as a percent reduction to the running total of baseline energy remaining in each end use after the previous measures have been applied. This ensures that the available pie of baseline energy shrinks in proportion to the number of DSM measures applied, as it would in reality. The loading order is based on the levelized cost of conserved energy, such that the more economical measures that are more likely to be selected from a resource planning perspective will be the first to be applied to the modeled population.

We also account for exclusivity of certain measure options when defining measure assumptions. For instance, if an AFUE 95% furnace is installed in a single-family home, the model will not allow that same home to install an AFUE 98% furnace, or any other furnace, until the newly installed AFUE 95% option has reached its end of useful life. For non-equipment measures, which do not have a native applicability limit, we define base saturations and applicabilities such that measures do not overlap. For example, we model two flavors of ceiling insulation. The first assumes the installation of insulation where there previously was none. The second upgrades pre-existing insulation if it falls under a certain threshold. We used regional market research data to ensure exclusivity of these two options. NEEA's 2014 RBSA contains information on average R-values of insulation installed. The AEG team used this data to define the percent of homes that could install one measure, but not the other.

Estimating Customer Adoption

Once the technical potential is established, estimates for the market adoption rates for each measure are applied that specify the percentage of customers that will select the highest–efficiency economic option. This phases potential in over a more realistic time frame that considers barriers such as imperfect information, supplier constraints, technology availability, and individual customer preferences. The intent of market adoption rates is to establish a path to full market maturity for each measure or technology group and ensure resource planning does not overstep acquisition capabilities. We adapted the Northwest Power and Conservation Council's Seventh Plan ramp rates to develop these achievability factors for each measure. Applying these ramp rates as factors leads directly to the achievable technical potential. More details on this process can be found in Section 7.

Screening Measures for Cost-Effectiveness

With achievable technical potential established, the final step is to apply an economic screen and arrive at the subset of measures that are cost-effective and ultimately included in achievable economic potential.

LoadMAP performs an economic screen for each individual measure in each year of the planning horizon. This study uses the UCT test as the primary cost-effectiveness metric, which compares the lifetime hourly energy benefits of each applicable measure with the incentive and administrative costs incurred by the utility. The lifetime benefits are calculated by multiplying the annual energy savings for each measure by Cascade's avoided costs and discounting the dollar savings to the present value equivalent. Lifetime costs represent incremental measure cost. The analysis uses each measure's values for savings, costs, and lifetimes that were developed as part of the measure characterization process described above.

The LoadMAP model performs this screening dynamically, considering changing savings and cost data over time. Thus, some measures pass the economic screen for some, but not all, of the years in the forecast.

It is important to note the following about the economic screen:

- The economic evaluation of every measure in the screen is conducted relative to a baseline condition. For instance, in order to determine the therm savings potential of a measure, consumption with the measure applied must be compared to the consumption of a baseline condition.

- The economic screening was conducted only for measures that are applicable to each building type and vintage; thus, if a measure is deemed to be irrelevant to a building type and vintage, it is excluded from the respective economic screen.

This constitutes the achievable economic potential and includes every program-ready opportunity for conservation savings. Potential results are presented in Chapters 4 and 5. Measure-level detail is available as a separate appendix to this report.

Data Development

This section details the data sources used in this study, followed by a discussion of how these sources were applied. In general, data were adapted to local conditions, for example, by using local sources for measure data and local weather for building simulations.

Data Sources

The data sources are organized into the following categories:

- Cascade-provided data
- AEG's databases and analysis tools
- Other secondary data and reports

Cascade Data

Our highest priority data sources for this study were those that were specific to Cascade, including the primary market research conducted specifically for this study. This data is specific to Cascade's service territory and is an important consideration when customizing the model for Cascade's market. This is best practice when developing CPA baselines when the data is available.

- **Cascade customer account database.** Cascade provided billing data for development of customer counts and energy use for each sector. This included a very detailed database of customer building classifications which was instrumental in the development of segmentation. This also included equipment flags, identifying the presence of a substantial number of gas-consuming technologies. This data was very useful in developing a detailed estimate of energy consumption within Cascade's service territory.
- **Load forecasts.** Cascade provided forecasts, by sector and climate zone, of energy consumption, customer counts, weather actuals for 2016 and 2017, as well as weather-normal HDD60s.
- **Economic information.** Cascade provided a discount rate as well as avoided cost forecasts and transportation loss factors.
- **Cascade program data.** Cascade provided information about past and current programs, including program descriptions, goals, and measure achievements to date. Cascade also provided a comprehensive list of measure costs, developed from measure installations within actual Cascade conservation programs as per guidance they received from a previous third-party program evaluation.

Northwest Regional Data

The study utilized a variety of local data and research, including research performed by the Northwest Energy Efficiency Alliance (NEEA) and analyses conducted by the Council. Most important among these are:

- **Northwest Power and Conservation Council Seventh Plan and Regional Technical Forum workbooks.** To develop its Power Plan, the Council maintains workbooks with detailed information about measures. This was used as a primary data source when Cascade-specific program data was not available, and the data was determined to be applicable to natural gas conservation measures. The most recent data and workbooks available were used at the time of this study.
- **Northwest Energy Efficiency Alliance, 2011 Residential Building Stock Assessment Single-Family**, Market Research Report, http://neea.org/docs/reports/residential-building-stock-assessment-single-family-characteristics-and-energy-use.pdf?sfvrsn=8
- **Northwest Energy Efficiency Alliance, 2011 Residential Building Stock Assessment: Manufactured Home**, Market Research Report, #E13-249, January 2013. http://neea.org/docs/default-source/reports/residential-building-stock-assessment--manufactured-homes-characteristics-and-energy-use.pdf?sfvrsn=8
- **Northwest Energy Efficiency Alliance, 2011 Residential Building Stock Assessment: Multifamily**, Market Research Report, #13-263, September 2013. http://neea.org/docs/default-source/reports/residential-building-stock-assessment--multi-family-characteristics-and-energy-use.pdf?sfvrsn=4
- **Northwest Energy Efficiency Alliance, 2014 Commercial Building Stock Assessment**, December 16, 2014, http://neea.org/docs/default-source/reports/2014-cbsa-final-report_05-dec-2014.pdf?sfvrsn=12.
- **Northwest Energy Efficiency Alliance, 2014 Industrial Facilities Site Assessment,** December 29, 2014, http://neea.org/resource-center/regional-data-resources/industrial-facilities-site-assessment

Since Cascade's billing data included information on appliance saturations at the customer-level, the NEEA surveys were used more for benchmarking and comparative purposes, rather than as a primary source of data. The NEEA surveys were used extensively to develop base saturation and applicability assumptions for many of the non-equipment measures within the study. It is worth noting that NEEA's 2016 RBSA was released during the drafting of this report, following conclusion of analysis. This survey incorporates new market trends and building characteristics and is expected to be a useful source of measure baseline saturations when updating this CPA.

AEG Data

AEG maintains several databases and modeling tools that we use for forecasting and potential studies. Relevant data from these tools has been incorporated into the analysis and deliverables for this study.

- **AEG Energy Market Profiles.** For more than 10 years, AEG staff has maintained profiles of end-use consumption for the residential, commercial, and industrial sectors. These profiles include market size, fuel shares, unit consumption estimates, and annual energy use by fuel (natural gas and electricity), customer segment and end use for 10 regions in the U.S. The Energy Information

Administration surveys (RECS, CBECS and MECS) as well as state-level statistics and local customer research provide the foundation for these regional profiles.

- **Building Energy Simulation Tool (BEST)**. AEG's BEST is a derivative of the DOE 2.2 building simulation model, used to estimate base-year UECs and EUIs, as well as measure savings for the HVAC-related measures.
- **AEG's Database of Energy Conservation Measures (DEEM).** AEG maintains an extensive database of measure data for our studies. Our database draws upon reliable sources including the California Database for Energy Efficient Resources (DEER), the EIA Technology Forecast Updates – Residential and Commercial Building Technologies – Reference Case, RS Means cost data, and Grainger Catalog Cost data.
- **Recent studies**. AEG has conducted more than 60 studies of EE potential in the last five years. We checked our input assumptions and analysis results against the results from these other studies, both within the region and across the country.

Other Secondary Data and Reports

Finally, a variety of secondary data sources and reports were used for this study. The main sources are identified below.

- **Annual Energy Outlook**. The Annual Energy Outlook (AEO), conducted each year by the U.S. Energy Information Administration (EIA), presents yearly projections and analysis of energy topics. For this study, we used data from the 2016 and 2017 AEO.
- **American Community Survey.** The US Census American Community Survey is an ongoing survey that provides data every year on household characteristics. http://www.census.gov/acs/www/
- **Local Weather Data**. Weather from NOAA's National Climatic Data Center for Bellingham (Cascade climate zone 1), Bremerton (Cascade climate zone 2), and Yakima (Cascade climate zone 3) were used where applicable. For the commercial and industrial sectors, where analysis was not done at the climate zone-level, we used a weighted average of the three weather stations based on Cascade's billing data within each zone.
- **EPRI End-Use Models (REEPS and COMMEND)**. These models provide the energy-use elasticities we apply to prices, household income, home size, heating, and cooling.
- **Database for Energy Efficient Resources (DEER).** The California Energy Commission and California Public Utilities Commission (CPUC) sponsor this database, which is designed to provide well-documented estimates of energy and peak demand savings values, measure costs, and effective useful life (EUL) for the state of California. We used the DEER database to cross check the measure savings we developed using BEST and DEEM.
- **Other relevant resources:** These include reports from the Consortium for Energy Efficiency, the EPA, and the American Council for an Energy-Efficient Economy. This also includes technical reference manuals (TRMs) from other states. When using data from outside the region, especially weather-sensitive data, AEG adapted assumptions for use within Cascade's territory.

Application of Data to the Analysis

We now discuss how the data sources described above were used for each step of the study.

Data Application for Market Characterization

To construct the high-level market characterization of natural gas consumption and market size units (households for residential, floor space for commercial, and employees for industrial), we primarily used Cascade's billing data as well as secondary data from AEG's Energy Market Profiles database.

Data Application for Market Profiles

The specific data elements for the market profiles, together with the key data sources, are shown in Table 2-5. To develop the market profiles for each segment, we used the following approach:

1. Develop control totals for each segment. These include market size, segment-level annual natural gas use, and annual intensity. Control totals were based on Cascade's actual sales and customer-level information found in Cascade's customer billing database.
2. Develop existing appliance saturations and the energy characteristics of appliances, equipment, and buildings using equipment flags within Cascade's billing data, NEEA's 2011 RBSA, 2014 CBSA, and 2014 IFSA, DOE's 2009 RECS, the 2016 and 2017 editions of the Annual Energy Outlook, AEG's Energy Market Profile (EMP) for the Pacific region, and the American Housing Survey.
3. Ensure calibration to Cascade control totals for annual natural gas sales in each sector and segment.
4. Compare and cross-check with other recent AEG studies.
5. Work with Cascade staff to verify the data aligns with their knowledge and experience.

Table 2-5 Data Applied for the Market Profiles

Model Inputs	Description	Key Sources
Market size	Base-year residential dwellings, commercial floor space, and industrial employment	Cascade 2016 actual sales Cascade customer account database
Annual intensity	Residential: Annual use per household Commercial: Annual use per square foot Industrial: Annual use per employee	Cascade customer account database AEG's Energy Market Profiles AEO 2016 – Pacific Region Other recent studies
Appliance/equipment saturations	Fraction of dwellings with an appliance/technology Percentage of C&I floor space/employment with equipment/technology	Cascade equipment flags in customer account database 2011 RBSA, 2014 CBSA and IFSA 2014 American Community Survey AEG's Energy Market Profiles
UEC/EUI for each end-use technology	UEC: Annual natural gas use in homes and buildings that have the technology EUI: Annual natural gas use per square foot/employee for a technology in floor space that has the technology	HVAC uses: BEST simulations using prototypes developed for Cascade Engineering analysis AEG DEEM AEO 2016 – Pacific Region Recent AEG studies
Appliance/equipment age distribution	Age distribution for each technology	2011 RBSA, 2014 CBSA, and recent AEG studies
Efficiency options for each technology	List of available efficiency options and annual energy use for each technology	Cascade current program offerings AEG DEEM AEO 2015 through AEO 2017 CA DEER Recent AEG studies

Data Application for Baseline Projection

Table 2-6 summarizes the LoadMAP model inputs required for the baseline projection. These inputs are required for each segment within each sector, as well as for new construction and existing dwellings/buildings.

Table 2-6 Data Applied for the Baseline Projection in LoadMAP

Model Inputs	Description	Key Sources
Customer growth forecasts	Forecasts of new construction in residential and C&I sectors	Cascade load forecast
Equipment purchase shares for baseline projection	For each equipment/technology, purchase shares for each efficiency level; specified separately for existing equipment replacement and new construction	Shipments data from AEO and ENERGY STAR AEO 2017 regional forecast assumptions[7] Appliance/efficiency standards analysis
Utilization model parameters	Price elasticities, elasticities for other variables (income, weather)	EPRI's REEPS and COMMEND models

In addition, assumptions were incorporated for known future equipment standards as of December 2017, as shown in Table 2-7 and Table 2-8. The assumptions tables here extend through 2025, after which all standards are assumed to hold steady.

[7] We developed baseline purchase decisions using the Energy Information Agency's *Annual Energy Outlook* report (2017), which utilizes the National Energy Modeling System (NEMS) to produce a self-consistent supply and demand economic model. We calibrated equipment purchase options to match distributions/allocations of efficiency levels to manufacturer shipment data for recent years.

Table 2-7 Residential Natural Gas Equipment Federal Standards[8]

End Use	Technology	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Space Heating	Furnace – Direct Fuel	AFUE 80%								AFUE 92%*	
	Boiler – Direct Fuel	AFUE 82%					AFUE 84%				
Secondary Heating	Fireplace	N/A									
Water Heating	Water Heater <= 55 gal.	UEF 0.58									
	Water Heater > 55 gal.	UEF 0.76									
Appliances	Clothes Dryer	CEF 3.30									
	Stove/Oven	N/A									
Miscellaneous	Pool Heater	TE 0.82									
	Miscellaneous	N/A									

* This code was originally set to take effect in 2021 but exempts smaller systems. The comment period was also extended into 2017 and the standard will not take effect until at least 5 years after that has concluded. As a result, we modeled this standard coming online officially in 2024.

Table 2-8 Commercial and Industrial Natural Gas Equipment Standards

End Use	Technology	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Cooling	Furnace	AFUE 80% / TE 0.80									
	Boiler	Average around AFUE 80% / TE 0.80 (varies by size)									
	Unit Heater	Standard (intermittent ignition and power venting or automatic flue damper)									
Water Heater	Water Heating	TE 0.80									

[8] The assumptions tables here extend through 2025, after which all standards are assumed to hold steady.

Energy Conservation Measure Data Application

Table 2-9 details the energy-efficiency data inputs to the LoadMAP model. It describes each input and identifies the key sources used in the Cascade analysis.

Table 2-9 Data Inputs for the Measure Characteristics in LoadMAP

Model Inputs	Description	Key Sources
Energy Impacts	The annual reduction in consumption attributable to each specific measure. Savings were developed as a percentage of the energy end use that the measure affects.	Cascade program data NWPCC workbooks, RTF AEG BEST AEG DEEM AEO 2017 CA DEER Other secondary sources
Costs	Equipment Measures: Includes the full cost of purchasing and installing the equipment on a per-household, per-square-foot, or per employee basis for the residential, commercial, and industrial sectors, respectively. Non-Equipment Measures: Existing buildings – full installed cost. New Construction - the costs may be either the full cost of the measure, or as appropriate, it may be the incremental cost of upgrading from a standard level to a higher efficiency level.	Cascade program data NWPCC workbooks, RTF AEG DEEM AEO 2017 CA DEER RS Means Other secondary sources
Measure Lifetimes	Estimates derived from the technical data and secondary data sources that support the measure demand and energy savings analysis.	NWPCC workbooks, RTF AEG DEEM AEO 2017 CA DEER Other secondary sources
Applicability	Estimate of the percentage of dwellings in the residential sector, square feet in the commercial sector, or employees in the industrial sector where the measure is applicable and where it is technically feasible to implement.	2011 RBSA, 2014 CBSA 2015 WSEC for limitations on new construction AEG DEEM CA DEER Other secondary sources
On Market and Off Market Availability	Expressed as years for equipment measures to reflect when the equipment technology is available or no longer available in the market.	AEG appliance standards and building codes analysis

Data Application for Cost-effectiveness Screening

To perform the cost-effectiveness screening, a number of economic assumptions were needed. All cost and benefit values were analyzed as real dollars, converted from nominal provided by Cascade. We applied Cascade's long-term discount rate of 3.52% excluding inflation. This rate was based off the average 30-year mortgage value rather than weighted average cost of capital (WACC) to maintain consistency with the IRP. LoadMAP is configured to vary this by market sector (e.g. residential and commercial) if Cascade develops alternative values in the future. All impacts in this report are presented at the customer meter, but transportation losses were provided by Cascade and were included for cost-effectiveness screening.

Estimates of Customer Adoption

To estimate the timing and rate of customer adoption in the potential forecasts, two sets of parameters are needed:

- Technical diffusion curves for non-equipment measures. Equipment measures are installed when existing units fail. Non-equipment measures do not have this natural periodicity, so rather than installing all available non-equipment measures in the first year of the projection (instantaneous potential), they are phased in according to adoption schedules that generally align with the diffusion of similar equipment measures. For this analysis, we used the Council's retrofit ramp rates, "Retro", applied before the 85% achievability adjustment.
- Customer adoption rates, also referred to as take rates or ramp rates, are applied to measures on a year by year basis. These rates represent customer adoption of measures when delivered through a best-practice portfolio of well-operated efficiency programs under a reasonable policy or regulatory framework. Information channels are assumed to be established and efficient for marketing, educating consumers, and coordinating with trade allies and delivery partners. The primary barrier to adoption reflected in this case is customer preferences. Again, these are based on the ramp rates from the Northwest Power and Conservation Council's Seventh Plan.

The ramp rates referenced above were adapted for use for assessing natural gas measure potential. We describe this process in Section 7. The customer adoption rates used in this study are available in Appendix E.

3

MARKET CHARACTERIZATION AND MARKET PROFILES

In this section, we describe how customers in the Cascade service territory use natural gas in the base year of the study, 2016. It begins with a high-level summary of energy use across all sectors and then delves into each sector in more detail.

Overall Energy Use Summary

Total natural gas consumption for all sectors for Cascade in 2016 was 207,445 thousand therms. As shown in Figure 3-1 and Table 3-1, the residential sector accounts for the largest share of annual energy use at 51.5%, followed by the commercial sector at 38.7%. Core customers within the industrial sector (non-transport) account for 9.8% of usage.

Figure 3-1 Sector-Level Natural Gas Use in Base Year 2016 (annual therms, percent)

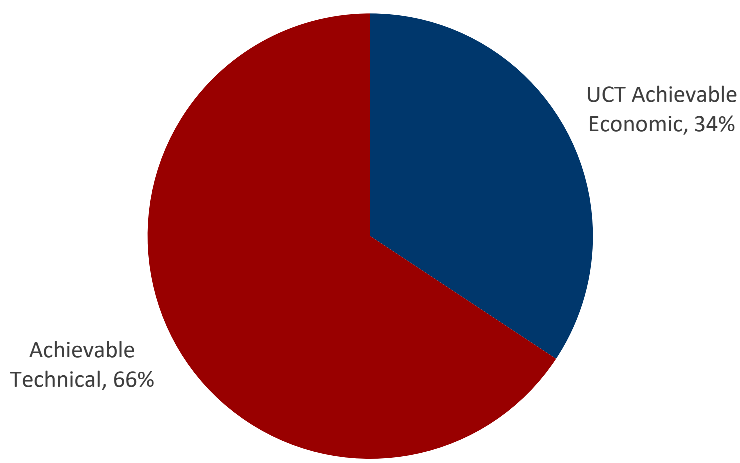


Table 3-1 Cascade Sector Control Totals, 2016

Sector	Number of Customers/Buildings	Natural Gas Use (thousand therms)
Residential	200,716	106,837
Commercial	18,495	80,267
Industrial	1,749	20,341
Total		**207,445**

Residential Sector

The total number of households and gas sales for the service territory were obtained from Cascade's actual sales for 2016. Details, including number of households and 2016 natural gas consumption for the residential sector can be found in Table 3-2 below. In 2016, there were over 200,000 households in the Cascade territory that used a total of nearly 107,000 thousand therms, resulting in an average use per household of 532 therms per year. This is an important number for the calibration process.

One adjustment made to Cascade customer counts was in the multifamily segments. A common trend in billing data is master accounts that represent multiple units within the same floor or building. When natural gas usage is shared in that way, we do not use the data directly. To account for this, we used 2011 RBSA data on multifamily usage per customer, then scaled it based on the relative usage within the three climate zones. For example, multifamily homes used comparatively more natural gas in climate zone 1 compared to zone 3, so the RBSA intensities were scaled upward in zone 1 and downward in zone 3. In future updates to the LoadMAP model, Cascade may substitute the RBSA data for a more local source if additional research is done into this topic.

These values represent weather actuals for 2016 and were adjusted within LoadMAP to normal weather using heating degree day, base 60°F, using data provided by Cascade. 2016 was an exceptionally warm year, which is reflected in lower than average consumption. When adjusting these values for normal weather in 2018, heating consumption increased by between 10 and 20% depending on the climate zone.

Table 3-2 Residential Sector Control Totals, 2016

Segment	Households	Natural Gas Use (thousand therms)	Annual Use/Customer (therms/HH)
CZ1 - Single Family	69,111	43,217	625
CZ1 - Multi Family	21,473	7,175	334
CZ2 - Single Family	35,863	21,815	608
CZ2 - Multi Family	4,092	1,182	289
CZ3 - Single Family	56,689	29,599	522
CZ3 - Multi Family	13,488	3,848	285
Total	**200,716**	**106,837**	**532**

Figure 3-2 Residential Natural Gas Use by Segment, 2016

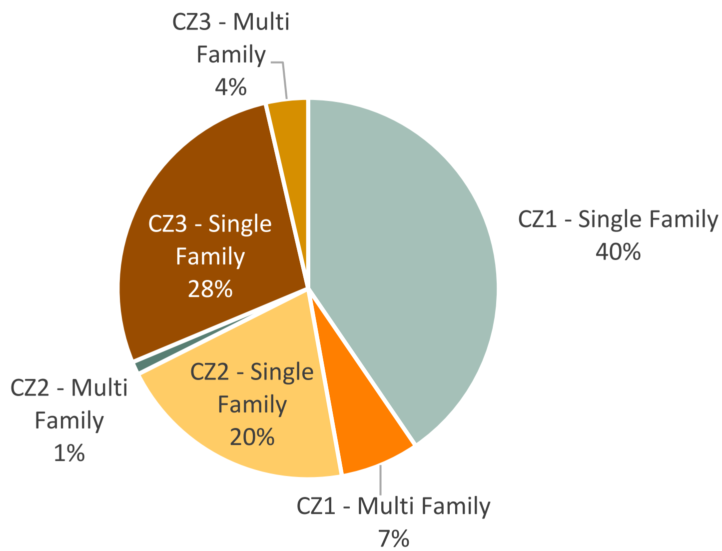
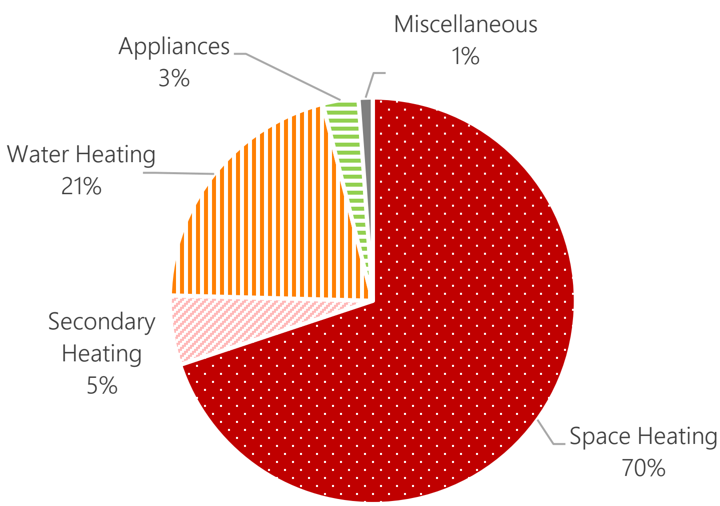


Figure 3-3 shows the distribution of annual natural gas consumption by end use for an average residential household. Space heating comprises a majority of the load at 70% followed by water heating at 21%. Miscellaneous loads make up a very small portion of the total load. This is expected for a natural gas profile as there are very few miscellaneous technologies. One example are natural gas barbecues.

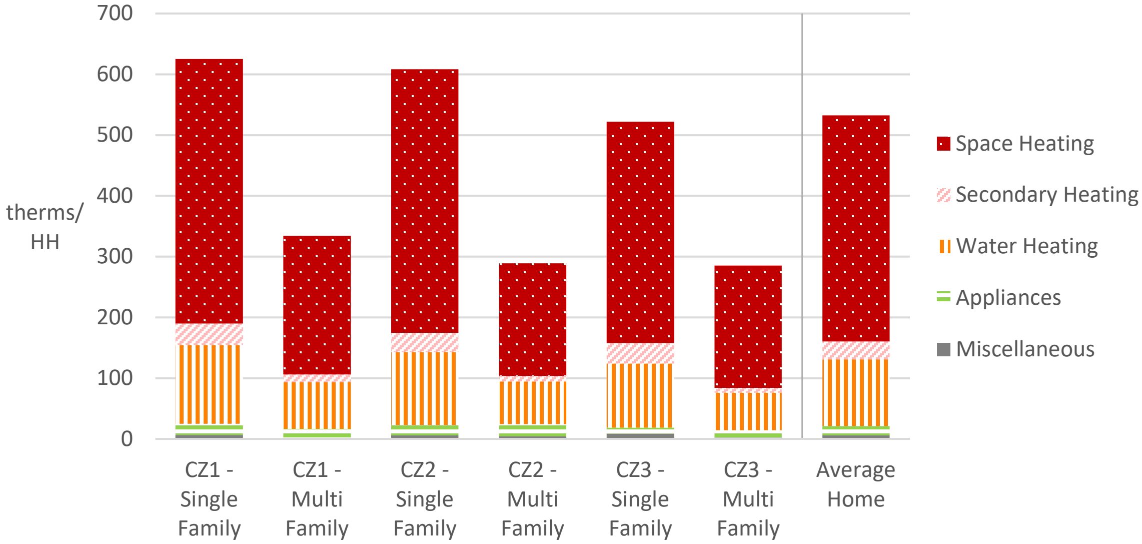
Figure 3-3 Residential Natural Gas Use by End Use, 2016



Equipment flags within Cascade's billing data informed estimates of the saturation of key equipment types, which were used to distribute usage at the technology and end use level.

Figure 3-4 presents average natural gas intensities by end use and housing type. Single family homes consume substantially more energy in space heating. This is due to two factors. The first is that single family homes are larger. The second is that more walls are exposed to the outside environment, compared to multifamily dwellings with many shared walls. This increases heat transfer, resulting in greater heating loads. Water heating consumption is higher in single family homes as well. This is due to a greater number of occupants, which increases the demand for hot water.

Figure 3-4 Residential Energy Intensity by End Use and Segment, 2016 (Annual Therms/HH)



The market profile for an average home in the residential sector is presented in Table 3-3 below. An important step in the profile development process is model calibration. All consumption within an average home must sum up to the intensity extracted from billing data. This is necessary so estimates of consumption for a piece of equipment do not exceed the actual usage in a home. Since consumption in 2016 was rather low, the household intensity increased in 2018 when normalizing weather, allowing for increased consumption in space heating and secondary heating technologies.

Table 3-3 Average Market Profile for the Residential Sector, 2016

End Use	Technology	Saturation	UEC (therms)	Intensity (therms/HH)	Usage (thousand therms)
Space Heating	Furnace - Direct Fuel	83.5%	437.4	365.1	73,276
	Boiler - Direct Fuel	1.6%	442.6	7.0	1,402
Secondary Heating	Fireplace	28.3%	103.8	29.4	5,901
Water Heating	Water Heater <= 55 gal.	64.4%	166.6	107.3	21,539
	Water Heater > 55 gal.	1.2%	197.4	2.4	480
Appliances	Clothes Dryer	8.8%	26.6	2.3	471
	Stove/Oven	23.5%	54.5	12.8	2,566
Miscellaneous	Pool Heater	0.8%	380.0	3.1	614
	Miscellaneous	100.0%	2.9	2.9	587
Total				**532.3**	**106,837**

Commercial Sector

The total number of nonresidential accounts and natural gas sales for the service territory were obtained from Cascade's customer account database.

AEG first separated the Commercial accounts from Industrial by analyzing the SIC codes and rate codes assigned in the company's billing system. Prior to using the data, AEG inspected individual accounts to confirm proper assignment. This was done on the top accounts within each segment, but also via spot checks when reviewing the database. Energy use from accounts where the customer type could not be identified were distributed proportionally to all C&I segments. In addition, transportation-only customers were excluded from consideration in the potential study, as they are not eligible for participation in demand-side programs. This left only core industrial customers in the study.

Once the billing data was analyzed, the final segment control totals were derived by distributing the total 2016 nonresidential load to the sectors and segments according to the proportions in the billing data.

Table 3-4 below shows the final allocation of energy to each segment in the commercial sector, as well as the energy intensity on a square-foot basis. Intensities for each segment were derived from a combination of the 2014 CBSA and equipment saturations extracted from Cascade's database. The CBSA intensities corresponded to spaces with lower natural gas saturations than Cascade's database, so AEG increased intensities proportionally based on the additional presence of natural gas-consuming equipment.

Table 3-4 Commercial Sector Control Totals, 2016

Segment	Description	Intensity (therms/Sq Ft)	2016 Natural Gas Use (thousand therms)
Office	Traditional office-based businesses including finance, insurance, law, government buildings, etc.	0.77	9,629
Retail	Department stores, services, boutiques, strip malls etc.	1.00	10,480
Restaurant	Sit-down, fast food, coffee shop, food service, etc.	4.95	15,527
Grocery	Supermarkets, convenience stores, market, etc.	1.50	4,930
Education	College, university, trade schools, etc.as well as day care, pre-school, elementary, secondary schools	0.42	12,194
Health	Health practitioner office, hospital, urgent care centers, etc.	1.21	7,201
Lodging	Hotel, motel, bed and breakfast, etc.	0.97	5,657
Warehouse	Large storage facility, refrigerated/unrefrigerated warehouse	0.71	1,698
Miscellaneous	Catchall for buildings not included in other segments, includes churches, recreational facilities, public assembly, correctional facilities, etc.	1.19	12,952
Total		**0.96**	**80,267**

Figure 3-5 shows each segments' natural gas consumption as a percentage of the entire commercial sector energy consumption. The four segments with the highest natural gas usage in 2016 are restaurant, education, miscellaneous, and retail, in descending order. As expected, the highest intensity segment is restaurant. This is based on the high presence of food preparation equipment.

Figure 3-5 Commercial Natural Gas Use by Segment, 2016

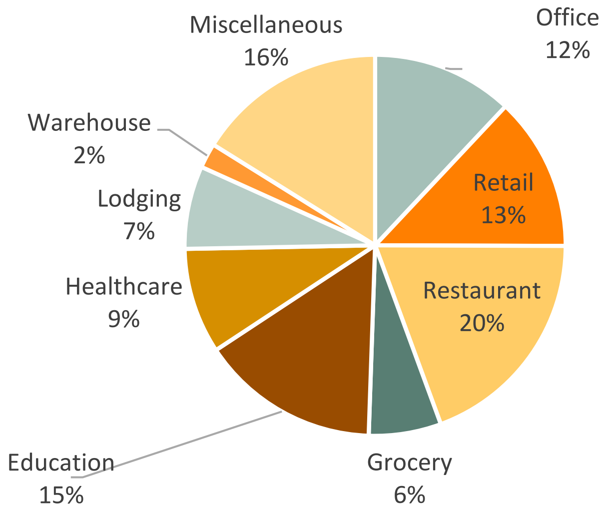


Figure 3-6 shows the distribution of natural gas consumption by end use for the entire commercial sector. Space heating is the largest end use, followed closely by food preparation and water heating. The miscellaneous end use is quite small, as expected.

Figure 3-6 Commercial Sector Natural Gas Use by End Use, 2016

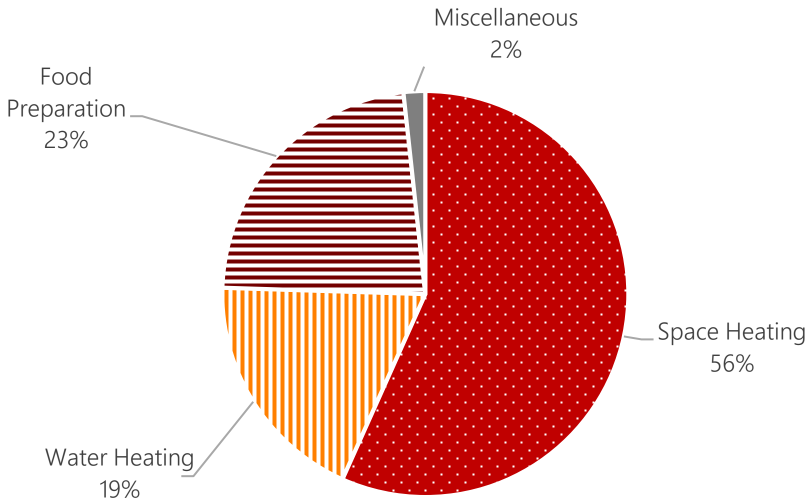
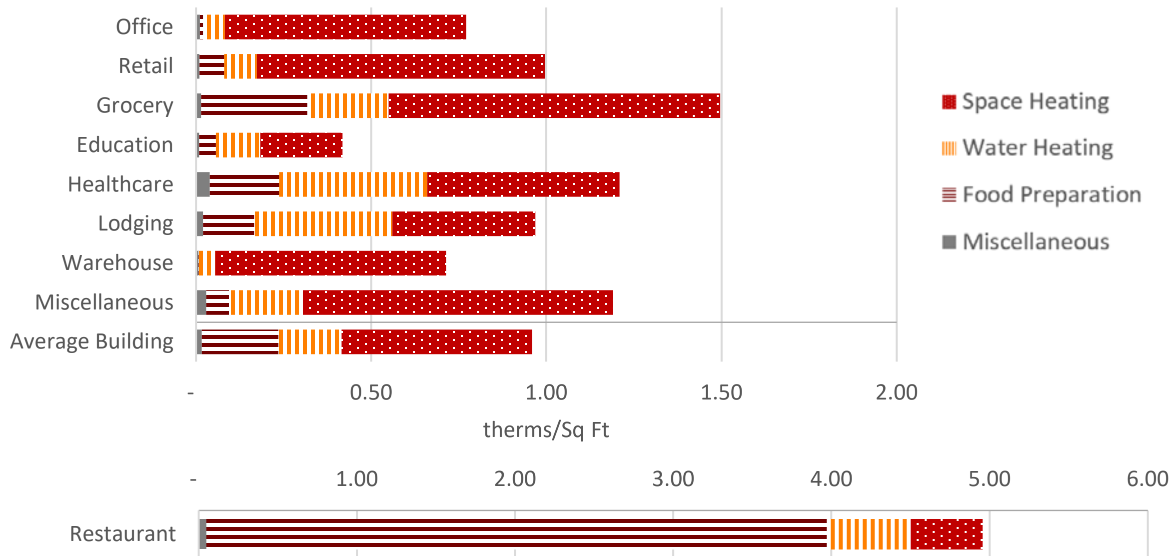


Figure 3-7 presents average natural gas intensities by end use and segment.

Figure 3-7 Commercial Energy Usage Intensity by End Use and Segment, 2016 (Annual Therms/Sq. Ft)



The total market profile for an average building in the commercial sector is presented in Table 3-5 below. Cascade customer account data informed the market profile by providing information on saturation of key equipment types. Secondary data was used to develop estimates of energy intensity and square footage and to fill in saturations for any equipment types not included in the database.

Table 3-5 Average Market Profile for the Commercial Sector, 2016

End Use	Technology	Saturation	EUI (therms/ Sq Ft)	Intensity (therms/ Sq Ft)	Usage (thousand therms)
Heating	Furnace	63.9%	0.50	0.32	26,862
	Boiler	26.8%	0.50	0.14	11,299
	Unit Heater	18.0%	0.49	0.09	7,349
Water Heating	Water Heater	62.6%	0.29	0.18	15,089
Food Preparation	Oven	5.7%	0.22	0.01	1,076
	Conveyor Oven	2.9%	0.38	0.01	921
	Double Rack Oven	2.9%	0.58	0.02	1,398
	Fryer	9.4%	0.63	0.06	4,933
	Broiler	3.2%	0.71	0.02	1,899
	Griddle	5.0%	0.49	0.02	2,041
	Range	16.7%	0.30	0.05	4,257
	Steamer	3.1%	0.40	0.01	1,026
	Commercial Food Prep Other	3.1%	0.28	0.01	734
Miscellaneous	Pool Heater	4.6%	0.03	0.00	103
	Miscellaneous	100.0%	0.02	0.02	1,280
Total				**0.96**	**80,267**

Industrial Sector

The total sum of natural gas used in 2016 by Cascade's core industrial customers was 20,341 thousand therms. The industrial sector total natural gas usage does not include transport-only customers as they are not eligible for DSM programs. Like in the commercial sector, customer account data was used to allocate usage among segments. Energy intensity was derived from AEG's Energy Market Profiles database. We cross-referenced this data with bureau of labor statistics employment data by industry. Number of employees is calculated by dividing total usage by intensity. For the industrial sector, the unit of measure chosen is employment. This is because floor area is not as indicative of process loads, which may be constrained to one portion of a larger warehouse/storage facility. We chose to capture usage on an employment basis rather than customer since NEEA's 2014 IFSA reports in a similar metric and it allows us to compare intensities with those estimated for the region as a whole. Most industrial measures are installed through custom programs, where the unit of measure is not as necessary to estimate potential.

Table 3-6 Industrial Sector Control Totals, 2016

Segment	Intensity (therms/employee)	Natural Gas Usage (thousand therms)	Employees
Food Products	3,055	6,338	2,075
Agriculture	215,375	3,220	15
Primary Metals	10,134,779	2,670	0
Stone, Clay, and Glass	6,298,221	1,357	0
Petroleum	75,572,940	1,214	0
Paper and Printing	6,853,926	797	0
Instruments	245,457	706	3
Wood and Lumber Products	1,028,622	567	1
Other Industrial	215,375	3,473	16
Total	**9,642**	**20,341**	**2,110**

Figure 3-8 summarizes core-customer industrial natural gas consumption by industry type.

Figure 3-8 Industrial Natural Gas Use by Segment, 2016

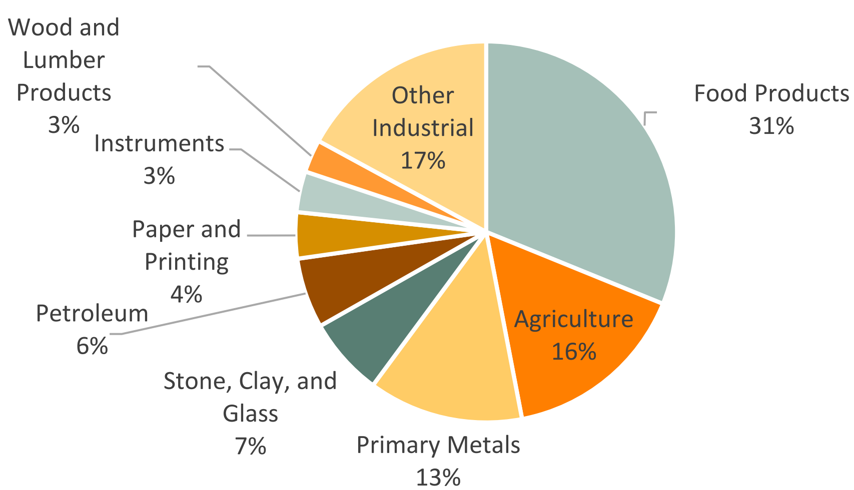


Figure 3-9 shows the distribution of annual natural gas consumption by end use for all industrial customers. Two major sources were used to develop this consumption profile. The first was AEG's analysis of warehouse usage as part of the commercial sector. We begin with this prototype as a starting point to represent non-process loads. We then added in process loads using our Energy Market Profiles database, which summarizes usage by end use and process type. Accordingly, process is the largest overall end use for the industrial sector, accounting for 80% of energy use. Heating is the second largest end use, and miscellaneous, non-process industrial uses round out consumption.

Figure 3-9 Industrial Natural Gas Use by End Use, 2016, All Industries

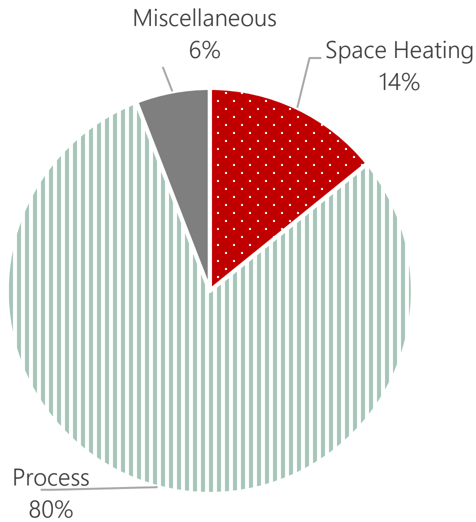


Figure 3-10 summarizes industrial energy intensities by industry type. Petroleum is presented on a separate axis due to the much higher usage per employee estimate.

Figure 3-10 Industrial Energy Usage Intensity by End Use and Segment, 2016 (Annual Therms/Employee)

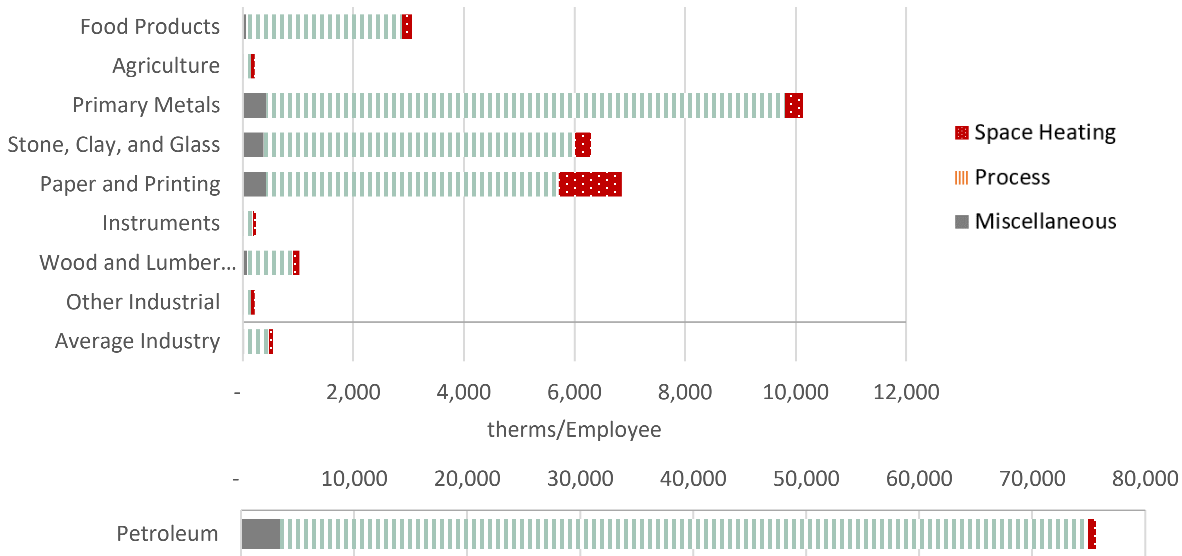


Table 3-7 shows the composite market profile for the industrial sector. Process cooling is very small and represents technologies such as gas-driven absorption chillers.

Table 3-7 Average Natural Gas Market Profile for the Industrial Sector, 2016

End Use	Technology	Saturation	EUI (therms/ employee)	Intensity (therms/ employee)	Usage (thousand therms)
Heating	Furnace	42.2%	71.29	30.06	1,118
	Boiler	9.1%	83.79	7.62	283
	Unit Heater	41.8%	95.42	39.87	1,483
Process	Process Boiler	100.0%	189.13	189.13	7,034
	Process Heating	100.0%	238.22	238.22	8,860
	Process Cooling	100.0%	0.90	0.90	33
	Other Process	100.0%	8.83	8.83	329
Miscellaneous	Miscellaneous	100.0%	32.29	32.29	1,201
Total				**546.93**	**20,341**

4

BASELINE PROJECTION

Prior to developing estimates of energy conservation potential, we developed a baseline end-use projection to quantify what the consumption is likely to be in the future in absence of any energy conservation programs. The savings from past programs are embedded in the forecast, but the baseline projection assumes that those past programs cease to exist in the future. Thus, the potential analysis captures all possible savings from future programs.

The baseline projection incorporates assumptions about:

- 2016 energy consumption based on the market profiles
- Customer population growth
- Appliance/equipment standards and building codes already mandated
- Appliance/equipment purchase decisions
- Cascade's customer forecast
- Trends in fuel shares and appliance saturations and assumptions about miscellaneous natural gas growth

Although it aligns closely, the baseline projection is not Cascade's official load forecast. Rather it was developed as an integral component of our modeling construct to serve as the metric against which energy conservation potentials are measured. This chapter presents the baseline projections we developed for this study. Below, we present the baseline projections for each sector, which include projections of annual use in thousand therms. We also present a summary across all sectors.

Summary of Overall Baseline Projection

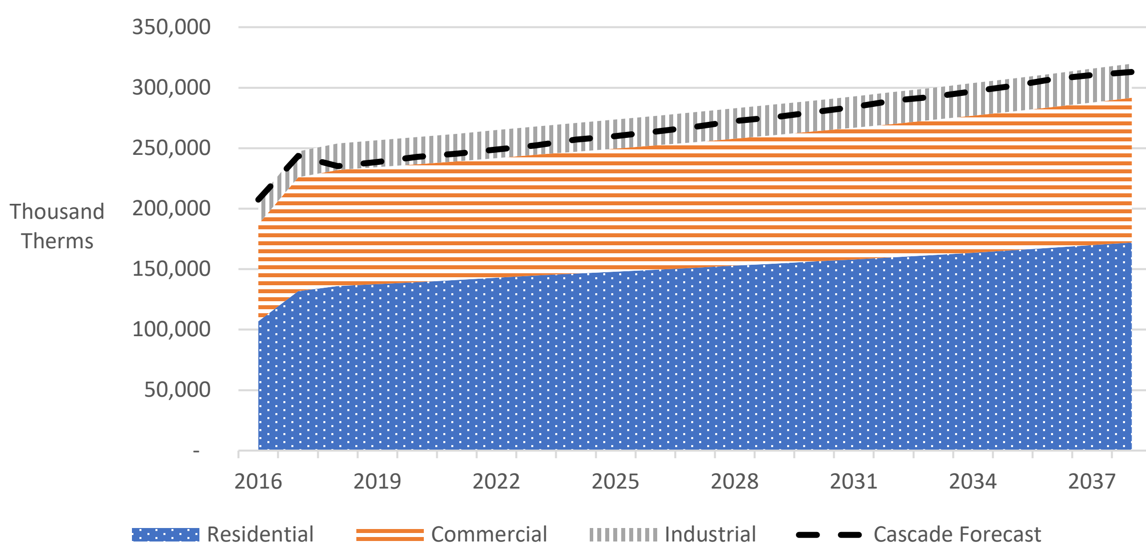
Table 4-1 and Figure 4-1 provide a summary of the baseline projection for annual use by sector for the entire Cascade service territory. The large spike between 2016 and 2017 is due to the adjustment from 2016 actual weather to 2017 actual weather (which was a colder year and very similar to normal weather).

Overall, the forecast shows modest growth in natural gas consumption, driven roughly equally by all sectors. We compare change and growth rates starting in 2018 since that is the first year with weather-normal assumptions. Beginning in 2018, we differ from Cascade's official forecast. This is because AEG updated 2017 with actual sales. At the time this analysis was completed, Cascade's official forecast had not yet been updated to reflect the substantial difference between these two years, as described above.

Table 4-1 Baseline Projection Summary by Sector, Selected Years (thousand therms)

Sector	2018	2019	2020	2022	2028	2038	% Change ('18-'38)	Avg. Growth
Residential	136,048	137,623	139,291	142,899	152,857	171,945	26.4%	1.2%
Commercial	95,999	96,641	97,334	98,885	105,013	119,718	24.7%	1.1%
Industrial	21,822	22,149	22,473	23,101	24,960	28,137	28.9%	1.3%
Total	**253,869**	**256,413**	**259,098**	**264,884**	**282,830**	**319,800**	**26.0%**	**1.2%**

Figure 4-1 Baseline Projection Summary by Sector (thousand therms)



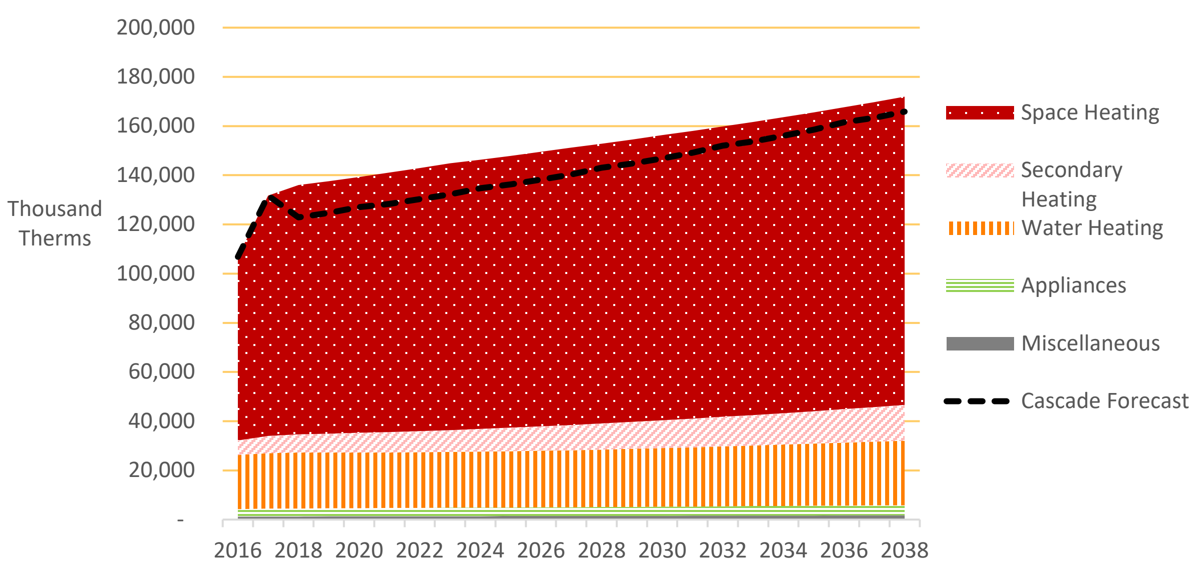
Residential Sector Baseline Projection

Table 4-2 and Figure 4-2 present the baseline projection for natural gas at the end-use level for the residential sector, as a whole. Overall, residential use increases from 136,048 thousand therms in 2018 to 171,945 thousand therms in 2038, an increase of 26.4%. There are two high-level factors affecting growth. The first is a moderate increase in number of households and customers. The second is a decrease in equipment consumption due to future standards and naturally occurring efficiency improvements (notably the AFUE upcoming 92% furnace standard). Consumption in Cascade's load forecast decreases in 2018 while the LoadMAP projection remains at an elevated level. This difference is due to how recently 2017 actual data became available, which resulted in a large change compared to historical sales. At the time this analysis was completed, Cascade had not yet updated their official load forecast to account for this large spike. If new information becomes available, the Cascade team will have the tools to update 2018 consumption within LoadMAP to reflect updated forecast data. We model gas-fired fireplaces as secondary heating. These consume energy and may heat a space but are rarely relied on to be a primary heating technology. As such, they are estimated to be more aesthetic and less weather-dependent. This end use grows faster than others since new homes are more likely to install a unit, increasing fireplace stock. Miscellaneous is a very small end use in natural gas studies and includes technologies with low penetration, such as gas barbeques.

Table 4-2 Residential Baseline Projection by End Use (thousand therms)

End Use	2018	2019	2020	2022	2028	2038	% Change ('18-'38)	Avg. Growth
Space Heating	101,359	102,671	104,039	106,934	113,806	125,346	23.7%	1.1%
Secondary Heating	7,465	7,740	8,022	8,611	10,571	14,551	94.9%	3.3%
Water Heating	22,707	22,640	22,602	22,610	23,362	26,217	15.5%	0.7%
Appliances	3,229	3,264	3,301	3,375	3,617	4,079	26.3%	1.2%
Miscellaneous	1,288	1,307	1,327	1,368	1,501	1,752	36.0%	1.5%
Total	**136,048**	**137,623**	**139,291**	**142,899**	**152,857**	**171,945**	**26.4%**	**1.2%**

Figure 4-2 Residential Baseline Projection by End Use (thousand therms)



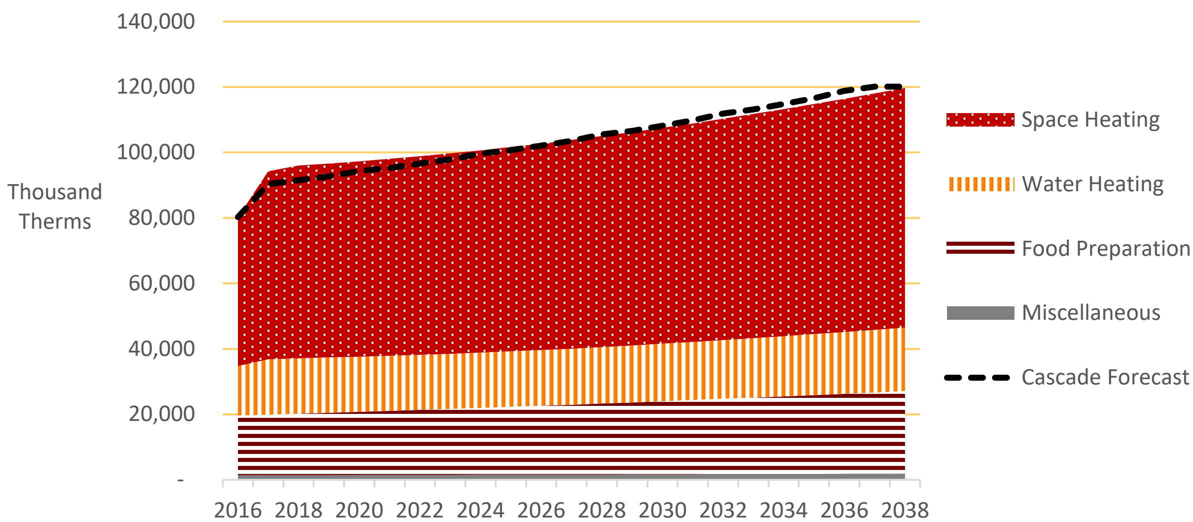
Commercial Sector Baseline Projection

Annual natural gas use in the commercial sector grows 24.7% during the overall forecast horizon, starting at 95,999 thousand therms in 2016, and increasing to 119,718 thousand therms in 2038. Table 4-3 and Figure 4-3 present the baseline projection at the end-use level for the commercial sector, as a whole. Similar to the residential sector, market size is increasing and usage per square foot is decreasing slightly. The weather normalization between 2016 and 2018 is also readily apparent in both AEG's projection and Cascade's official load forecast.

Table 4-3 Commercial Baseline Projection by End Use (thousand therms)

End Use	2018	2019	2020	2022	2028	2038	% Change ('18-'38)	Avg. Growth
Heating	58,854	59,266	59,709	60,694	64,453	73,184	24.3%	1.1%
Water Heating	16,941	16,895	16,860	16,837	17,264	19,430	14.7%	0.7%
Food Preparation	18,783	19,040	19,303	19,851	21,658	25,197	34.2%	1.5%
Miscellaneous	1,421	1,441	1,461	1,502	1,639	1,907	34.2%	1.5%
Total	**95,999**	**96,641**	**97,334**	**98,885**	**105,013**	**119,718**	**24.7%**	**1.1%**

Figure 4-3 Commercial Baseline Projection by End Use (thousand therms)



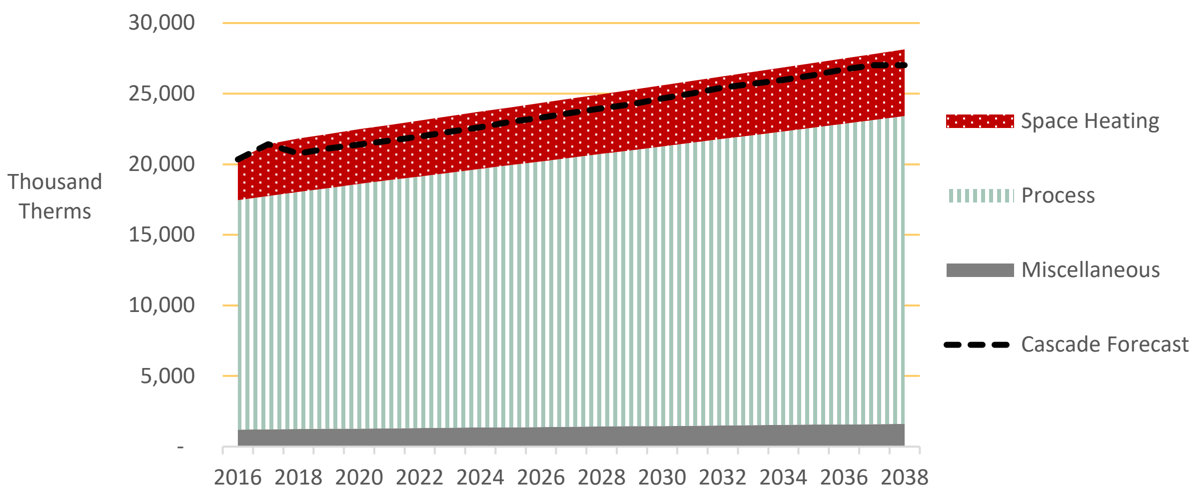
Industrial Sector Baseline Projection

Industrial sector usage increases throughout the planning horizon. Table 4-4 and Figure 4-4 present the projection at the end-use level. Overall, industrial annual natural gas use increases from 21,822 thousand therms in 2018 to 28,137 thousand therms in 2038. Growth in most end uses is consistent at around 1.3% per year but impacts of naturally occurring efficiency lowers consumption in the space heating end use. We applied a much smaller weather normalization factor for the industrial heating end use since consumption is so heavily dominated by motors and process and a correlation to such small consumption values is much lower. The industrial load grows at a similar rate to Cascade's official forecast but increases in 2017 due to the alignment with actual consumption in that year, as described above.

Table 4-4 Industrial Baseline Projection by End Use (thousand therms)

End Use	2018	2019	2020	2022	2028	2038	% Change ('18-'38)	Avg. Growth
Heating	3,783	3,828	3,873	3,960	4,229	4,721	24.8%	1.1%
Process	16,798	17,061	17,321	17,824	19,305	21,805	29.8%	1.3%
Miscellaneous	1,241	1,261	1,280	1,317	1,426	1,611	29.8%	1.3%
Total	**21,822**	**22,149**	**22,473**	**23,101**	**24,960**	**28,137**	**28.9%**	**1.3%**

Figure 4-4 Industrial Baseline Projection by End Use (thousand therms)



5

OVERALL ENERGY EFFICIENCY POTENTIAL

This chapter presents the measure-level energy conservation potential across all sectors. This includes every possible measure that is considered in the measure list, regardless of program implementation concerns. Year-by-year savings for annual energy usage are available in the LoadMAP model and measure assumption summary, which were provided to Cascade at the conclusion of the study. Please note that all savings are provided at the customer site. This section includes potential from the residential, commercial, and industrial analyses.

Summary of Overall Energy Efficiency Potential

Table 5-1 and Figure 5-1 summarize the energy conservation savings in terms of annual energy use for all measures for four levels of potential relative to the baseline projection. Figure 5-2 displays the energy conservation forecasts. Savings are represented in cumulative terms, which reflect the effects of persistent savings in prior years in addition to new savings. This allows for the reporting of annual savings impacts as they actually impact each year of the forecast.

- **Technical Potential** reflects the adoption of all conservation measures regardless of cost-effectiveness. In this potential case, efficient equipment makes up all lost opportunity installations and all retrofit measures are installed, regardless of achievability. 2018 first-year savings are 3,361 thousand therms, or 1.3% of the baseline projection. Cumulative savings in 2028 are 52,882 thousand therms, or 18.7% of the baseline. By 2038, cumulative savings reach 88,728 thousand therms, or 27.7% of the baseline. Technical potential is useful as a theoretical construct, applying an upper bound to the potential that may be realized in any one year. Other levels of potential are based off this level which makes it an important component in the estimation of potential.
- **Achievable Technical Potential** refines technical potential by applying customer participation rates that account for market barriers, customer awareness and attitudes, program maturity, and other factors that affect market penetration of conservation measures. For the 2018-2038 CPA, ramp rates from the Seventh Power Plan were customized for use in natural gas programs and applied. Since the Seventh Plan does not assign ramp rates for the majority natural gas measures, we assigned these based on similar electric technologies present in the Plan as a starting point. These ramp rates may be found in Appendix E. 2018 first-year net savings are 1,314 thousand therms, or 0.5% of the baseline projection. Cumulative net savings in 2028 are 39,459 thousand therms, or 14.0% of the baseline. By 2038 cumulative savings reach 75,884 thousand therms, or 23.7% of the baseline.
- **UCT Achievable Economic Potential** further refines achievable technical potential by applying an economic cost-effectiveness screen. In this analysis, the cost-effectiveness is measured by the utility cost test (UCT), which compares lifetime energy benefits to the total utility costs of delivering the measure through a utility program, excluding monetized non-energy impacts. Avoided costs of energy were provided by Cascade. A 10% conservation credit was applied to these costs per Council methodologies. Additional details can be found in Appendix A. 2018 first-year savings are 658 thousand therms, or 0.3% of the baseline projection. Cumulative savings in 2028 are 29,035 thousand therms, or 10.3% of the baseline. By 2038 cumulative savings reach 63,358 thousand therms, or 19.8% of the baseline.

- **TRC Achievable Economic Potential** further refines achievable technical potential by applying an economic cost-effectiveness screen. In this analysis, the cost-effectiveness is measured by the total resource cost (TRC) test, which compares lifetime energy benefits to the total customer and utility costs of delivering the measure through a utility program, including monetized non-energy impacts. AEG also applied benefits for non-gas energy savings, such as electric HVAC savings for weatherization and lighting savings for retrocommissioning. We also applied the Council's calibration credit to space heating savings to reflect the fact that additional fuels may be used as a supplemental heat source within an average home and may be accounted for within the TRC. Avoided costs of energy were provided by Cascade. A 10% conservation credit was applied to these costs per the Council methodologies. 2018 first-year savings are 472 thousand therms, or 0.2% of the baseline projection. Cumulative net savings in 2028 are 24,097 thousand therms, or 8.5% of the baseline. By 2038 cumulative savings reach 47,533 thousand therms, or 14.9% of the baseline. Potential under the TRC test is lower than UCT due to the inclusion of full measure costs rather than the utility portion. For most measures, these far outweigh the quantified and monetized non-energy impacts included in the TRC.

Table 5-1 Summary of Energy Efficiency Potential (thousand therms)

Scenario	2018	2019	2020	2022	2028	2038
Baseline Projection (thousand therms)	253,869	256,413	259,098	264,884	282,830	319,800
Cumulative Savings (thousand therms)						
UCT Achievable Economic Potential	658	1,404	2,382	6,758	29,035	63,358
TRC Achievable Economic Potential	472	967	1,600	5,116	24,097	47,533
Achievable Technical Potential	1,314	2,691	4,316	10,667	39,459	75,884
Technical Potential	3,361	6,560	9,945	19,760	52,882	88,728
Cumulative Savings (% of Baseline)						
UCT Achievable Economic Potential	0.3%	0.5%	0.9%	2.6%	10.3%	19.8%
TRC Achievable Economic Potential	0.2%	0.4%	0.6%	1.9%	8.5%	14.9%
Achievable Technical Potential	0.5%	1.0%	1.7%	4.0%	14.0%	23.7%
Technical Potential	1.3%	2.6%	3.8%	7.5%	18.7%	27.7%

Figure 5-1 Summary of Energy Efficiency Potential as % of Baseline Projection (thousand therms)

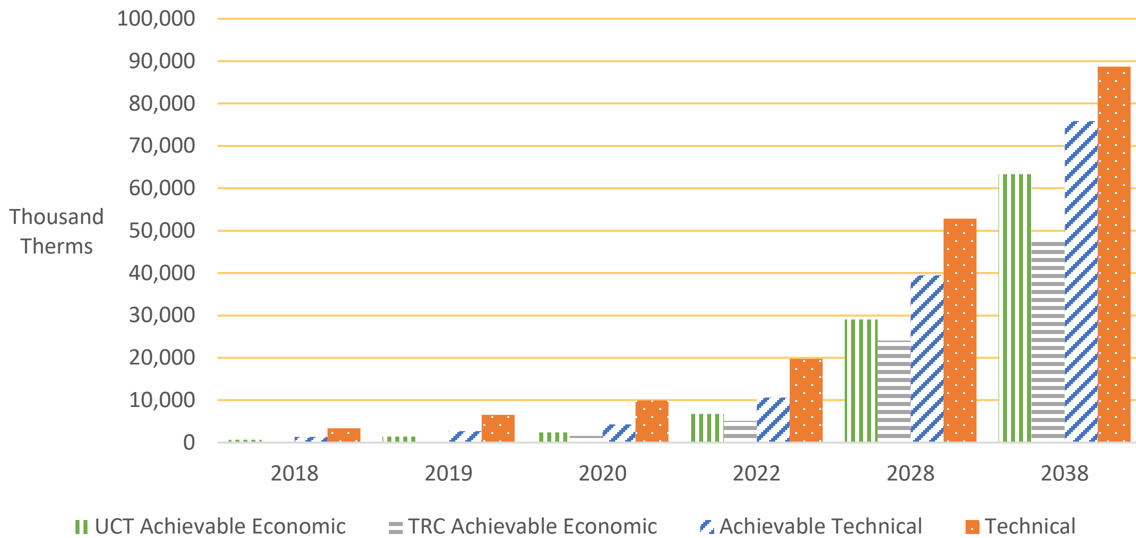
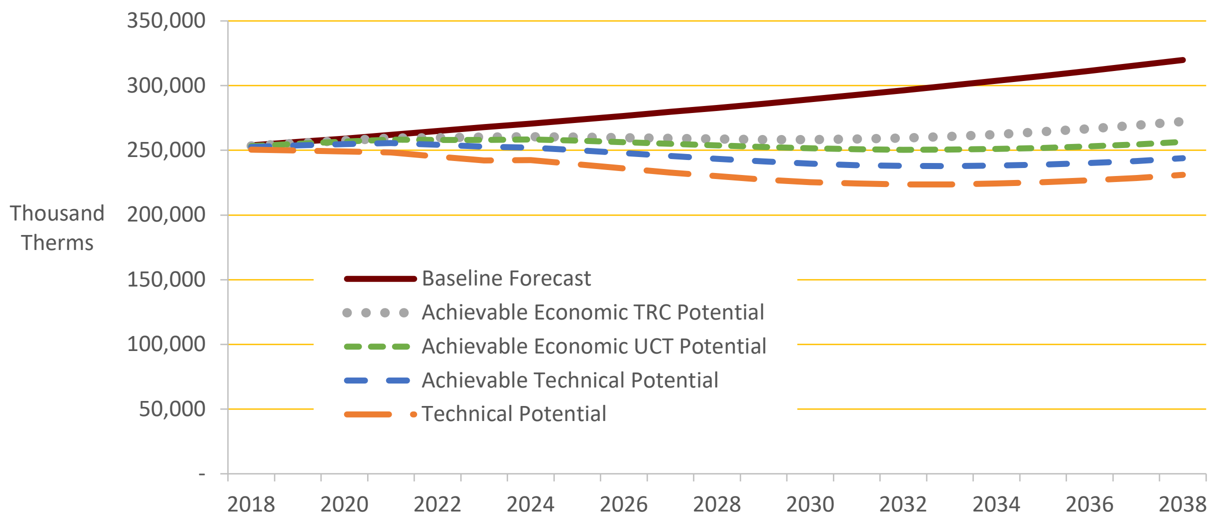


Figure 5-2 Baseline Projection and Energy Efficiency Forecasts (thousand therms)



Summary of Overall UCT Achievable Economic Potential

Figure 5-3 shows the cumulative UCT achievable potential by sector for the full timeframe of the analysis as percent of total. Table 5-2 summarizes UCT achievable potential by market sector for selected years.

While the residential and commercial sectors represent a comparable share of the overall potential in the early years, by the mid-2020s, the residential sector share grows to a significant majority of savings potential. Since industrial consumption is such a low percentage of the baseline once large customers have been excluded, potential for this sector makes up a lower percentage of the total. While residential and commercial potential ramps up, industrial potential is mainly retrofit in nature, and is much flatter. This is because process equipment is highly custom and most potential comes from controls modifications or process adjustments rather than high-efficiency equipment upgrades. Additionally, we model retrocommissioning to phase in evenly over the next twenty years. This measure has a maintenance component, and not all existing facilities may be old enough to require the tune-up immediately but will be eligible at some point over the course of the study.

There is a notable downtick in residential savings around 2024. This is due to the impacts of the residential forced-air furnace standard, which raises the baseline from AFUE 80% to AFUE 92%, which is a substantial increase when the efficient option is an AFUE 95% unit.

Figure 5-3 Cumulative UCT Achievable Economic Potential by Sector (% of Total)

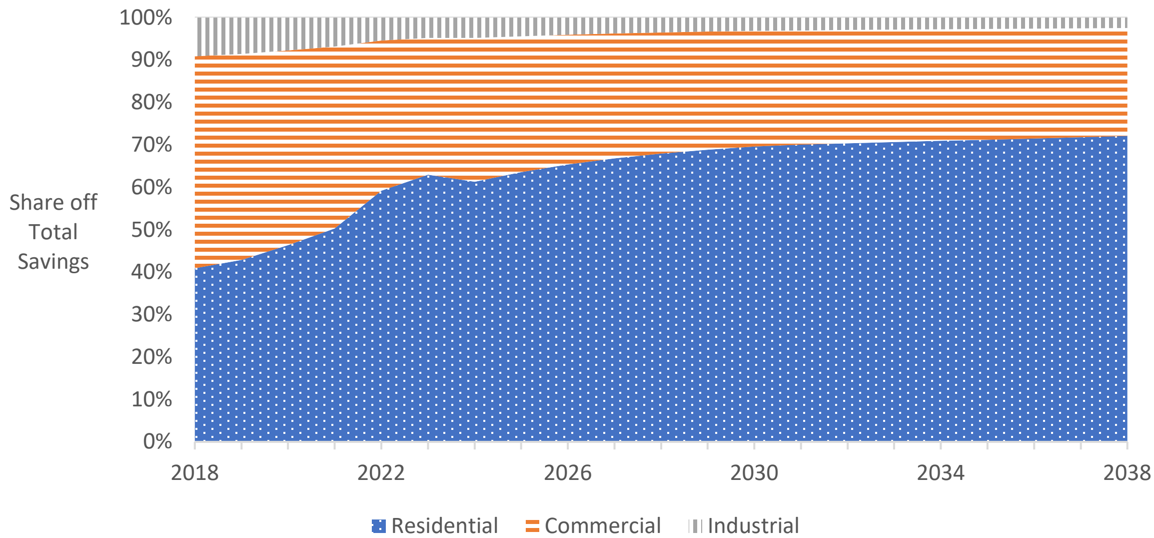


Table 5-2 Cumulative UCT Achievable Economic Potential by Sector, Selected Years (thousand therms)

Sector	2018	2019	2020	2022	2028	2038
Residential	275	596	1,080	4,106	20,792	48,850
Commercial	284	592	975	2,218	7,962	15,732
Industrial	59	118	180	359	1,016	1,587
Total	**618**	**1,305**	**2,235**	**6,683**	**29,770**	**66,169**

6

SECTOR-LEVEL ENERGY EFFICIENCY POTENTIAL

The previous section provided a summary of potential for the Cascade territory as a whole. In this section, we provide details for each sector.

Residential Sector Potential

Table 6-1 and Figure 6-1 summarize the energy efficiency potential for the residential sector. In 2018, UCT achievable economic potential is 269 thousand therms, or 0.2% of the baseline projection. By 2028, cumulative savings are 19,726 thousand therms, or 12.9% of the baseline.

Table 6-1 Residential Energy Conservation Potential Summary (thousand therms)

Scenario	2018	2019	2020	2022	2028	2038
Baseline Forecast (thousand therms)	136,048	137,623	139,291	142,899	152,857	171,945
Cumulative Savings (thousand therms)						
UCT Achievable Economic Potential	269	602	1,104	3,999	19,726	45,708
TRC Achievable Economic Potential	157	318	565	2,810	16,043	32,298
Achievable Technical Potential	412	876	1,537	5,474	25,775	53,050
Technical Potential	1,790	3,419	5,210	11,425	33,906	61,335
Energy Savings (% of Baseline)						
UCT Achievable Economic Potential	0.2%	0.4%	0.8%	2.8%	12.9%	26.6%
TRC Achievable Economic Potential	0.1%	0.2%	0.4%	2.0%	10.5%	18.8%
Achievable Technical Potential	0.3%	0.6%	1.1%	3.8%	16.9%	30.9%
Technical Potential	1.3%	2.5%	3.7%	8.0%	22.2%	35.7%

Figure 6-1 Residential Energy Conservation by Case (thousand therms)

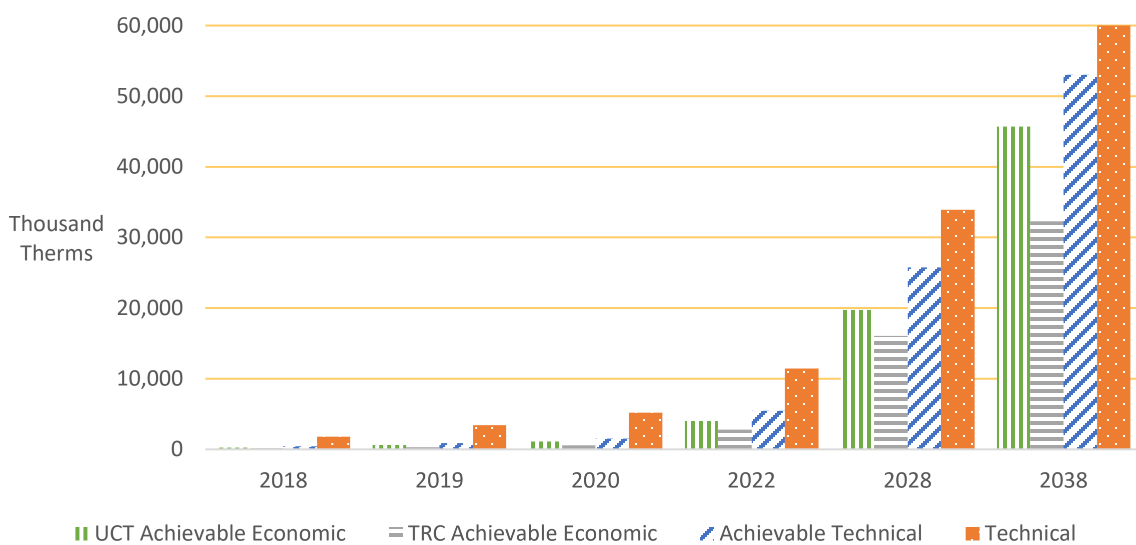


Figure 6-2 presents forecasts of energy savings by end use as a percent of total annual savings and cumulative savings. Space heating makes up a majority of potential but declines slightly in the early to mid-2020s due to the future furnace standard.

Figure 6-2 Residential UCT Achievable Economic Potential – Cumulative Savings by End Use (thousand therms, % of total)

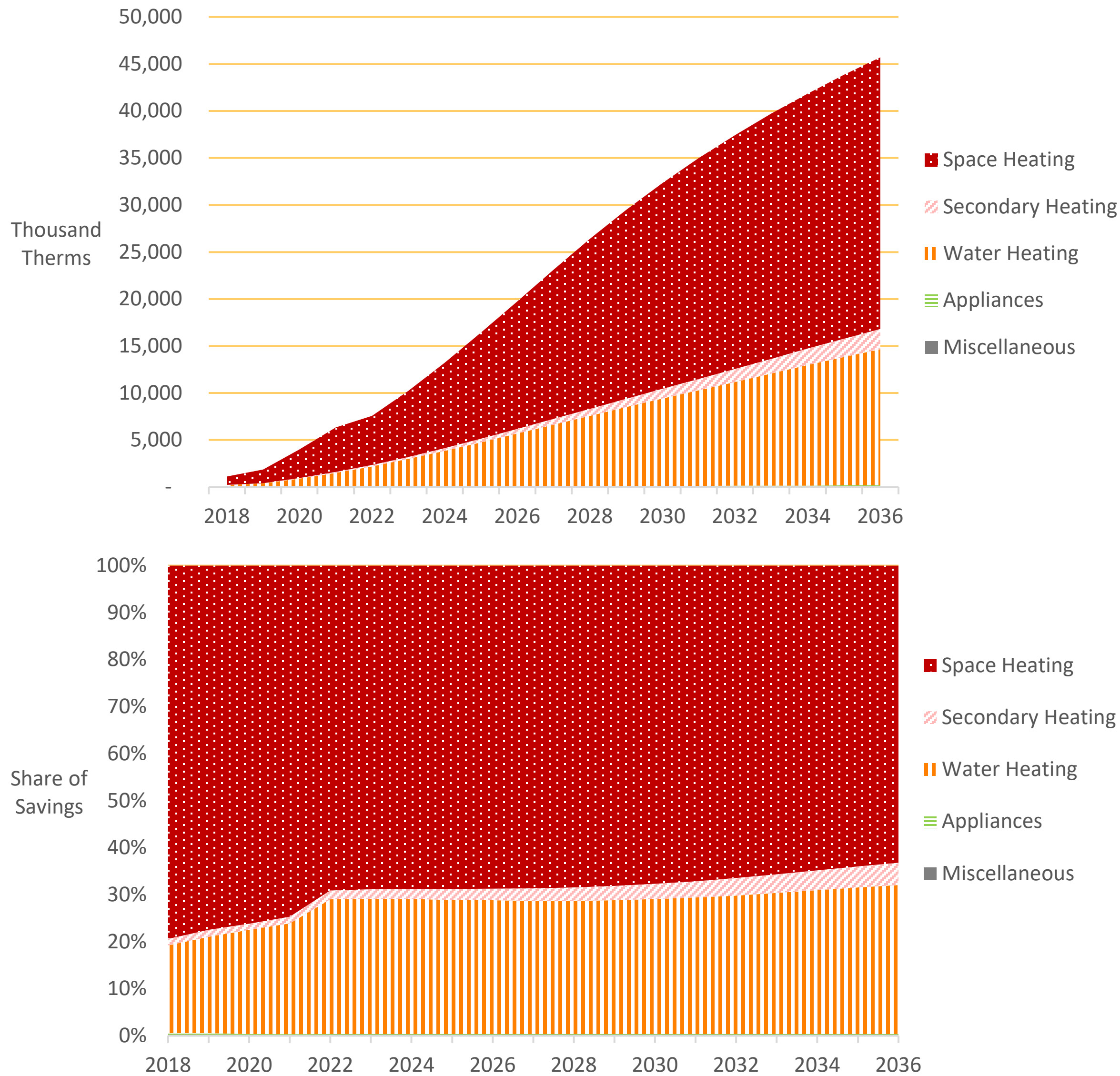


Table 6-2 identifies the top 20 residential measures by cumulative 2018 and 2019 savings. Furnaces, weatherization, Built Green homes, and tankless water heaters are the top measures.

Table 6-2 Residential Top Measures in 2018 and 2019, UCT Achievable Economic Potential (thousand therms)

Rank	Measure / Technology	2018 Cumulative Potential Savings (thousand therms)	% of Total	2019 Cumulative Potential Savings (thousand therms)	% of Total
1	Furnace - Direct Fuel - AFUE 95%	126.7	47.1%	267.4	44.4%
2	Insulation - Ceiling, Installation - R-38 (Retro only)	22.8	8.5%	45.6	7.6%
3	Insulation - Floor/Crawlspace - R-30	18.4	6.9%	36.8	6.1%
4	Built Green homes - Built Green spec (NC Only)	14.5	5.4%	41.9	7.0%
5	Thermostat - Wi-Fi/Interactive - Interactive/learning thermostat (ie, NEST)	11.0	4.1%	21.9	3.6%
6	Insulation - Ducting - duct thermal losses reduced 50%	9.6	3.6%	19.2	3.2%
7	Water Heater <= 55 gal. - Instantaneous - ENERGY STAR (UEF 0.87)	8.4	3.1%	19.7	3.3%
8	Insulation - Wall Cavity, Installation - R-11	7.6	2.8%	15.1	2.5%
9	Water Heater - Faucet Aerators - 1.5 GPM faucet	5.4	2.0%	10.6	1.8%
10	Insulation - Ceiling, Upgrade - R-49	5.3	2.0%	10.6	1.8%
11	Water Heater - Pipe Insulation - Insulated 5' of pipe between unit and conditioned space	4.8	1.8%	9.4	1.6%
12	Insulation - Basement Sidewall - R-15	4.2	1.6%	8.4	1.4%
13	Insulation - Infiltration Control (Air Sealing) - 20% reduction in ACH50	4.0	1.5%	8.1	1.3%
14	Gas Boiler - Pipe Insulation - Pipe insulated throughout home	3.8	1.4%	12.1	2.0%
15	Fireplace - Tier 1 (70% FE Rating)	3.5	1.3%	7.8	1.3%
16	Thermostat - Programmable - Programmed thermostat	2.4	0.9%	4.8	0.8%
17	Water Heater - Thermostatic Shower Restriction Valve - Restrictor installed, shutting off water when it is warm	2.4	0.9%	4.7	0.8%
18	Water Heater <= 55 gal. - ENERGY STAR (UEF 0.64)	2.3	0.9%	5.5	0.9%
19	Water Heater - Temperature Setback - Setback to 120° F	1.9	0.7%	3.7	0.6%
20	Ducting - Repair and Sealing - 50% reduction in duct leakage	1.8	0.7%	3.5	0.6%
Subtotal		**260.8**	**96.8%**	**556.8**	**92.5%**
Total Savings in Year		**269.2**	**100.0%**	**602.1**	**100.0%**

Commercial Sector Potential

Table 6-3 and Figure 6-3 summarize the energy conservation potential for the commercial sector. In 2018, UCT achievable economic potential is 329 thousand therms, or 0.3% of the baseline projection. By 2028, cumulative savings are 8,291 thousand therms, or 7.9% of the baseline.

Table 6-3 Commercial Energy Conservation Potential Summary

Scenario	2018	2019	2020	2022	2028	2038
Baseline Forecast (thousand therms)	95,999	96,641	97,334	98,885	105,013	119,718
Cumulative Savings (thousand therms)						
UCT Achievable Economic Potential	329	682	1,094	2,394	8,291	16,093
TRC Achievable Economic Potential	259	537	866	1,967	7,104	13,776
Achievable Technical Potential	835	1,682	2,577	4,798	12,612	21,204
Technical Potential	1,478	2,954	4,455	7,811	17,646	25,473
Energy Savings (% of Baseline)						
UCT Achievable Economic Potential	0.3%	0.7%	1.1%	2.4%	7.9%	13.4%
TRC Achievable Economic Potential	0.3%	0.6%	0.9%	2.0%	6.8%	11.5%
Achievable Technical Potential	0.9%	1.7%	2.6%	4.9%	12.0%	17.7%
Technical Potential	1.5%	3.1%	4.6%	7.9%	16.8%	21.3%

Figure 6-3 Commercial Energy Conservation by Case (thousand therms)

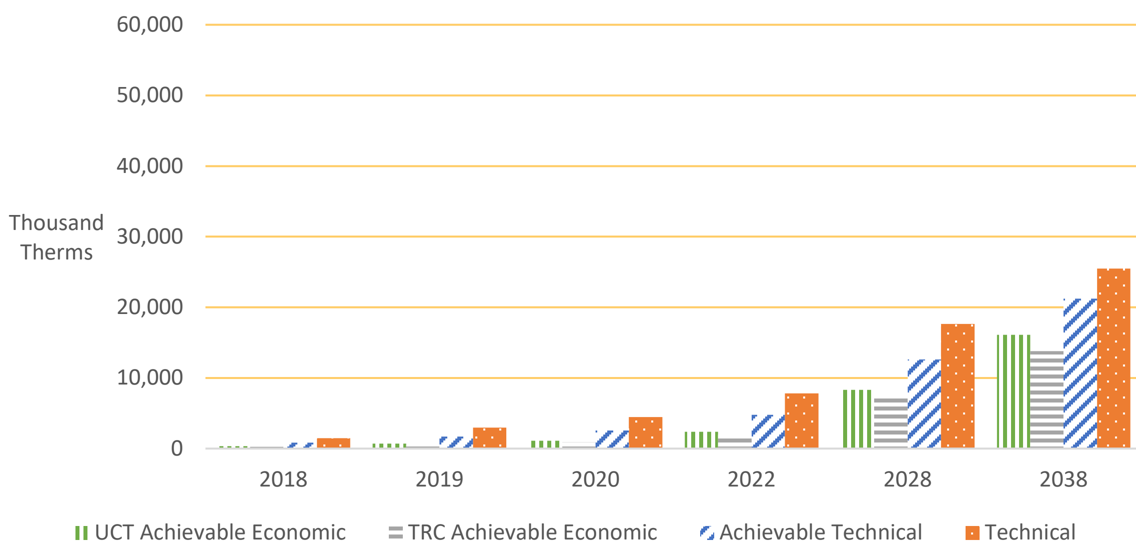


Figure 6-4 presents forecasts of energy savings by end use as a percent of total annual savings and cumulative savings. Space heating makes up a majority of the potential early, but food preparation equipment upgrades provide substantial savings opportunities in the later years.

Figure 6-4 Commercial UCT Achievable Economic Potential – Cumulative Savings by End Use (thousand therms, % of total)

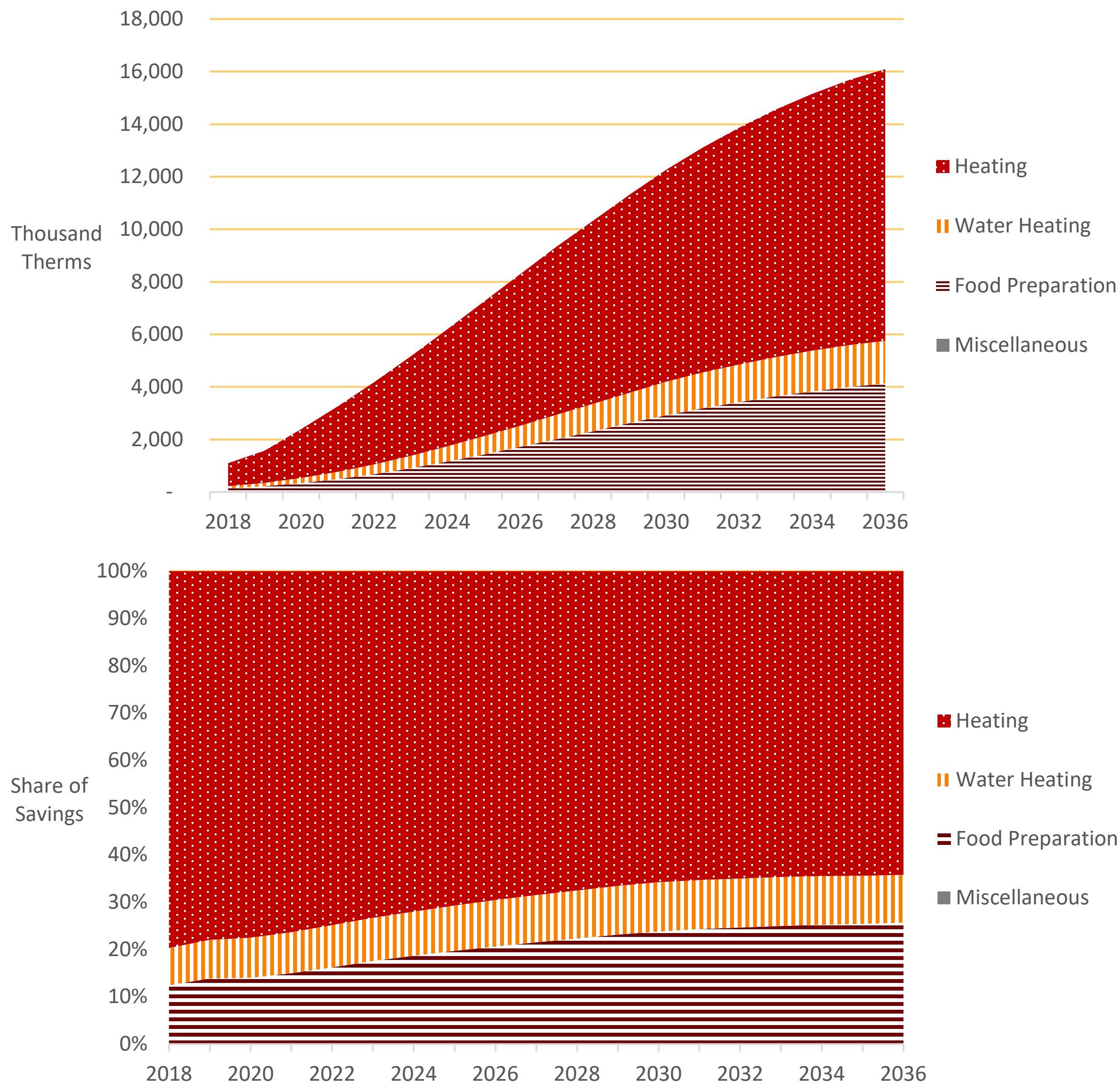


Table 6-4 identifies the top 20 commercial measures by cumulative savings in 2018 and 2019. Boilers are the top measure, followed by weatherization and food preparation. Retrocommissioning potential is present in the top measures but is a smaller contributor due to revised savings assumptions. RCx in the commercial sector is a restoration of HVAC systems to their original, or better, conditions.

Table 6-4 Commercial Top Measures in 2018 and 2019, UCT Achievable Economic Potential (thousand therms)

Rank	Measure / Technology	2018 Cumulative Potential Savings (thousand therms)	% of Total	2019 Cumulative Potential Savings (thousand therms)	% of Total
1	Boiler - AFUE 98%	65.8	20.0%	138.3	22.9%
2	Insulation - Roof/Ceiling - R-38	21.9	6.7%	40.4	6.7%
3	Fryer - ENERGY STAR	21.5	6.5%	47.6	7.9%
4	HVAC - Demand Controlled Ventilation - DCV enabled	19.0	5.8%	28.1	4.6%
5	Insulation - Wall Cavity - R-21	18.8	5.7%	34.8	5.8%
6	Gas Boiler - Insulate Steam Lines/Condensate Tank - Lines and condensate tank insulated	17.4	5.3%	25.7	4.3%
7	Retrocommissioning - HVAC - Optimized HVAC flow and controls	15.2	4.6%	22.6	3.7%
8	Water Heater - TE 0.94	12.6	3.8%	30.2	5.0%
9	Space Heating - Heat Recovery Ventilator - HRV installed	12.0	3.7%	17.8	2.9%
10	Gas Boiler - Insulate Hot Water Lines - Insulated water lines	11.6	3.5%	17.2	2.9%
11	Furnace - AFUE 95%	11.4	3.5%	29.0	4.8%
12	Gas Furnace - Maintenance - General cleaning and maintenance	11.4	3.5%	15.3	2.5%
13	Gas Boiler - High Turndown - Turndown control installed	9.6	2.9%	14.2	2.4%
14	Kitchen Hood - DCV/MUA - DCV/HUA vent hood	9.3	2.8%	13.9	2.3%
15	Strategic Energy Management - Energy management system installed and programmed	8.9	2.7%	13.4	2.2%
16	Gas Boiler - Hot Water Reset - Reset control installed	8.0	2.4%	12.7	2.1%
17	Steam Trap Maintenance - Cleaning and maintenance	5.8	1.8%	8.6	1.4%
18	HVAC - Shut Off Damper - Damper installed	5.7	1.7%	8.5	1.4%
19	Water Heater - Faucet Aerator - 1.5 GPM faucet	5.5	1.7%	8.6	1.4%
20	Gas Boiler - Stack Economizer - Economizer installed	5.0	1.5%	7.5	1.2%
Subtotal			**296.6**	**90.2%**	**534.4**
Total Savings in Year			**328.8**	**100.0%**	**604.7**

Industrial Sector Potential

Table 6-5 and Figure 6-5 summarize the energy conservation potential for the core industrial sector. In 2018, UCT achievable economic potential is 60 thousand therms, or 0.3% of the baseline projection. By 2028, cumulative savings reach 1,018 thousand therms, or 4.1% of the baseline. Industrial potential is a lower percentage of overall baseline compared to the residential and commercial sectors. While large, custom process optimization and controls measures are present in potential, these are not applicable to all applications which limits potential at the technical level. Additionally, since the largest customers were excluded from this analysis due to their status as transport-only customers making them ineligible to participate in energy efficiency programs for the utility, the remaining customers are smaller and tend to have lower process end-use shares, further lowering industrial potential. As seen in the figure below, industrial potential is substantially lower due to the smaller sector size and process uses.

Table 6-5 Industrial Energy Conservation Potential Summary (thousand therms)

Scenario	2018	2019	2020	2022	2028	2038
Baseline Forecast (thousand therms)	21,822	22,149	22,473	23,101	24,960	28,137
Cumulative Savings (thousand therms)						
UCT Achievable Economic Potential	60	120	184	365	1,018	1,557
TRC Achievable Economic Potential	56	112	170	338	950	1,460
Achievable Technical Potential	67	133	203	395	1,072	1,631
Technical Potential	94	186	280	524	1,330	1,921
Energy Savings (% of Baseline)						
UCT Achievable Economic Potential	0.3%	0.5%	0.8%	1.6%	4.1%	5.5%
TRC Achievable Economic Potential	0.3%	0.5%	0.8%	1.5%	3.8%	5.2%
Achievable Technical Potential	0.3%	0.6%	0.9%	1.7%	4.3%	5.8%
Technical Potential	0.4%	0.8%	1.2%	2.3%	5.3%	6.8%

Figure 6-5 Industrial Energy Conservation Potential (thousand therms)

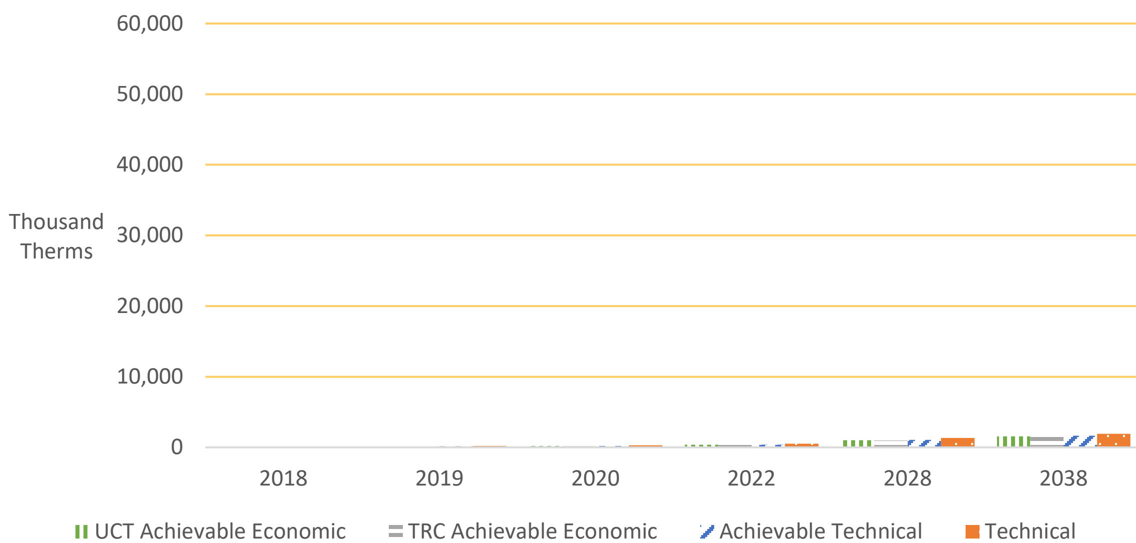


Figure 6-6 presents forecasts of energy savings by end use as a percent of total annual savings and cumulative savings.

Figure 6-6 Industrial UCT Achievable Economic Potential – Cumulative Savings by End Use (thousand therms, % of total)

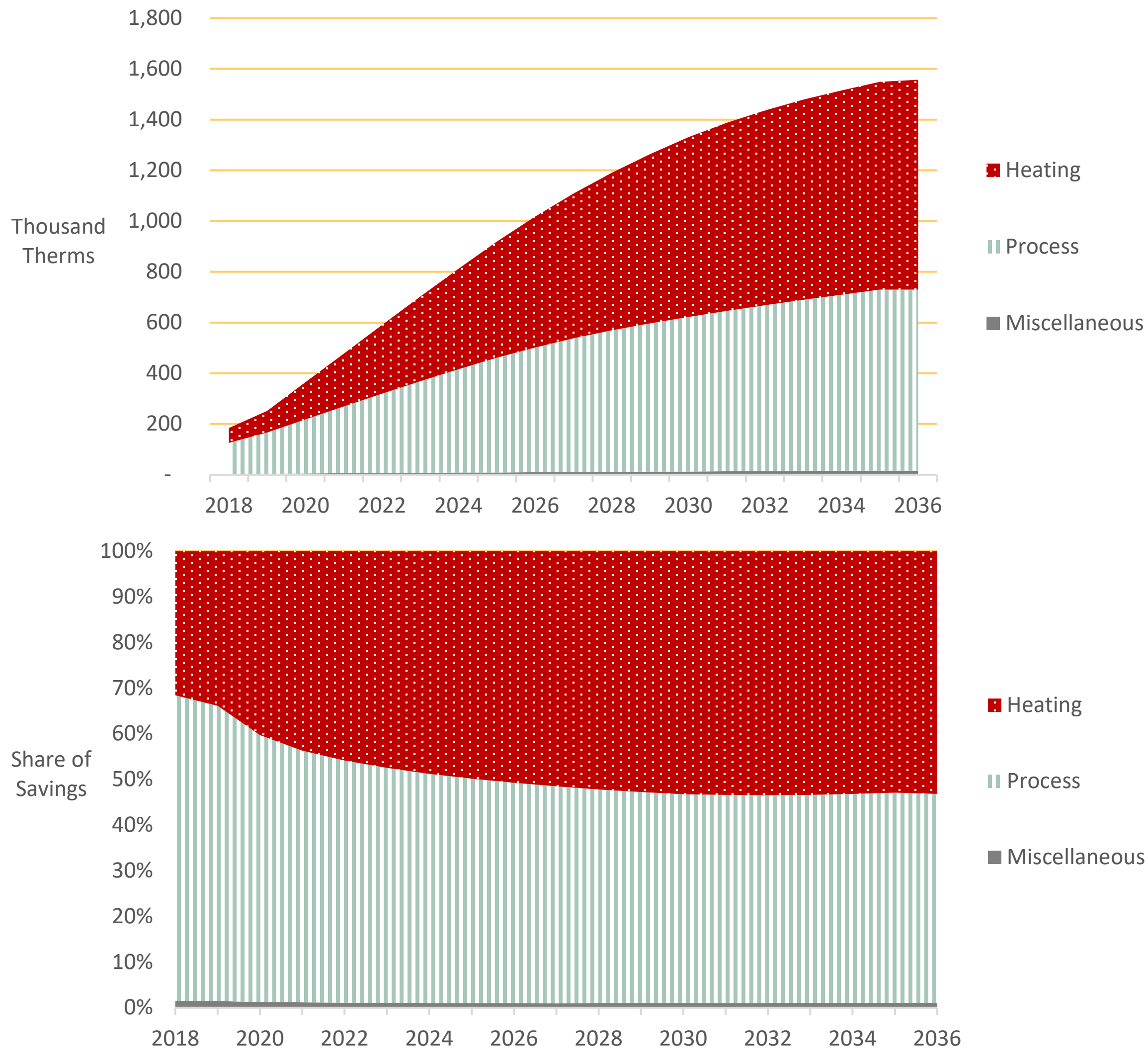


Table 6-6 identifies the top 20 industrial measures by cumulative 2018 and 2019 savings. Strategic energy management and retrocommissioning are top measures in the industrial sector. Strategic energy management of industrial process applications is the highest measure by total savings. For smaller industrial customers, this measure typically involves a cohort of between five to ten customers who form a working group facilitated by an energy management expert. One or more employees at each facility are designated an energy conservation "champion" who work to integrate efficient energy-consuming behavior into the company's culture. Many of these measures are more custom in nature, such as strategic energy management and retrocommissioning. These results in behavior-based and low-cost/no-cost measures but result in larger custom projects. We estimate that this potential will be captured within these measures/delivery mechanisms.

Table 6-6 Industrial Top Measures in 2018 and 2019, UCT Achievable Economic Potential (thousand therms)

Rank	Measure / Technology	2018 Cumulative Potential Savings (thousand therms)	% of Total	2019 Cumulative Potential Savings (thousand therms)	% of Total
1	Strategic Energy Management - Energy management system installed and programmed	16.8	34.7%	25.0	31.6%
2	Gas Boiler - Hot Water Reset - Reset control installed	5.5	11.4%	8.9	11.3%
3	Gas Boiler - Stack Economizer - Economizer installed	3.8	7.8%	5.7	7.2%
4	Boiler - AFUE 98%	3.6	7.4%	7.9	10.0%
5	Gas Boiler - High Turndown - Turndown control installed	3.2	6.6%	4.8	6.1%
6	Insulation - Roof/Ceiling - R-38	3.2	6.5%	5.8	7.4%
7	Retrocommissioning - Optimized HVAC flow and controls	2.6	5.5%	3.9	5.0%
8	Gas Boiler - Maintenance - General cleaning and maintenance	2.5	5.2%	3.4	4.3%
9	Insulation - Wall Cavity - R-21	2.4	5.1%	4.5	5.7%
10	Steam Trap Maintenance - Cleaning and maintenance	1.3	2.7%	1.9	2.5%
11	Gas Boiler - Insulate Steam Lines/Condensate Tank - Lines and condensate tank insulated	1.1	2.2%	1.6	2.0%
12	Unit Heater - Infrared Radiant	0.7	1.5%	1.9	2.4%
13	Building Automation System - Automation system installed and programmed	0.5	1.0%	0.9	1.2%
14	Furnace - AFUE 95%	0.4	0.7%	0.9	1.1%
15	Gas Boiler - Insulate Hot Water Lines - Insulated water lines	0.3	0.6%	0.9	1.1%
16	Gas Boiler - Burner Control Optimization - Optimized burner controls	0.3	0.5%	0.5	0.6%
17	Windows - High Efficiency - U-.22 or better	0.2	0.4%	0.4	0.5%
18	Gas Furnace - Maintenance - General cleaning and maintenance	0.0	0.0%	0.0	0.0%
Subtotal		**48.3**	**100.0%**	**79.0**	**100.0%**
Total Savings in Year		**48.3**	**100.0%**	**79.0**	**100.0%**

7

COMPARISON WITH CURRENT PROGRAMS AND RAMP RATE ADJUSTMENTS

One of the goals of this study is to inform targets for future programs, including the current calendar-year, 2018. As such, AEG conducted an in-depth comparison of the CPA's 2018 UCT Achievable Economic Potential with Cascade's 2017 accomplishments at the sector-level. This involved assigning each measure within the CPA to an existing Cascade program or a new "Other" bundle to be considered. Compared to 2017 accomplishments, AEG estimates lowered potential in the residential sector and higher in the commercial and industrial sectors. We will describe these in more detail below.

Residential Comparison with 2017 Programs

Table 7-1 summarizes Cascade's 2017 residential accomplishments and the 2018 UCT Achievable Economic potential estimates from LoadMAP. The LoadMAP estimate of 269.2 thousand therms is slightly lower than Cascade's 2017 accomplishments at 297.2 thousand therms. Please note, the achieved therms are based on preliminary assessments from Cascade with final program accomplishments officially available once their annual report is filed in June 2018.

Table 7-1 Comparison of Cascade's 2017 Residential Accomplishments with 2018 UCT Achievable Economic Potential (thousand therms)

Program Group	Cascade 2017 (thousand therms)	LoadMAP 2018 UCT (thousand therms)
Built Green	20.4	14.5
Furnace	172.5	126.7
Fireplace	4.1	3.5
Combination Unit	12.3	1.9
Water Heater	16.5	11.1
Air Sealing	12.9	4.0
Ceiling Insulation	29.5	28.2
Floor Insulation	13.3	18.5
Wall Insulation	5.0	11.8
Door	0.3	0.3
ESK	4.9	8.1
Thermostat	5.5	13.4
Other		27.3
Program Total	**297.2**	**241.9**
All Measures		**269.2**

The main reason that potential is lower is that the baseline assumed for forced-air furnaces is adjusted in the following ways.

- The 2015 Washington State Energy Code (WSEC) prescribes very efficient building shell requirements, which substantially reduces the consumption of a new home. Since every new home requires a lost opportunity purchasing decision when constructed, they make up a large portion of the potential. The lower unit energy savings in new homes due to lower heating requirements reduces the unit energy savings (UES) from this measure.
- Another reason is the incorporation of a market baseline, which assumes not everyone purchases the minimum federal standard in the absence of efficiency programs. This results in approximately 20% of customers purchasing an AFUE 90% and 5% purchasing an AFUE 92% in the baseline, which reduces the average unit energy consumption upon which savings for an AFUE 95% are based,

Additional descriptions for other measure differences are provided below:

- Potential for Built Green Homes has been reduced due to WSEC 2015. The efficient shell requirements lower space heating savings from the prior estimate, which was made before this code went into effect.
- Weatherization measures are an existing construction measure and WSEC 2015 does not apply. We have found that Cascade’s weatherization programs, especially in Climate Zone 3, are ramping up. As such, we are modeling higher potential for these measures in 2018.
- Combination unit potential is lowered due to a reduction in unit energy savings. Once AEG characterized Cascade’s market, we recalculated potential for this measure using the revised baseline, where consumption for boilers was lower than previously estimated. This reduces the savings substantially.

Commercial and Industrial Comparison with 2017 Programs

Table 7-2 summarizes Cascade's 2017 commercial and industrial accomplishments and the 2018 UCT Achievable Economic potential estimates from LoadMAP. The LoadMAP estimate of 388.8 thousand therms is substantially higher than Cascade's 2017 accomplishments at 260.3 thousand therms. Please note, the achieved therms are based on preliminary assessments from Cascade with final program accomplishments officially available once their annual report is filed in June 2018.

Table 7-2 Comparison of Cascade's 2017 Commercial and Industrial Accomplishments with 2018 UCT Achievable Economic Potential (thousand therms)

Program Group	Cascade 2017 (thousand therms)	LoadMAP 2018 UCT (thousand therms)
Custom	105.6	186.5
Insulation	50.1	76.7
Boilers	48.1	69.4
Fryer	18.0	21.5
Water Heaters	14.5	12.6
Furnaces	9.8	11.8
Motion Faucet Controls	6.4	0.0
Convection Oven	4.5	4.3
Energy Saver Kit	2.5	5.5
Dishwashers	0.4	0.5
Clothes Washers	0.3	0.0
HVAC Bonus	-	0.0
All Measures	**260.3**	**388.8**

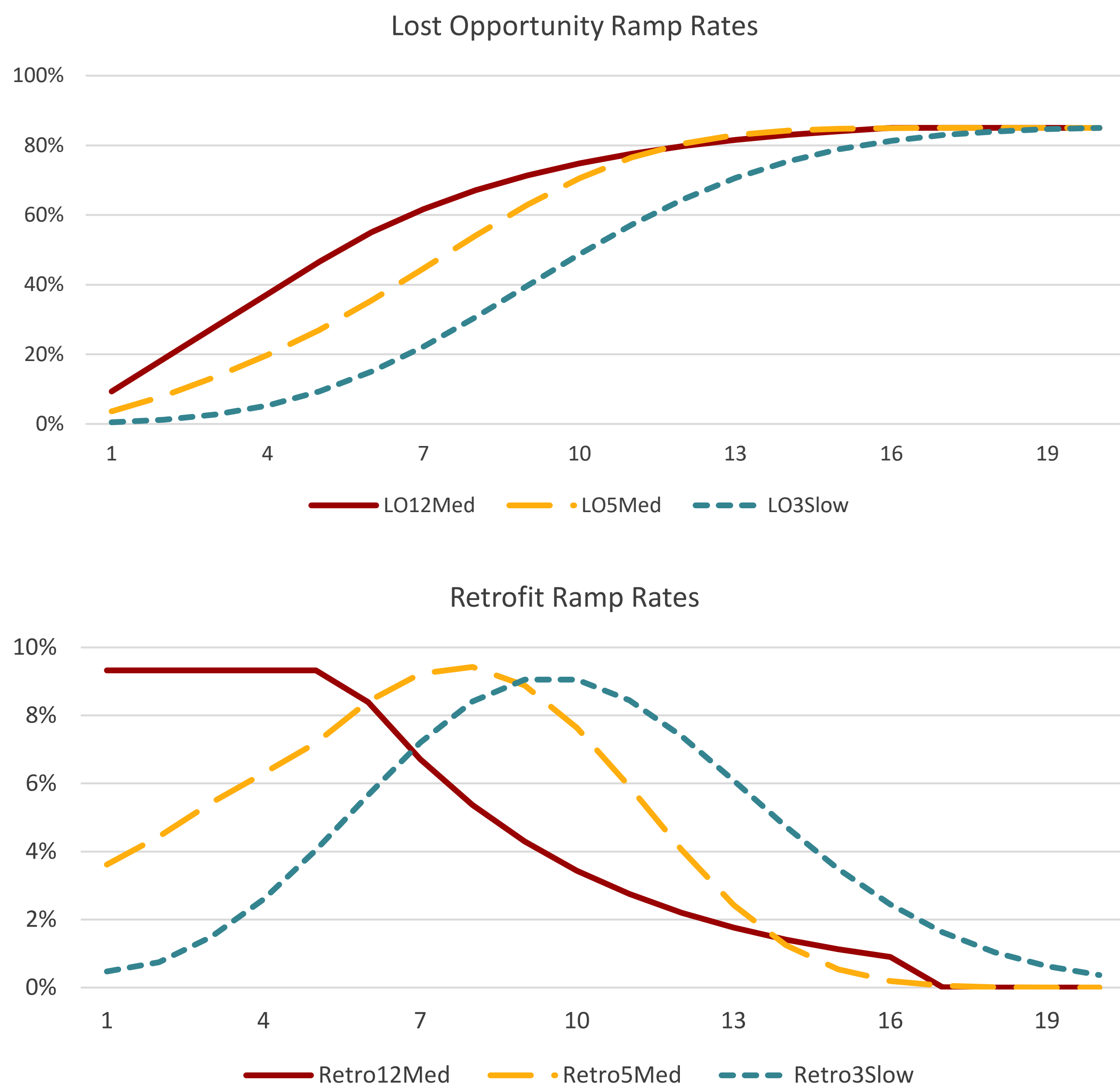
The following are key drivers in commercial potential:

- In addition to new measures within the "Custom" bundle such as retrocommissioning and strategic energy management, we estimate that some measures may realize additional potential in 2018. These, along with additional custom opportunities, make up the majority of additional potential.
- HVAC equipment shows promising levels of potential. Efficient boiler and furnace installations are two of the top ten measures, even after reducing the applicable furnace market to exclude difficult-to-reach rooftop unit furnaces, which make up about 40-50% of the installed technology.
- Fryer and convection oven potential is substantial due to the high gas consumption of restaurants and Cascade's current success with this program.

Application of Electricity Ramp Rates to Natural Gas Measures

A key driver in estimation of potential are participation rates, also known as ramp rates. These identify the percentage of an applicable population that will adopt an efficiency measure as part of a utility EE program or other non-utility mechanism within the territory. For CPAs in the Northwest, and particularly the state of Washington, the Seventh Plan's electric ramp rates are a key source of information. While very thorough and straightforward to use, these were developed with electric utilities and electric programs in mind. This implies that they may not be appropriate to apply directly to natural gas EE programs or measures.

Figure 7-1 Example Power Council Ramp Rates

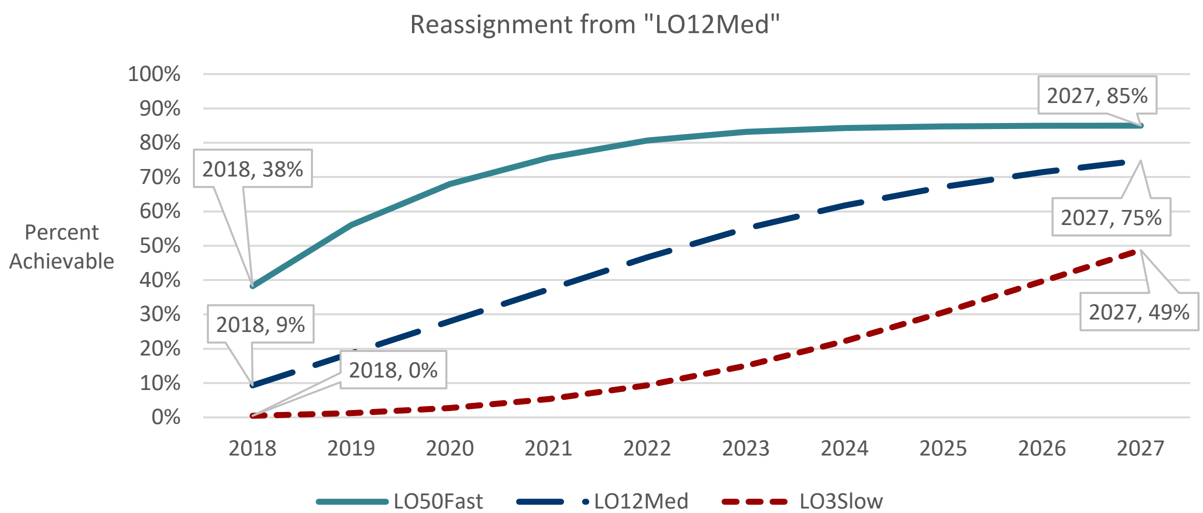


AEG adjusted the Power Council's ramp rates using three of the four approaches illustrated below.

Reassign an individual measure's ramp rate

Each electric measure within the Seventh Plan was prescribed a ramp rate as part of the analysis. AEG began by mapping those to similar gas measures (e.g. using similar HVAC equipment or low-flow showerhead ramp rates) when estimating potential. In some cases, we found that these did not align with what we expected for natural gas programs or Cascade's accomplishments. For example, commercial boilers were originally on the "LO20Fast" ramp rate, which is a lost opportunity (turnover) ramp rate that starts at about 20% of applicable participants and approaches 85% quickly. When comparing with Cascade's current programs, AEG observed that they were realizing higher potential, indicating that this is a more mature program. As a result, we reassigned this to the "LO50Fast" ramp rate, which begins around 50% and ramps up quickly as well. We also investigated lowering a few ramp rates. The most notable is in residential weatherization. When discussing current Cascade programs with the team, we noticed that potential has been challenging to achieve in recent years, but due to recruitment of a new implementer in Climate Zone 3, potential there is increasing. In this case, we remapped weatherization to a slower ramp rate, which begins at a lower percentage but increases year-over-year as the program gains traction. Figure 7-2 summarizes the process of reassigning "LO12Med" to both a faster and slower rate.

Figure 7-2 Example of Ramp Rate Reassignment

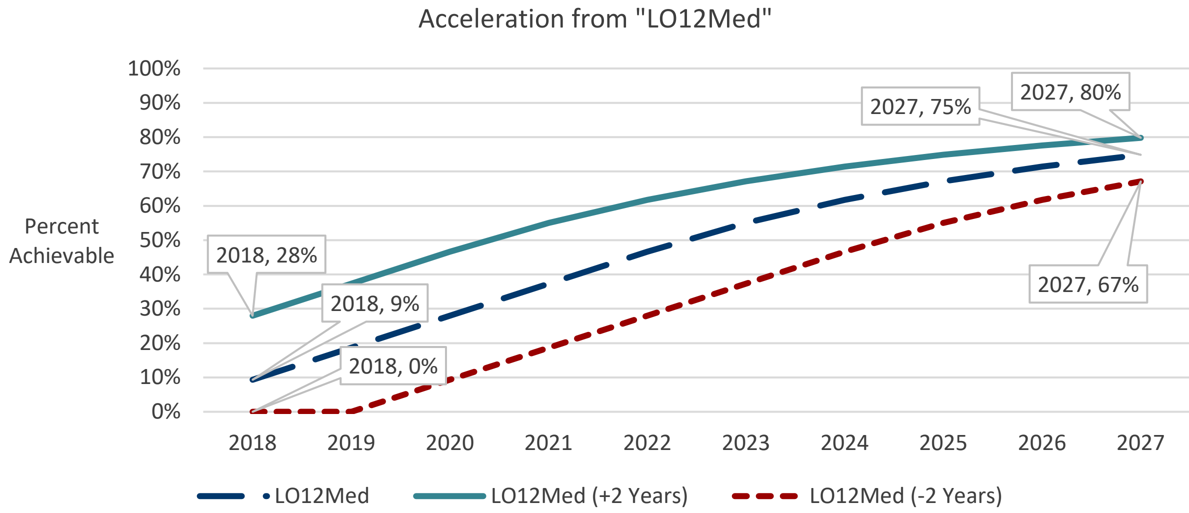


Accelerate or Decelerate an Existing Ramp Rate

While reassignment of rates was used to make changes to the achievability, AEG also configured the model to shift ramp rates forward or backward to start in a year other than the first. This allows us to state that a measure or program may be more mature than the rate originally implies but allows us to keep it on the same trajectory. We may employ this method when we observe a measure to be conserving more in practice than LoadMAP originally estimates, but not by enough to warrant complete reassignment.

Another use of this approach is to delay potential for specific measures by beginning the ramp rate in year 2 or beyond. We used this primarily for large new programs that the model identified but would not fit into 2018 programs since programs had already been designed for that year. For example, AEG identified that efficient windows (Class 30 and Class 22) were passing cost-effectiveness and have a large impact on potential. Adding this measure to the portfolio will require Cascade to recruit trade allies and generate program interest, which requires the rest of this year to accomplish. As such, we began estimating window potential in 2019. This was also used for Built Green Homes in Climate Zones 1 and 2, where the measure has not yet taken off. We anticipate there to be substantial potential, but Cascade is currently working with builders to implement this measure, which may take a few years to finalize. Figure 7-3 illustrates the process of accelerating and decelerating the "LO12Med" ramp rate by two years.

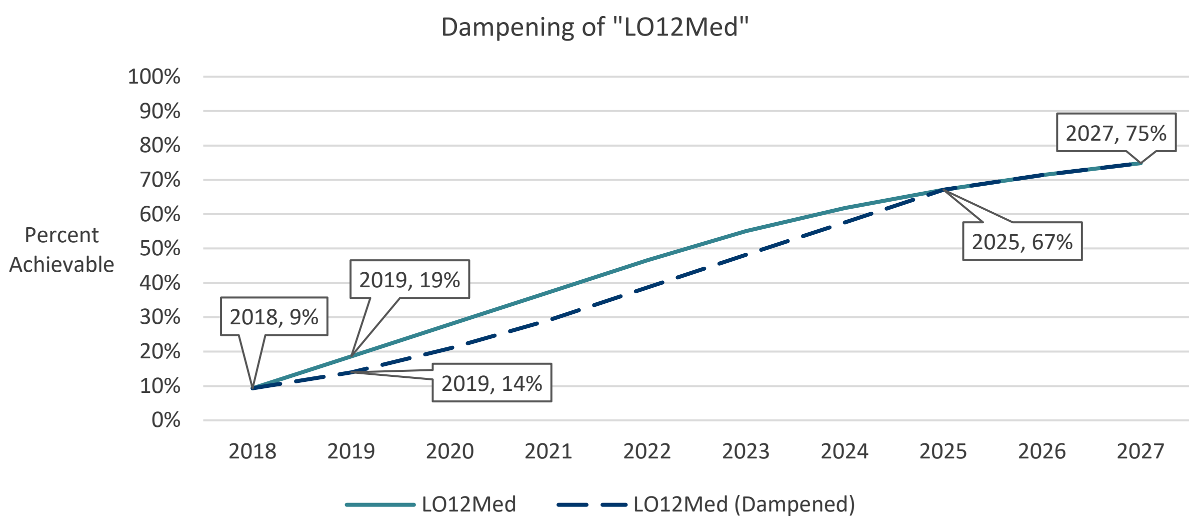
Figure 7-3 Example of Ramp Rate Acceleration/Deceleration



Dampen Early-Year Measure Ramping Effects

Many of the Power Council ramp rates are designed to increase achievability rapidly over time. This can result in two-to-three times the incremental potential for a measure compared to the previous year. In our experience, this is not always a possibility as programs require time to mature and gain traction. As such, we applied an early-year adjustment to ramp rates within LoadMAP. To do this, we reduced the acceleration in years two and three by 50%, then accelerated in years four through eight to catch up with the unmodified ramp rate. We did this such that the Council's 85% long-term achievability target would still be met while reflecting the realities in working to increase program participation. Note that this does not affect many of the more mature "Retrofit" ramp rates since they achieve a constant percentage in each of the early years. Figure 7-4 illustrates the impact of this dampening and re-acceleration on the "LO12Med" ramp rate.

Figure 7-4 Example of Ramp Rate Dampening



Design a New Ramp Rate

The final approach which AEG developed for adjusting ramp rates is to design an entirely new rate. While we prefer to use prescribed rates consistent with the Council, there are measures and programs which may not be suitable for any existing rate. While completing Cascade's CPA, AEG did not apply this approach. We are instead documenting it here for future use.

We recommend using this approach sparingly, and to reflect specific programs or measures where participation is dramatically different from a typical approach. In other CPAs, we have used this approach most frequently when assessing potential for home energy reports. Within this measure, the utility contracts with a third party to communicate energy-efficient behaviors directly to customers, using their bills as a reference. The difference between this measure and others is that it does not require the customer to participate. Participation is rather determined by the utility in coordination with their report vendor. Typical program participation may take the form of a small pilot (small achievability percentage in year-1) and a full-scale program in years 2 and 3 (high achievability percentage). This measure may also apply to more or less than the 85% maximum achievability based on the number of customers reserved in a control group for future evaluation efforts.

In the example above, none of the Council's electricity ramp rates accelerate over the course of two-to-three years to maximum achievability, which removes them as applicable options, necessitating development of this "Custom" ramp rate. The actual percentages in each year will be documentable based on the utility's deployment plan. AEG's LoadMAP model is configured to quickly incorporate additional ramp rates as necessary, which can be assigned to each individual measure permutation within the study.

8

FUTURE RECOMMENDATIONS

As part of this study, AEG is delivering a fully populated end-use model for Cascade to use in future program and resource planning efforts. This model, and all of its inputs, are "unlocked", allowing Cascade to make any changes in assumptions necessary to estimate potential as new data becomes available. In this section, we provide recommendations for future consideration by Cascade on a number of topics:

- Future Updates to the CPA
- Updating Ramp Rates in Later Years
- Incorporating the Total Resource Cost Test
- Options for Savings Outside Standard Utility Rebate Offerings

Future Updates to the CPA

Assumptions, methodologies, measures, and approaches within the industry are constantly changing. New market research surveys and emerging technologies become relevant every year. While AEG recommends more continuous monitoring for incremental updates, potential studies are generally updated every two to four years, depending on the jurisdiction. In the state of Washington, electric utilities are required to conduct a new CPA every two-years by law. With this in mind, AEG recommends tracking key data points and making updates to the LoadMAP model as they become developed and citable. Ideally, these updates would occur every two to four years at a maximum. AEG has identified a few key assumptions that may have large impacts on potential which may be tracked:

Updates to market research stock assessments (NEEA's RBSA, CBSA, and IFSA)

These surveys provide details into how energy is consumed in recent years within the Northwest. They contain detailed assumptions on home and building characteristics, including how the baseline stock has evolved over time. They are therefore a very useful resource when updating the study, either as a relevant data source or regional benchmark for Cascade-specific data. During the drafting of this report, NEEA released data on the 2016 RBSA, which may include updated assumptions on insulation levels, measure installations, and other useful details. This may also help determine the average annual consumption for a multifamily dwelling as described in the next section.

New measures or substantial changes to high-profile measures

Many measure assumptions change over time. As additional evaluation studies are conducted, and new technologies come on market, individual measure assumptions may need to be updated. For example, if a new type of highly-efficient water heater comes on market with promising technical applicability (e.g. not limited to laboratory testing), it may warrant inclusion within the model. Lifetime, savings, costs, and non-energy impacts may all be updated or added.

In addition, Cascade may determine while conducting EE programs that a certain measure is now obsolete and should be removed from the potential or replaced with a new option. This is the case with network-enabled thermostats, which are in the process of replacing standard programmable thermostats as a measure within utility programs. As Cascade recognizes people transitioning from standard programmable thermostat incentives to the networked options, this measure may be removed from the model and efforts can be fully focused on the more popular technology. NEEA also collaborates to develop new pilots and measures to be considered. These can be incorporated as they are defined, such as the new condensing rooftop heater measure which is currently under development.

Updates in federal standards or building codes

New federal equipment standards and updates to state-level building codes may be finalized and take effect during the study period. If these impact high-potential measures, AEG recommends updating the model to explicitly remove obsolete technologies from the market. This could take the form of an accelerated, or delayed, AFUE 92% furnace standard, which has implications for programs in the mid-2020's. Additionally, the state of Washington will be releasing new building codes every three years. While the 2015 WSEC is very efficient and resulting in large efficiency gains in new homes, it is possible that enhancements or additional specifications may be made. Cascade may choose to update the model to remove or tailor measures to meet these new standards. For example, if it is determined that high-efficiency water heaters are part of the base-code rather than the optional credit section (where they are now), potential for this measure and Built Green Homes may be modified downward.

Future refinements based on natural gas primary data

Through programs, audits, inspections, and surveys, Cascade may identify changes in the market or additional details to be considered within the model. These can be easily built into the base-year market profile or baseline projection, further customizing the model to the territory. Examples of future data which may become available include:

- Updates to appliance saturations within Cascade's customer database
- Additional research into multifamily consumption per apartment dwelling
- Progress in vendor recruitment for weatherization and windows in the various Climate Zones, accelerating potential for those measures
- Results of new pilots in Cascade's territory, such as Built Green Homes in Climate Zones 1 and 2 or results of NEEA emerging technology pilots

Another useful refinement includes enhancing the model by incorporating the most recent years of billing data. In February of 2018, AEG worked with Cascade to incorporate actual data (consumption and customers at a sector-level) into the models. Results of this update can be seen in the baseline section of this report.

Updating Ramp Rates in Later Years

Customer participation in programs may change over time for a variety of reasons. In addition to the updates discussed in Section 7, it will be necessary to update all ramp rates at various points in the future. This may occur after the Council releases their Eighth Electric Power Plan with updated ramp rates or when Cascade chooses to update the base-year of the potential study.

In the first case, AEG recommends performing a similar step to that taken in this study. This includes mapping electric ramp rates to their closest gas counterparts then adjusting appropriately to reflect the differences between electric and gas EE programs. The four approaches identified here may be utilized to accomplish this.

In the second case, the question is whether to shift all ramp rates back to year-1 or continue with a different starting year. This is an interesting point of discussion, where AEG recommends a hybrid approach:

1. Re-align the first year of each ramp rate with the new start year (reassigning ramp rates to the most similar Council rates is likely not necessary here)
2. Evaluate accelerating key measures based on program accomplishments (e.g. starting furnaces in year-3 if potential continues to outperform the original rate)
3. Evaluate market conditions and identify any barriers to participation where measures are not keeping up with estimates
    a. This point may also be used to re-evaluate existing barriers and consider adjusting if they have been mitigated (e.g. fireplace efficiency labeling becomes simplified resulting in more efficient purchases)

Please note that we recommend beginning the faster retrofit ramp rates in year-1. In contrast to lost opportunity rates, which increase over time to reach 85%, retrofits decrease such that the sum of all years is 85%. By starting a retrofit ramp rate in year 2 or 3, that first year of achievability is lost and the sum will be less than 85% by the end of the study. Note this may still be appropriate for some of the slowest rates where the percent lost is fractional and it aligns better but should not be used for the "Medium" or "Fast" ramp rates.

Incorporating the Total Resource Cost Test

In addition to the UCT, LoadMAP has been configured to evaluate potential using the TRC. This test focuses on impacts for both the utility and customer, which is an alternative frame of reference from the UCT. The TRC includes the full measure cost (incremental for lost opportunities, full cost for retrofits), which is generally substantially higher than the incentive cost included within the UCT. The TRC does include one additional value stream that the UCT does not, non-energy impacts. This test is fully incorporated into LoadMAP and prepared for Cascade to use in the event the Company feels a "fully balanced" TRC is identified.

In accordance with Council methodology, these impacts must be quantified and monetized, meaning impacts such as personal comfort, which are difficult to assign a value to, are not included. What this does include are additional savings including water reductions due to low-flow measures or reduced detergent requirements to wash clothes in a high-efficiency clothes washer. AEG has incorporated these impacts as they are available in source documentation, such as RTF UES workbooks.

Some impacts are already included within Cascade's avoided costs. These include the 10% conservation credit applied by the Council for infrastructure benefits of efficiency. The future prices of carbon are also included. Additionally, risk adders for the procurement of natural gas supplies in future years are also already incorporated. Per TRC methodology, as these impacts are already captured within the avoided costs provided to AEG, we did not incorporate them a second time outside the costs.

Another set of impacts captured within Council methodology include the Simplified Energy Enthalpy Model (SEEM) "calibration credits". The Council calibrates this energy model using metered end-use energy consumption to reflect actual conditions. While these are technically energy impacts, they are not captured as a benefit to a natural-gas utility as they are instead an impact on the customer. The Council then assumes the difference between the uncalibrated and calibrated models represents the impacts of secondary heating by different fuels present in the home. In the Council's case, these could be small gas heaters or wood stoves present alongside an electric forced-air furnace. For Cascade, AEG followed a similar methodology, but instead applied the calibration percent impact to estimated gas-heating savings rather than electric. To monetize these impacts, we incorporated the latest Mid C energy prices, including carbon impacts, from the RTF's website, adjusted for differences in efficiency between electric and natural gas heating equipment (e.g. converted therm savings from an AFUE 80% baseline to kWh savings from an EF 0.97 resistance heater baseline). We applied these impacts to many non-equipment measures with space heating impacts in all sectors as well as to residential space heating equipment, which was the primary use for the Council.

Finally, AEG identified additional non-gas end uses which may be impacted by gas efficiency measures. These include impacts from other end uses, such as cooling savings due to efficient shell measures or lighting savings due to a comprehensive retrocommissioning or strategic energy management program. Like the calibration credit above, these do not have a benefit to a natural-gas utility but do to the customer. It is worth a note of caution when incorporating these impacts. Certain comprehensive building measures, such as retrocommissioning and strategic energy management have very large electric impacts that may be greater than the original estimated gas impacts. LED lighting is a very popular technology within electric utility-programs and can have massive impacts. Commercial HVAC retrocommissioning includes both cooling and ventilation electric impacts, which could outweigh the gas space heating impacts. We only recommend incorporating these into future TRC analyses if additional steps are taken to partner with electric utilities within the territory to share the costs. We have seen this accomplished successfully in other jurisdictions, leading to a high level of both electric and natural gas savings. If this step is not taken, AEG recommends removing these impacts from LoadMAP. This can be done by setting these values to "FALSE" when generating new impacts.

Options for Savings Outside Standard Utility Rebate Offerings

In addition to the recommendations above, AEG has also identified recommendations for achieving additional savings outside standard utility rebate offerings. There are several delivery mechanisms and tools at a utility's disposal when looking to expand EE initiatives. We discuss several of them here:

Identify additional measure bundles

One way to achieve deeper energy savings is to bundle the installation of compatible measures within a utility program. Cascade currently implements this as a bonus incentive credit for installing more than one measure, which is a good way to increase participation in existing programs. Another option is to bundle low-cost or no-cost measures.

Regarding low-cost or no-cost measures, these are typically less costly operations and maintenance type measures (O&M) which may not be cost-effective on their own. This is because it would cost too much in labor for a contractor to travel to a customer site just to implement this one measure, but the incremental cost is very low when already on-site. Examples of this include cleaning filters or checking sensors on the heating system when installing a new measure or sealing off the most problematic areas of a home "prescriptively" while installing attic insulation. Both of these are difficult measures to incentivize on their own but can be added onto a larger measure. It is worth noting in these cases that interactive effects between measures may be much greater than the population as a whole. For example, if installing insulation and tuning up a furnace at the same time, the reduced runtime due to less heat loss results in a lower baseline that the maintenance measure is applied to, reducing savings. This may not apply to a prescriptive air sealing measure and weatherization since they are reducing heat loss from two separate sources within the home and do not interact. Please note that if employed within Cascade's programs, future research and exploration into interactive savings for these bundles would be required to accurately track energy savings.

"Cross-sell" additional measures

Another option is to encourage contractors to "cross-sell" measures when engaged with a customer. This could involve the installation of a smart thermostat when already onsite to install an efficient furnace or the installation of low-flow showerheads when upgrading a water heater. In the cases described here, interactive effects would need to be considered.

These options don't necessarily need to be related to result in additional savings. A common approach in electric direct install programs is to replace high-usage lamps with LEDs and showerheads with low-flow variants when onsite for a larger project. These are cheaper technologies that can be installed without significant additional work and can result in savings that are unlikely to interact with one another (e.g. different end uses).

One of the most successful uses of this approach is with retrocommissioning and energy management programs. These programs get a trained contractor or engineer onsite to improve operation of a building or industrial facility. This expert is able to identify additional capital measures at the same time, resulting in increased participation in programs and additional custom savings. In this case, the retrocommissioning study can be funded by, or partially by, the utility and include the stipulation that the customer install a certain number of non-capital measures with short simple paybacks. At the same time, larger capital projects with deeper energy savings will be identified for the contractor, which can "fast track" the implementation and review process, increasing customer participation.

Partner with nearby electric utilities

The retrocommissioning and strategic energy management programs described above are best employed by leveraging relationships with neighboring electric utilities. These programs can address many end uses at once and are typically more efficient when doing so. Working with an electric utility to split the costs can have significant upsides. It allows for the companies to share marketing and outreach and contact more customers. This may be necessary to incorporate retrocommissioning programs under the TRC since the electric benefits may outweigh those identified for gas.

Another opportunity for collaboration is on weatherization or energy kit programs. Weatherization can save energy on both gas heating and electric cooling plus ventilation, so once again, costs and outreach can be shared. Energy savings kits could also combine electric and gas measures. If a standard gas kit with showerheads, aerators, and possibly weather strips is expanded to include LED lamps, both utilities can benefit from savings and outreach.

Continue participating in pilot/emerging technology studies with NEEA

Cascade already participates with NEEA regarding gas efficiency initiatives and pilots. These are a valuable source of potential and can help inform future full-scale efficiency programs. Continuing to be involved in these initiatives can be a good way to introduce new measures and technologies to market.

Assist in market transformation initiatives

AEG's final recommendation is to assist in market transformation efforts in the region. This could manifest itself both by participation in NEEA's market transformation efforts, which affect the regional and national levels, as well as independent research projects. For example, if a measure is popular, widely available, and non-cost prohibitive, there may be ways to incorporate this technology into the baseline. This approach does not reduce the energy savings realized by a customer, just shifts it out of a utility EE program into the baseline where it is automatically captured in new construction and major retrofits. The state of Washington drafts new building codes every three years and looks to incorporate measures that may be achieving market transformation.

Applied Energy Group, Inc.
500 Ygnacio Valley Road, Suite 250
Walnut Creek, CA 94596
P: 510.982.3525

Applied Energy Group

2017 CASCADE NATURAL GAS CONSERVATION POTENTIAL ASSESSMENT

Volume 2, Appendices

April 17, 2018

Report prepared for:
CASCADE NATURAL GAS CORPORATION

Energy Solutions. Delivered.

This work was performed by:

Applied Energy Group, Inc.
500 Ygnacio Valley Road, Suite 250
Walnut Creek, CA 94596

Project Director: I. Rohmund
Project Manager: K. Kolnowski
Lead Analyst: K. Walter

AEG would also like to acknowledge the valuable contributions of

Cascade Natural Gas Corporation
1600 Iowa Street
Bellingham, WA 98229

Project Team: M. Cowlishaw
K. Burin
A. Sargent
K. Crouse
J. Napolitano
S. McElhinney
R. White

EXECUTIVE SUMMARY

In the fall of 2017, Cascade Natural Gas Corporation (Cascade) contracted with Applied Energy Group (AEG) to conduct this Conservation Potential Assessment (CPA) in support of their conservation and resource planning activities. This report documents this effort and provides estimates of the potential reductions in annual energy usage for natural gas customers in the Cascade service territory from energy conservation efforts in the time period of 2018 to 2038. To produce a reliable and transparent estimate of energy efficiency (EE) resource potential, the AEG team performed the following tasks to meet Cascade's key objectives:

- Used information and data from Cascade, as well as secondary data sources, to describe how customers currently use gas by sector, segment, end use and technology.
- Developed a baseline projection of how customers are likely to use gas in absence of future EE programs. This defines the metric against which future program savings are measured. This projection used up-to-date technology data, modeling assumptions, and energy baselines that reflect both current and anticipated federal, state, and local energy efficiency legislation that will impact energy EE potential.
- Estimated the technical, achievable technical, and achievable economic potential at the measure level for energy efficiency within Cascade's service territory over the 2018 to 2038 planning horizon.
- Deliver a fully configured end-use conservation planning model, LoadMAP, for Cascade to use in future potential and resource planning initiatives

In summary, the potential study provided a solid foundation for the development of Cascade's energy savings targets. Table ES-1 summarizes the results of this study at a high level. AEG analyzed potential for the residential, commercial, and industrial market sectors. First-year utility cost test (UCT) achievable economic potential is 658 thousand therms. This increases to 1,404 thousand therms in the second year and 29,035 thousand therms by the eleventh year. As part of this study, we also estimated total resource cost (TRC) potential, with the focus of fully balancing non-energy impacts. This includes the use of full measure costs as well as quantified and monetizable non-energy impacts and non-gas fuel impacts (e.g. electric cooling or wood secondary heating) consistent with methodology within the Seventh Northwest Conservation and Electric Power Plan (Seventh Plan). We have also built a framework for estimating potential under the Resource Value Test (RVT) in the event jurisdictional goals are defined.

Table ES-1 Conservation Potential by Case, Selected Years (thousand therms)

Scenario	2018	2019	2020	2022	2028	2038
Baseline Projection (thousand therms)	253,869	256,413	259,098	264,884	282,830	319,800
Cumulative Savings (thousand therms)						
UCT Achievable Economic Potential	658	1,404	2,382	6,758	29,035	63,358
Achievable Technical Potential	1,314	2,691	4,316	10,667	39,459	75,884
Technical Potential	3,361	6,560	9,945	19,760	52,882	88,728
Cumulative Savings (% of Baseline)						
UCT Achievable Economic Potential	0.3%	0.5%	0.9%	2.6%	10.3%	19.8%
Achievable Technical Potential	0.5%	1.0%	1.7%	4.0%	14.0%	23.7%
Technical Potential	1.3%	2.6%	3.8%	7.5%	18.7%	27.7%

Key opportunities for savings include residential furnace and water heating equipment upgrades and weatherization as well as Built Green savings in later years.

CONTENTS

Executive Summary ... i

1 INTRODUCTION ... 5
Goals of the Conservation Potential Assessment ... 5
Summary of Report Contents ... 6
Abbreviations and Acronyms ... 8

A ALIGNMENT WITH THE COUNCIL'S SEVENTH PLAN METHODOLOGY ... A-1

B DATA DICTIONARY ... B-1
Modeling Tool ... B-1
LoadMAP End-Use Forecasting Tool ... B-1
Model Input Spreadsheets ... B-1
Market Profile ... B-2
Segmentation ... B-2
Profile Parameters ... B-2
Base-Year Energy Equation ... B-3
Segmentation Definitions ... B-4
Residential Segmentation ... B-4
Commercial Segmentation ... B-4
Industrial Segmentation ... B-5
End-Use Definitions ... B-5
Baseline Projection ... B-6
Projection Modeling Components ... B-6
Projection Parameters ... B-6
Baseline Projection Equation ... B-7
Potential Estimation ... B-7
ECM Parameters ... B-8

C RESOURCE VALUE TEST POTENTIAL ... C-1
Background ... C-1
Summary of RVT Impacts and AEG's Recommendations ... C-1
Methodology for Quantifying Benefits ... C-3
Jurisdiction-Specific Studies ... C-3
Studies from Other Jurisdictions ... C-3
Apply Similar Proxies ... C-3
Quantitative and Qualitative Information and Alternative Thresholds ... C-4
Preliminary Results of RVT Analysis ... C-4

D MARKET PROFILES ... D-1
Residential Market Profiles ... D-1
Commercial Market Profiles ... D-4
Industrial Market Profiles ... D-9

E CUSTOMER ADOPTION FACTORS ... E-1

LIST OF FIGURES

Figure 1-1 Cascade's Washington Service Territory (courtesy Cascade)....................................6
Figure C-1 Annual Share of Preliminary RVT Estimates by Sector C-5

LIST OF TABLES

Table ES-1 Conservation Potential by Case, Selected Years (thousand therms) i
Table 1-1 Explanation of Abbreviations and Acronyms 8
Table B-1 Description of End Uses by Market Sector... B-5
Table C-1 Non-Utility RVT Impacts Considered for the 2017 Cascade CPA...........................C-2
Table C-2 Preliminary Potential Estimates using the RVT (thousand therms)..........................C-4
Table C-3 Preliminary RVT Potential Estimates by Sector (thousand therms) C-5
Table D-1 Average Market Profile for the Single-Family Segment in Climate Zone 1, 2016 . D-1
Table D-2 Average Market Profile for the Multi-Family Segment in Climate Zone 1, 2016 ... D-1
Table D-3 Average Market Profile for the Single-Family Segment in Climate Zone 2, 2016 . D-2
Table D-4 Average Market Profile for the Multi-Family Segment in Climate Zone 2, 2016 ... D-2
Table D-5 Average Market Profile for the Single-Family Segment in Climate Zone 3, 2016 . D-3
Table D-6 Average Market Profile for the Multi-Family Segment in Climate Zone 3, 2016 ... D-3
Table D-7 Average Market Profile for the Office Segment, 2016 .... D-4
Table D-8 Average Market Profile for the Retail Segment, 2016 .... D-4
Table D-9 Average Market Profile for the Restaurant Segment, 2016 .... D-5
Table D-10 Average Market Profile for the Grocery Segment, 2016.. D-5
Table D-11 Average Market Profile for the Education Segment, 2016 .... D-6
Table D-12 Average Market Profile for the Healthcare Segment, 2016 .... D-6
Table D-13 Average Market Profile for the Lodging Segment, 2016.. D-7
Table D-14 Average Market Profile for the Warehouse Segment, 2016 .... D-7
Table D-15 Average Market Profile for the Miscellaneous Segment, 2016 .... D-8
Table D-16 Average Market Profile for the Food Products Segment, 2016............................. D-9
Table D-17 Average Market Profile for the Agriculture Segment, 2016................................... D-9
Table D-18 Average Market Profile for the Primary Metals Segment, 2016............................. D-9
Table D-19 Average Market Profile for the Stone, Clay, and Glass Segment, 2016.............. D-10
Table D-20 Average Market Profile for the Petroleum Segment, 2016 .... D-10
Table D-21 Average Market Profile for the Paper and Printing Segment, 2016..................... D-10
Table D-22 Average Market Profile for the Instruments Segment, 2016 .... D-1
Table D-23 Average Market Profile for the Wood and Lumber Segment, 2016....................... D-1
Table D-24 Average Market Profile for the Other Industrial Segment, 2016 .... D-1
Table E-1 Ramp Rates Used in CPA Analysis..E-0

1

INTRODUCTION

This report documents the results of the Cascade Natural Gas Corporation 2018-2037 Conservation Potential Assessment (CPA) as well as the steps followed in its completion. Throughout this study, AEG worked with Cascade to understand the baseline characteristics of their service territory, including a detailed understanding of energy consumption in the territory, the assumptions and methodologies used in Cascade's official load forecast, and recent programmatic accomplishments. Adapting methodologies consistent with the Northwest Power and Conservation Council's (Council's) Seventh Conservation and Electric Power Plan[1] for natural gas studies, AEG then developed an independent estimate of achievable, cost-effective EE potential within Cascade's service territory between 2018 and 2038.

Goals of the Conservation Potential Assessment

The first primary objective of this study was to develop independent and credible estimates of EE potential achievably available within Cascade's service territory using accepted regional inputs and methodologies. This included estimating technical, achievable technical, then achievable economic potential, using the Council's ramp rates as the starting point for all achievability assumptions, leveraging Northwest Energy Efficiency Alliance's (NEEA's) market research initiatives, and utilizing assumptions consistent with Seventh Plan supply curves and RTF measure workbooks when appropriate for use in natural gas planning studies.

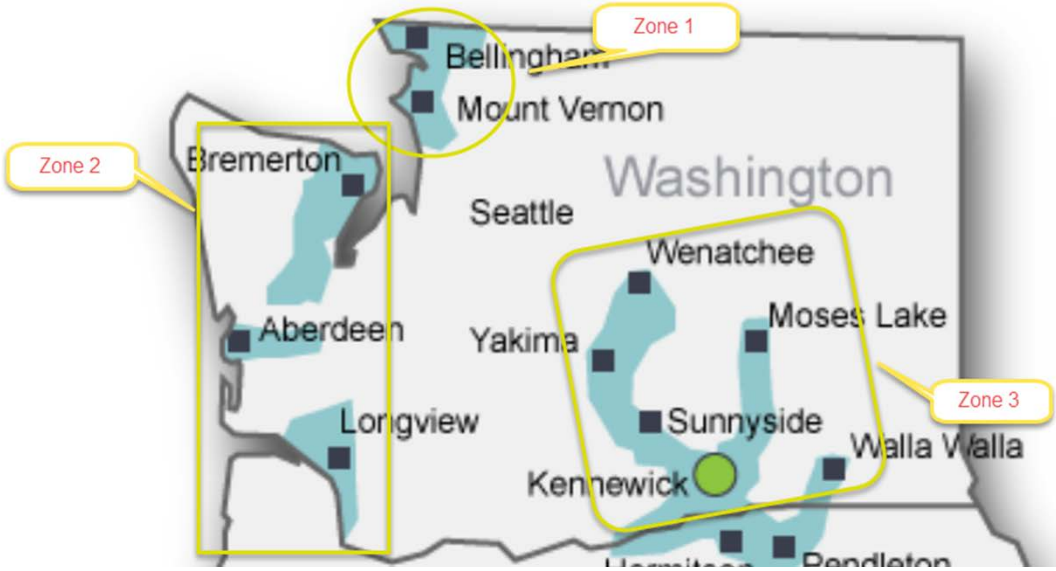
The second primary objective was to deliver a fully configured end-use model for Cascade to use in future EE planning initiatives. AEG has customized its LoadMAP end-use planning tool with data specific to Cascade's territory and the Northwest. This includes a detailed snapshot of how Cascade's customers use energy in the base year of the study, 2016, assumptions on future customer growth from Cascade's load forecasting team, and measure assumptions using Cascade primary data, regional research, and well-vetted sources from around the nation. AEG has also facilitated training sessions with the Cascade team to ensure a smooth handoff of the model.

Additionally, the CPA is intended to support the design of programs to be implemented by Cascade during the upcoming years. One output of the LoadMAP model is a comprehensive summary of measures. This summary documents input assumptions and sources on a per-unit value, program applicability and achievability (ramp rates), and potential results (units, incremental potential, and cumulative potential) as well as cost-effectiveness at the TRC, UCT, and RVT levels. This summary was developed in collaboration with Cascade and refined throughout the project.

Finally, this study was developed to provide EE inputs into Cascade's Integrated Resource Planning (IRP) process. To this end, AEG developed detailed achievable economic EE inputs by measure for input into Cascade's SENDOUT planning model. These inputs are highly customizable and provide potential estimates at the Washington-territory level, Cascade climate zone, and city-gate level. We present a map of Cascade's Washington climate zones and city gates in Figure 1-1, to summarize the terms we reference throughout this study.

[1] "Seventh Northwest Conservation and Electric Power Plan." Northwest Power & Conservation Council, February 10, 2016. http://www.nwcouncil.org/energy/powerplan/7/plan/

Figure 1-1 Cascade's Washington Service Territory (courtesy Cascade)



Summary of Report Contents

The document is divided into six additional chapters, summarizing the approach, assumptions, and results of the EE potential analysis. We describe each section below:

Volume 1, Final Report:

- **Analysis Approach and Data Development.** Detailed description of AEG's approach to conducting Cascade's 2018-2038 CPA and documentation of primary and secondary sources used.
- **Market Characterization and Market Profiles.** Characterization of Cascade's service territory in the base year of the study, 2016, including total consumption, number of customers and market units, and energy intensity. This also includes a breakdown of the energy consumption for residential, commercial, and core industrial customers by end use and technology.
- **Baseline Projection.** Projection of baseline energy consumption under a naturally occurring efficiency case, described at the end-use level. The LoadMAP models were first aligned with actual sales and Cascade's official, weather-normalized econometric forecast and then varied to include the impacts of future federal standards, ongoing impacts of the 2015 Washington State Energy Code on new construction, and future technology purchasing decisions.
- **Overall Energy Efficiency Potential.** Summary of EE potential for Cascade's entire service territory for selected years between 2018 and 2038.
- **Sector-Level Energy Efficiency Potential.** Summary of EE potential for each market sector within Cascade's service territory, including residential, commercial, core industrial customers. This section includes a more detailed breakdown of potential by measure type, vintage, market segment, end use, and Cascade climate zone in the case of residential.
- **Comparison with Current Programs and Ramp Rate Adjustments** Detailed comparison of potential with current Cascade programs, including new opportunities for potential. Also describes AEG's

recommended process for adapting the Council's Seventh Plan ramp rates for use with natural gas EE measures.

- **Recommendations:** Discussion of recommendations for future analysis or research by Cascade. Includes notes on updating the CPA in future years, refinements on primary natural gas data, adjustment of participation rates in future years, and additional options for savings outside of standard rebate offerings.

Volume 2, Appendices:

- **Alignment with the Council's Seventh Plan Methodology.** Discussion on how this study aligns with Council electric-centric methodologies, including ramp rates, regional data, and measure assumptions.
- **Data Dictionary.** Defines terms commonly used within the potential study process and LoadMAP models. This covers all phases of the potential study from market characterization through potential estimation and resource planning.
- **Resource Value Test Potential.** Preliminary estimate of EE potential using the recently released Resource Value Test rather than UCT or TRC for cost-effectiveness.
- **Market Profiles.** Detailed market profiles for each market segment. Includes equipment saturation, unit energy consumption or energy usage index, energy intensity, and total consumption.
- **Customer Adoption Factors.** Documentation of the ramp rates used in this analysis. These were adapted from the Seventh Plan electrical power conservation supply curve workbooks for use in the estimation of achievable natural gas potential.
- **Measure List.** Contained in a separate spreadsheet accompanying delivery of this report. List of measures, along with example baseline definitions and efficiency options by market sector analyzed.
- **Detailed Measure Assumptions.** Contained in a separate spreadsheet accompanying delivery of this report. This dataset provides input assumptions, measure characteristics, cost-effectiveness results, and potential estimates for each measure permutation analyzed within the study.
- **LoadMAP Process Manual.** Contained within a separate document and delivered alongside this report, the process manual is intended to serve as a guide to updating and running the LoadMAP model. It also contains recommendations on how to update key data and assumptions relevant to future planning efforts undertaken by Cascade.

Abbreviations and Acronyms

Throughout the report we use several abbreviations and acronyms. Table 1-1 shows the abbreviation or acronym, along with an explanation.

Table 1-1 Explanation of Abbreviations and Acronyms

Acronym	Explanation
AEO	Annual Energy Outlook forecast developed by EIA
B/C Ratio	Benefit to Cost Ratio
BEST	AEG's Building Energy Simulation Tool
BPA	Bonneville Power Administration
C&I	Commercial and Industrial
CBSA	NEEA's 2014 Commercial Building Stock Assessment
Council	Northwest Power and Conservation Council (NWPCC)
DHW	Domestic Hot Water
DSM	Demand Side Management
EE	Energy Efficiency
EIA	Energy Information Administration
EUL	Estimated Useful Life
EUI	Energy Usage Intensity
HVAC	Heating Ventilation and Air Conditioning
IFSA	NEEA's 2014 Industrial Facilities Site Assessment
IRP	Integrated Resource Plan
LoadMAP	AEG's Load Management Analysis and Planning™ tool
NEEA	Northwest Energy Efficiency Alliance
O&M	Operations and Maintenance
RBSA	NEEA's 2012 Residential Building Stock Assessment
RTF	Regional Technical Forum
RVT	Resource Value Test
TRC	Total Resource Cost test
UCT	Utility Cost Test
UEC	Unit Energy Consumption
UES	Unit Energy Savings
WSEC	2015 Washington State Energy Code

A

ALIGNMENT WITH THE COUNCIL'S SEVENTH PLAN METHODOLOGY

While developing potential estimates for Cascade's CPA, AEG strove to adapt Northwest Power & Conservation Council's Seventh Conservation and Electric Power Plan methodologies wherever appropriate for gas studies and maintain consistency with analysis procedures within the region. To accomplish this, AEG employed the following approach:

- Estimate technical, achievable technical, and achievable economic potential
- Utilize regional market baseline data
- Consider all measures within the Seventh Plan and RTF work products when applicable to gas, utilize or adapt Council and RTF assumptions wherever possible
- Adapt the Seventh Plan's ramp rates for use in natural gas efficiency programs
- Incorporate all quantified and monetized non-energy impacts when developing a fully balanced TRC

We describe these in more detail below.

Estimate technical, achievable technical, and achievable economic potential

Within the Seventh Plan, the Council estimates three levels of potential, technical, achievable technical, and achievable economic. This is different from best-practice methodology for other parts of the country, where technical, economic, then achievable potential is estimated. The primary advantage of estimating achievable technical potential first is that it allows for a more apples-to-apples comparison with previous studies and other utilities throughout the region. Avoided costs are one of the most likely potential drivers to change and will likely vary by utility, so isolating this impact is important when making comparisons.

Within AEG's LoadMAP model, we estimate potential using the Council's preferred approach of beginning with technical potential, applying ramp rates to estimate achievable technical potential, and finally screening for cost effectiveness to estimate achievable economic potential. Within this study, AEG estimated potential primarily under the UCT, since that is Cascade's primary cost-effectiveness test, but also estimated potential using the Council's preferred test, a fully-balanced TRC, for future reference and planning initiatives if necessary.

Utilize regional market baseline data

In addition to Cascade-specific data, which is the best-practice primary source available, AEG relied on NEEA's regional stock and site assessments, the 2011 RBSA, 2014 CBSA, and 2014 IFSA. These surveys, which also informed the baseline of the Seventh Plan, contain detailed home, building, and industrial facility information for customers in the region. While these surveys have primarily been used to inform electric CPAs, AEG identified a list of useful data that is applicable for gas customers in the region as well. For example, AEG utilized detailed home and building shell characteristics to determine the applicable portion of the market for many retrofit opportunities. This included the percentage of customers with no, or very low, ceiling insulation. We also used this to determine baseline window types (e.g. single vs. double pane) and amount of homes with exterior ductwork.

NEEA's surveys were also used to inform commercial and industrial energy intensities on a square foot and employee basis respectively. This data, particularly the consumption per square foot, is invaluable when determining energy consumption in commercial and industrial facilities. Compared to a residential home, which roughly corresponds one-to-one with customer accounts, a commercial facility may be anywhere from a few thousand square feet to over one million. Utilizing NEEA data allowed AEG an additional benchmark upon which to estimate building energy consumption.

Consider all measures within the Seventh Plan and RTF work products when applicable to gas, utilize or adapt Council and RTF assumptions wherever possible

While many of the Council and RTF assumptions were developed with electricity savings in mind, there is data that may be adapted for use in estimating gas potential. For example, weatherization measures may be applied equally to both electric and gas heating systems, so assumptions on lifetime and cost are applicable to both. Additionally, energy savings as percent of baseline consumption may also be adapted if reasonably scrutinized. For example, electric resistance and natural gas direct-fuel furnaces should share similar load shapes and save similar percentages. On the other hand, efficiency of electric air-source heat pumps varies by load and outside temperatures and is not comparable to any commercially available gas technologies and should not be used.

When developing the measure list for this study, AEG began with workbooks from the Seventh Plan and RTF to ensure that all similar measures were captured. We used assumptions from these workbooks when appropriate, and substituted gas-specific details as necessary.

Adapt the Seventh Plan's ramp rates for use in natural gas efficiency programs

A key driver in estimation of potential are participation rates, also known as ramp rates. These identify the percentage of an applicable population that will adopt an efficiency measure as part of a utility EE program or other non-utility mechanism within the territory. For CPAs in the Northwest, and particularly the state of Washington, the Seventh Plan's electric ramp rates are a key source of information. While very thorough and straightforward to use, these were developed with electric utilities and electric programs in mind. This implies that they may not be appropriate to apply directly to natural gas EE programs or measures.

AEG utilized these ramp rates as a starting point for estimating potential. We adapted the Councils ramp rate assignments from electric measures to their most similar gas counterparts (e.g. started with identical ramp rates for weatherization). We also applied ramp rates based on similar electric technology categories (e.g. similar food preparation rates). The next step was to adapt these for use in natural gas programs, using observations from programs within the region as well as implementation knowledge provided by the Cascade team. This information was used to both identify high-performing programs (accelerate potential) and additional market barriers (to possibly delay potential). To apply these ramp rates to a natural gas potential assessment, AEG utilized three of the following approaches:

- Reassign an individual measure's ramp rate
- Accelerate or decelerate an existing ramp rate
- Dampen early-year measure ramping effects
- Design a new ramp rate

A description of how these approaches were used may be found in Section 7 of this report. Recommendation on how to further adapt these ramp rates in the future may be found in Section 8.

Incorporate all quantified and monetized non-energy impacts when developing a fully balanced TRC

In addition to the UCT, LoadMAP has been configured to evaluate potential using the TRC. This test focuses on impacts for both the utility and customer, which is a different frame of reference from the UCT. In the TRC, this involves including the full measure cost (incremental for lost opportunities, full cost for retrofits), which is generally substantially higher than the incentive cost included within the UCT. The TRC does include one additional value stream that the UCT does not, non-energy impacts. This test is fully incorporated into LoadMAP and prepared for Cascade to use in the event a "fully balanced" TRC is identified.

In accordance with Council methodology, these impacts must be quantified and monetized, which means impacts such as personal comfort, which are difficult to assign a value to, are not included. What this does include are additional savings such as water reductions due to low-flow measures or less detergent required to wash clothes in a high-efficiency clothes washer. AEG has incorporated these impacts as they are available in source documentation, such as RTF UES workbooks. We estimated TRC non-energy impacts in the following ways:

- Include quantified and monetized non-energy impacts present in Council and RTF workbooks
- Incorporate NEIs directly into the avoided cost (e.g. 10% conservation credit, carbon adders, and natural gas risk adders)
- Account for the presence of secondary heating when calibrating energy models (e.g. apply a calibration credit to many space heating savings)
- Account for non-gas impacts, such as cooling savings within a weatherization program or lighting savings from a retrocommissioning program

These impacts are quantified within the LoadMAP models and utilized to assess achievable economic potential under the TRC. Results of this analysis may be found in Sections 5 and 6 of this report.

B

DATA DICTIONARY

This appendix provides definitions for a list of terms commonly used in the development of Cascade's 2017 Conservation Potential Assessment (CPA).

Modeling Tool

LoadMAP End-Use Forecasting Tool

AEG's custom end-use energy forecasting and modeling tool. The model is separated into three modules as detailed below.

LoadMAP Baseline

Baseline end-use forecasting tool. The model takes a units-based approach to stock turnover, tracking equipment installations in each year.

LoadMAP Potential

Potential forecasting module which calculates potential relative to the baseline projection developed in the previous module. This model begins with the detailed stock accounting results from the LoadMAP Baseline analysis but converts all measures to single line-item for transparency and ease of review.

LoadMAP Results

Summarizes modeling outputs from the two prior modules at both a high level and in measure-by-measure detail. This module does not perform any potential estimation calculations but is instead intended to serve as a centralized location for reviewing model outputs and summarizing results.

Model Input Spreadsheets

Three separate spreadsheets are used to develop inputs that feed into the LoadMAP model. These allow us to organize data, efficiently update assumptions, and convert data into a format more suitable for computer use.

Market Profile

LoadMAP input tool which deconstructs utility-provided base-year consumption data into detailed sectors, segments, end uses, and technologies as described below.

Equipment Input Generator

Formats modeling inputs for all equipment types of technologies. The LoadMAP modeling framework defines a piece of equipment as a piece of energy-consuming technology whose primary function is to deliver an end-use service, such as heating a home.

Non-Equipment Input Generator

Formats modeling inputs for all non-equipment types of measures. The primary purpose of non-equipment measures is to modify energy consumption of equipment technologies and save energy. Examples include smart thermostats and low-flow showerheads.

Occasionally, an equipment technology may be classified as a non-equipment measure for modeling considerations, such as if the equipment in question does not directly use the energy fuel under study, or if more than one end use would be affected. This occurs in the case of clothes washers, which consume electricity to mechanically clean clothes, but will save natural gas if connected to a gas-fired water heater.

Market Profile

Market profiles characterize energy use for each customer segment, end use, and technology for the base year. The base-year market profiles are the basis for developing the forecast of annual energy use by customer segment and end use.

Segmentation

The purpose of segmenting a market is to group customers into segments with common properties. When developing a profile, we break energy out using the following categories:

Market Sector

Distributes the market by general use type. The most common sectors are residential, commercial, and industrial.

Market Segment

Defines the primary market segments. This approach is useful because energy-use patterns differ strongly across home types in the residential sector, building types in the commercial sector, and industries in the industrial sector. Differences reflect variation in energy-using activities and energy-using equipment and technologies.

Vintage

The model separates floor area into new and existing vintages. Existing homes are present in the base-year of the study and go off-market over the study period. The new vintage includes new construction as well as major retrofits which are subject to current building codes. The new vintage grows over time.

End Use

An energy end use is the ultimate service delivered by energy-using equipment, such as Space Heating, Water Heating, etc.

Technology

The term "Technology" is used in LoadMAP to indicate the specific type of equipment used to deliver the end-use service. Equipment technologies consume energy and represent the most granular energy classification within the market profile. Examples of equipment technologies include forced-air furnaces, tankless water heaters, and ovens.

Profile Parameters

The market profile contains the following data fields:

Control Total

Annual energy consumption in the base year of the study, typically the most recent calendar year with 12 months of billing data.

Market Size

Number of modeling units within a given sector and segment. These are generally defined in households for the residential sector, floor stock for the commercial sector, and employment for the industrial sector.

Saturation

Indicates the share of the market that is served by a particular end-use technology. Three types of saturation definitions are commonly used:

- The conditioned space approach accounts for the fraction of each building that is conditioned by the end use. This applies to cooling and heating end uses.
- The whole-building approach measures shares of space in a building with an end use regardless of the portion of each building that is served by the end use. Examples are commercial refrigeration and food service, and domestic water heating and appliances.
- The 100% saturation approach applies to end uses that are generally present in every building or home and are simply set to 100% in the base year. This is used for process and miscellaneous consumption.

UEC or EUI

Unit Energy Consumption (the amount of energy a given piece of equipment is expected to use in one year) or Energy Use Index (a UEC indexed to a non-building market unit, such as per square foot or per employee).

These are indices that refers to a measure of average annual energy use per market unit (home, floor space, or employee in the residential, commercial, and industrial sector, respectively) that are served by an end-use technology. UECs and EUIs embody an average level of service and average equipment efficiency for the market segment.

Energy Intensity

Intensity is computed as the product of the saturation and the UEC or EUI and represents the average use for the technology across all market units. If the saturation is 100%, the intensity will exactly equal the UEC or EUI.

Intensity may be summed up at the end use level to calculate the average end-use consumption for a given market segment or fully summed to calculate consumption for an average home, square foot, or employee. The market profile is calibrated to the intensity calculated as the quotient between the control total and market size.

Base-Year Energy Equation

These are the key concepts used in end-use energy analysis. By developing data for these concepts, a complete profile of sector-level energy use can be produced. With the usage index set to 1.0, the central energy equipment defined the current energy use for each segment as the product of three factors: market size, saturation, and UEC or EUI. For a specific market segment, end use and technology, the central energy equation is:

$$Energy = \sum_{s}\sum_{e}\sum_{i} N_s \times Share_{se} \times UEC_{sei}$$

Where:

- N = market size
- Share = average saturation of space served by an end use and technology
- UEC (or EUI) is the average energy use per market size (floor space, GDP or home) of served space

Indices:

- s = segment
- e = end use
- i = technology

Market size, share and UEC / EUI values for each segment are the base-year input data required by end-use models. These data are combined in the central energy equation to give sales by end use and technology for each segment.

Segmentation Definitions

The following section describes the details that comprise each market segment. For end use and equipment technology definitions, please refer to the measure list Excel file delivered as part of this study.

Residential Segmentation

Residential segmentation is broken down into two or more housing types, as described below.

Single Family

Single family homes consist of standalone homes as well as town homes where less than five units are connected (e.g., duplexes, triplexes, etc.). Due to a larger footprint and fewer shared walls/ceilings/floors, single family homes consume considerably more energy per unit than the multifamily units described below.

Multifamily

The multifamily segment consists of both low-rise and high-rise apartment buildings as well as town homes where more than four units are connected. These units individually consume less energy than a single-family home and may have centralized heating or water heating equipment serving more than one unit at a time.

Commercial Segmentation

Commercial segmentation is broken down by building type, as described below.

Office

Traditional office-based businesses including finance, insurance, law, government buildings, etc.

Retail

Department stores, services, boutiques, strip malls etc.

Restaurant

Sit-down, fast food, coffee shop, food service, etc.

Grocery

Supermarkets, convenience stores, market, etc.

Education

College, university, trade schools, etc.as well as day care, pre-school, elementary, secondary schools

Health

Health practitioner office, hospital, urgent care centers, etc.

Lodging

Hotel, motel, bed and breakfast, etc.

Warehouse

Large storage facility, refrigerated/unrefrigerated warehouse

Miscellaneous

Catchall for buildings not included in other segments, includes churches, recreational facilities, public assembly, correctional facilities, etc.

Industrial Segmentation

Industrial segmentation is broken down by industry type. These include food products, agriculture, primary metals, stone clay and glass, petroleum, paper and printing, instruments, wood and lumber products, and other industrial.

End-Use Definitions

The following table describes the end uses modeled as part of this study and identifies which market sectors each applies to. In each case, we only call out segments where consumption of the end use is considerable. The remaining applications get captured by the miscellaneous end-use category.

Table B-1 Description of End Uses by Market Sector

End Use	Description	Residential	Commercial	Industrial
Space Heating	Provides heating for conditioned spaces and freeze protection for select unconditioned spaces	X	X	X
Secondary Heating	Provides backup or supplemental heating and is normally installed along with primary space heating equipment. May be used for aesthetic reasons rather than practical.	X		
Water Heating	Heating of potable hot water for domestic applications, typically delivered via faucets and showerheads.	X	X	
Appliances	Energy-consuming piece of equipment especially for use in the home or for performance of domestic chores.	X		
Food Preparation	Equipment designed for the use in commercial or institutional-scale kitchens used to cook and store food.		X	
Process	Industrial processes which use heat to form, process, or dry manufactured goods.			X
Miscellaneous	Catch-all category which includes small or non-typical applications. This includes equipment such as gas barbeques and pool heaters	X	X	X

Baseline Projection

For the base year, the market profiles discussed above provide a detailed depiction of energy-use patterns at the end-use level. The end-use forecasting framework projects these detailed profiles into the future. It is applied separately to each segment. As a result, it is appropriate to think of an end-use model as a matrix of models.

Projection Modeling Components

The following discussion describes each model component briefly within the end-use forecasting framework.

Market Size Projection

This component is used to organize information about the existing market size and to forecast future size. The outlook for market size embodies the utility planning assumptions about growth in population for the residential sector and growth in economic activity for the commercial and industrial sectors.

Saturation Growth/Decay

This component reflects trends in construction practices and consumer purchases for new and replacement appliances and equipment. While some end-use models attempt to model these changes in saturations, others (like LoadMAP) rely on observed historical trends and expected future outcomes to develop these forecasts.

UEC or EUI Changes

These values reflect the choices among energy technologies, primarily the decision to select a specific design option, defined by equipment type and efficiency level. The choices are reflected in a forecast of purchase shares for each specific design option. Combined with building and dwelling characteristics and initial usage patterns, this decision determines the UEC or EUI for each segment and end-use technology.

Projection Parameters

Once a building is constructed and equipment is in place, changes in usage levels reflect daily decisions about the frequency and intensity of equipment use. These decisions are determined by the behavior of building occupants and managers. The factors that influence usage are typically explicitly identified in an end-use model as energy prices, weather data, and other user-defined exogenous variables. These parameters include:

Purchase Shares

Represent equipment purchasing decisions for each year of the projection. Each share represents the percent of equipment purchased for each efficiency level within a technology. For each technology permutation, these must sum up to exactly 100% and obey off-market designations whenever a new federal standard or state building code goes into effect.

Vintage Distribution

Represents the age of equipment present in the base-year of a study. Equipment is classified into annual bins based on age. LoadMAP's stock-accounting model steps vintage forward one year then identifies the number of equipment units which have exceeded their lifetime. The model then repurchases equipment at the efficiency levels defined by that year's purchase shares.

Utilization Index

In the base year, usage levels are set to 1.0, providing an index of usage. Changes relative to the base-year usage pattern will be modeled as changes in the usage index, proportional to the starting value. For example, if a natural gas price increase leads to a change in thermostat settings that causes a 5% decline in space heating use, the usage index for natural gas would drop from 1.0 to .95.

Baseline Projection Equation

Within each market segment, or model cell, the end-use model computes energy sales using the central energy equation. For a given customer segment (s), end use (e), technology (i), this equation sums across all vintages as follows:

$$\sum_{v} Nv_v \times Share_v \times UEC_v \times Util_v$$

This equation defines the annual energy sales as the sum across vintages (v) of the product of four factors:

- Market size of vintage v
- The share of vintage market size using the end-use technology
- The UEC in vintage v
- Utilization rates in vintage v

Potential Estimation

In this study, the savings estimates are developed for three types of potential: technical potential, economic potential, and achievable potential. These are developed at the measure level, and results are provided as savings impacts over the 21-year forecasting horizon. The various levels are described below.

Technical Potential

Technical potential is defined as the theoretical upper limit of conservation potential. It assumes that customers adopt all feasible measures regardless of their cost. At the time of existing equipment failure, customers replace their equipment with the most efficient option available. In new construction, customers and developers also choose the most efficient equipment option.

Technical potential also assumes the adoption of every other available measure, where technically feasible. For example, it includes installation of high-efficiency windows in all new construction opportunities and furnace maintenance in all existing buildings with installed furnaces. These retrofit measures are phased in over a number of years to align with the stock turnover of related equipment units, rather than modeled as immediately available all at once.

Achievable Technical Potential

Achievable technical potential refines technical potential by applying customer participation rates that account for market barriers, customer awareness and attitudes, program maturity, and other factors that affect market penetration of conservation measures. The customer adoption rates used in this study were the ramp rates developed for the Northwest Power & Conservation Council’s Seventh Plan, modified for use in natural gas conservation programs.

UCT Achievable Economic Potential

UCT achievable economic potential further refines achievable technical potential by applying an economic cost-effectiveness screen. In this analysis, primary cost-effectiveness is measured by the utility cost test (UCT), which assesses cost-effectiveness from the utility's perspective. This test compares lifetime energy benefits to the costs of delivering the measure through a utility program, excluding monetized non-energy impacts. These costs are the incentive, as a percent of incremental cost of the given efficiency measure, relative to the relevant baseline course of action, plus any administrative costs that are incurred by the program to deliver and implement the measure. If the benefits outweigh the costs (that is, if the UCT ratio is greater than 0.9), a given measure is included in the economic potential. Note that we set the measure-level cost-effectiveness threshold at 0.9 for this analysis since Cascade is allowed to include non-cost-effective measures as long as the entire portfolio is cost effective. This is important because a portfolio considers more than just energy savings. Cascade may include popular measures that are on the cusp of cost-effectiveness, accommodate variance between climate zones, maintain a robust portfolio, or include a measure that improves customer outreach and communication.

TRC Achievable Economic Potential

TRC achievable economic potential is similar to UCT achievable economic potential in that it refines achievable technical potential through cost-effectiveness analysis. The total resource cost (TRC) test assesses cost-effectiveness from a combined utility and participant perspective. As such, this test includes full measure costs but also includes non-energy impacts realized by the customer if quantifiable and monetized. As a secondary screen, we include TRC results for comparative purposes and future use if Cascade uses the TRC as their primary cost-effectiveness screen in the future.

RVT Achievable Economic Potential

RVT Achievable Economic Potential is similar to the UCT and TRC achievable economic potential but assesses cost-effectiveness from a regional perspective. The resource value test (RVT) reframes the analysis around accomplishing a jurisdiction's regional policy goals and includes hard-to-quantify impacts through quantitative or qualitative approaches. This test allows jurisdictions to define policy goals which may include additional impacts beyond the traditional utility-customer TRC approach. In May of 2017, the National Efficiency Screening Project (NESP) released a National Standard Practice Manual[2] (2017 NSPM) which details an approach for conducting screening measures under the RVT. AEG assessed preliminary estimates of potential under the RVT as part of this study, but since policy goals are defined at the regional level under this test, we are awaiting recommendations on non-energy impacts and values from the Washington Utilities and Transportation Commission (WUTC). The model has been configured to accommodate these future updates as they become available.

A key step in the process of estimating energy conservation potential is the definition of each measure in terms of key parameters. These define how much energy a measure saves, how much it costs, how long the savings will last, any additional impacts the measure may have, the portion of the population where the measure is already installed, the percentage of the population for which measure installation is technically feasible, and the rate at which a measure may be achievably installed.

ECM Parameters

Lifetime

The effective useful lifetime (EUL) of an ECM. Determines the number of years for which a measure may be installed before requiring replacement. In the equipment model, EUL is typically defined as a

[2] National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources, May 18, 2017
https://nationalefficiencyscreening.org/wp-content/uploads/2017/05/NSPM_May-2017_final.pdf

range that averages out to a deemed value. This is done to the portion of the population which may maintain a unit longer than average and the portion that purchases new equipment earlier in a product's lifetime.

Measure Cost

Incremental cost of equipment plus labor required to install a measure. In the case of equipment measures, this is the difference in cost between installation of an efficient unit and the minimum baseline required by federal standards and building codes. In the case of non-equipment measures, the baseline is no action or installation, thus incremental costs equal full measure cost plus any labor.

Non-Energy Impacts

Additional benefits or costs present when installing a measure which may be present in addition to energy savings. A positive value represents a benefit while a negative value represents a cost. NEIs must be monetized in some way in order to be included within cost-effectiveness testing, typically as an annual $/year benefit, but may be monetized as a percentage scalar on utility costs or as a flat benefit added to the benefit-to-cost ratio calculation. Examples include reductions in water, detergent, and wood fuel usage.

O&M Impacts

Operation and maintenance costs or benefits required to keep a measure in operation. Most types of equipment technologies require periodic maintenance, so this cost or benefit only captures the difference in O&M between technologies. A piece of efficient equipment may be more complex, requiring more upkeep and therefore costing the consumer additional money each year. They may also be more robust and require less maintenance overall. Impacts due to a difference in baseline and efficient-case lifetimes may also be represented as an O&M impact and captured by the model.

Unit Energy Savings

Unit energy savings (UES) represent the annual savings, in therms, for a given measure or technology. This is specified in LoadMAP for each end use and technology for which it applies. In the case of efficient equipment, this is the difference in consumption between baseline technology and an efficient piece of equipment. The UES is given for the base-year of the study and is likely to change over time as baseline equipment becomes more efficient and exogenous utilization factors affect consumption.

Base Saturation

Percentage of market units for which a measure is present in the baseline. For equipment units, multiplying measure saturation by market units results in the total number of technology installations present. A subset of these units may be eligible for ECMs as determined by the stock turnover engine.

For non-equipment measures, this is the fraction of the population where a measure is already installed.

Technical Applicability

Technical applicability is the percentage of the market where a measure may be technically installed. This accounts for instances where a measure design may not be feasibly installed or where a technical barrier to installation is present. In equipment measures, this percentage is multiplied by the base saturation to determine the applicable percentage of the market. Since equipment measures are already limited by annual turnover, this is set to 100% by default and normally adjusted only for emerging technologies. Since this value is multiplied by equipment saturation, applicability fractions may be less than saturations.

For non-equipment measures, this represents the total fraction of the population upon which a measure may be installed. The difference between technical applicability and base saturation represents the technically eligible fraction of a population. Due to this arithmetic, applicability for a non-equipment measure must always be greater than or equal to its base saturation.

Additionally, applicability may be used to model the installation of more than one efficient technology or measure type, such as tanked and tankless water heaters or Class 30 and Class 22 windows. By splitting the applicability between two options, the model may include two mutually inclusive measures within the potential without running the risk of double-counting potential.

Please note that since LoadMAP only applies measures to relevant, specified equipment types, applicability does not represent the applicable percentage of end-use load (e.g. percent of heating which is ducted).

Ramp Rates

Also known as participation rates or potential factors. Ramp rates represent the achievable percentage of measure installations available in a given year. For equipment measures, these ramp rates are known as lost opportunity (LO) and represent the total percent of equipment turnover upon which a measure may be installed. As such, "LO" ramp rates begin at the base-year percentage and gradually increase until they reach maximum achievability.

For non-equipment measures, generally known as retrofits (Retro), ramp rates represent the percentage of entire stock eligible for measure installation. Since retrofit measures are not gated by end-of-life purchasing decisions, the total available number of units is much larger than in the lost opportunity case. These ramp rates are calculated from the lost opportunity ramp rates as the difference between two subsequent years. As such, retrofit ramp rates sum up to the steady-state maximum achievability rather than gradually reach it over time.

The standard assumption in CPAs in the Northwest is that ramp rates reach 85% achievability by the end of the study period. An exception is made for emerging technology ramp rates, which instead reach 55%. This may be modified on a measure-by-measure or program basis if real-world installation conditions differ from the regional average upon which these ramp rates are based.

C

RESOURCE VALUE TEST POTENTIAL

Background

As part of the 2017 CPA analysis, AEG has developed an approach for quantifying additional non-energy impacts (NEIs) used for assessing cost-effectiveness under the Resource Value Test (RVT). This test is similar in nature to a Total Resource Cost (TRC) test but reframes the analysis around accomplishing a jurisdiction's regional policy goals and includes hard-to-quantify impacts through quantitative or qualitative approaches. This test allows jurisdictions to define policy goals which may include additional impacts beyond the traditional utility-customer TRC approach. It is worth noting that certain impacts, such as those on public health, may be lessened for natural gas analysis, compared to electricity, especially in the Northwest. In the case of one notable impact, health benefits of emissions reductions, the impact is primarily from the reduction of fossil fuel electricity generation. Since natural gas is much cleaner than other fuels, translating this impact to end-user combustion will result in a small benefit. Additionally, this impact will be substantially reduced in the Northwest since the majority of generation comes from low-emission hydroelectric generation.

At this time, AEG recommends capturing all quantified and monetized impacts from the TRC described in the main volume of this report as well as a preliminary percent adder of 20% to all avoided costs to represent the impacts that cannot be easily monetized and have yet to be defined at a jurisdictional level.

The Washington Utilities and Transportation Commission (Commission) is currently developing recommendations for implementing the RVT by investor-owned utilities in the state and has provided guidance that this test be included in the current round of Conservation Potential Assessments (CPAs). Accordingly, AEG has built RVT functionality into its LoadMAP potential model. This includes the ability to assign quantified RVT-specific non-energy impacts and benefit-to-cost ratio adders at the detailed measure-level as well as to apply additional dollar and percentage benefits directly to avoided energy costs. Since the Commission has not yet finalized the jurisdiction's recommended policy goals, AEG recommends including the RVT as a secondary test for this CPA and not using RVT results for the setting of conservation goals. Placeholders have been included within LoadMAP to accept these specific benefits as they are defined.

In May of 2017, the National Efficiency Screening Project (NESP) released a National Standard Practice Manual[3] (2017 NSPM) which details an approach for conducting screening measures under the RVT. AEG will follow the approach for conducting resource value cost-effectiveness testing as described in this manual. The following sections of this memo provide a summary of RVT benefits and AEG's initial recommendations for Cascade's territory and documents our proposed approach for quantifying additional NEIs.

Summary of RVT Impacts and AEG's Recommendations

The 2017 NSPM provides details on potential policy goals to include and recommends five different approaches for quantifying the associated impacts. One key component of this analysis is symmetry, ensuring the inclusion of any related benefits associated with the costs are included in testing. An example

[3] National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources, May 18, 2017
https://nationalefficiencyscreening.org/wp-content/uploads/2017/05/NSPM_May-2017_final.pdf

of this would be the inclusion customer-side NEIs such as the water savings when also including the non-incentivized portion of a high-efficiency clothes dryer measure installation.

Another important aspect to be aware of within these categories is impact overlap. This may manifest itself in two different ways.

- First, care must be taken to exclude impacts already accounted for in utility avoided costs. For example, if the avoided costs already include a social cost of carbon or energy risk adders, then it is not appropriate to include these costs within the "Energy Security" category as well.
- Second, overlapping impacts between categories must also be accounted for. For example, if the economic benefits due to reduced energy bills are quantified as part of the "Economic Development and Jobs" category, then they should not be included as poverty alleviation under the "Impacts on Low-Income Customers" category.

The table below summarizes the eight categories of non-utility impacts presented in Table 6 of the 2017 NSPM. While this list is not intended to be exhaustive, it provides a detailed list of impacts to consider and is a suitable starting point. Once finalized, AEG recommends Cascade update this list based on the final set of impacts provided by the Commission, if applicable to Cascade's service territory and the region. Please note that the 10% bonus for the energy and capacity benefits of conservation[4] from the Pacific Northwest Electric Power Planning and Conservation Act does not fall neatly into one of the categories below but may also be included in some form if determined to be applicable to natural gas.

Table C-1 Non-Utility RVT Impacts Considered for the 2017 Cascade CPA

NSPM Section[5]	Non-Utility Impact	Recommendation	Description
3.3.2	Participant Impacts	Consider in Future	The more tangible benefits are already captured in the sections below. May include intangibles such as comfort and productivity if the Commission provides a recommendation.
3.3.3	Impacts on Low-Income Customers	Include Low-Income Measures in Model	The benefits of low-income energy efficiency programs are well-recognized and have been included in other jurisdictions around the country. We recommend including a tailored set of low-income measures in LoadMAP and applying a benefit-to-cost ratio adder to these measures, which may allow them to pass with an RVT ratio of less than one.
3.3.4	Other Fuel Impacts	Include	AEG recommends capturing the benefits from secondary fuels for measures where natural gas measures may have an impact. For weatherization measures, this would include a reduction in wood fuel use and/or the impact on electric cooling in the summertime.
3.3.5	Water Impacts	Include	Water impacts are already monetized for RTF and Seventh Plan measures. AEG recommends including these and expanding to non-RTF measures if appropriate.

[4] Washington Administrative Code 194-37-070 (5) (c) (xiv) http://apps.leg.wa.gov/WAC/default.aspx?cite=194-37-070

[5] Table 6 indicates that examples begin in section 3.3.1, but actually begin in 3.3.2. The first section instead summarizes the approach for the following eight impacts.

NSPM Section[5]	Non-Utility Impact	Recommendation	Description
3.3.6	Environmental Impacts	Carbon already included in Utility Avoided Costs	A carbon credit is already included in the avoided cost of energy used for this analysis.
3.3.7	Public Health Impacts	Exclude	Due to the potentially large impacts and variance in existing estimates, AEG believes that this category should be quantified at a regional level for use by all investor-owned utilities. AEG will add a placeholder within the LoadMAP model to be updated in should the Commission provide a recommended value for this category.
3.3.8	Economic Development and Jobs	Include	These impacts include both the use of conservation as a vehicle for job growth/job retention and an increase in a customer's disposable income and are of interest to both Cascade and the Commission.
3.3.9	Energy Security	Risk is already included in Utility Avoided Costs	Reliance on volatile energy markets is already reflected in the avoided energy costs as a risk premium adder.

Methodology for Quantifying Benefits

Table 12 of the 2017 NSPM recommends five different approaches for accounting for NEIs under the RVT. When followed in order, these approaches transition from more local and quantitative to more national and qualitative in nature. We detail the five approaches below.

Jurisdiction-Specific Studies

Relevant studies in Cascade's territory and the state of Washington should be used when available. These may take the form of low-income housing research, regional electricity prices for other fuel impacts, and local water costs for Cascade's territory. Since the RVT is a relatively new test and hasn't been widely implemented, we anticipate quantifying the more traditional NEIs using this approach.

Studies from Other Jurisdictions

Studies from other areas in the country or national sources may be used to quantify NEIs in the absence of regional sources. If these are used, care must be taken that assumptions are appropriate for Cascade's territory. For example, costs from a state that spends three to five times more on conservation than the average may not yield applicable data for more rural areas in Washington. In these cases, it still may be possible to adapt the methodology to Cascade's territory rather than the actual value.

Apply Similar Proxies

When no relevant sources are available, it may be useful to identify a similar metric or NEI and adapt it for use. One example where this may be appropriate is the ten percent electricity conservation credit defined above. While that credit may not fit neatly into one of the categories listed previously, it may provide insight for some combination of environmental impacts and energy security since the Conservation Act includes it to prioritize conservation over fossil-fuel emitting generation, which could require fuel to be imported from outside the region.

Quantitative and Qualitative Information and Alternative Thresholds

Care must be taken when using the final two approaches described in the 2017 NSPM, as they may not be traceable to well-documented sources. These approaches are important in context of the RVT because of the underlying test principle that *"using best-available information, proxies, alternative thresholds, or qualitative considerations to approximate hard-to-monetize impacts is preferable to assuming those cost and benefits do not exist or have no value"* (2017 NPSM, pg. viii).

Qualitatively monetized impacts will likely take the form of a percent addition to the avoided cost of energy ($/therm) since they likely will not be detailed enough to be applied to specific measures. This approach may be useful for highly subjective participant impacts, such as comfort, if determined to be an appropriate category in the region.

One example where an alternative threshold may be used would be to assess low-income measure cost-effectiveness. Since some low-income benefits such as reduced mobility may be difficult to quantify but we do not want to apply a low-income benefit globally to all measures, we may add a benefit-to-cost adder to all low-income measures, allowing them to pass with a cost-effectiveness ratio of 0.50 instead of 1.0 for example.

Preliminary Results of RVT Analysis

While developing potential estimates for the CPA analysis, AEG estimated preliminary impacts resulting from the additional non-energy impacts present within the RVT. The table below summarizes these impacts for selected years, compared to potential from the UCT test as well as the achievable technical and technical cases. As seen below, the RVT estimate is very similar to the UCT, resulting in slightly greater savings by the final year of the study. These values may change as additional impacts are finalized within the region.

Table C-2 Preliminary Potential Estimates using the RVT (thousand therms)

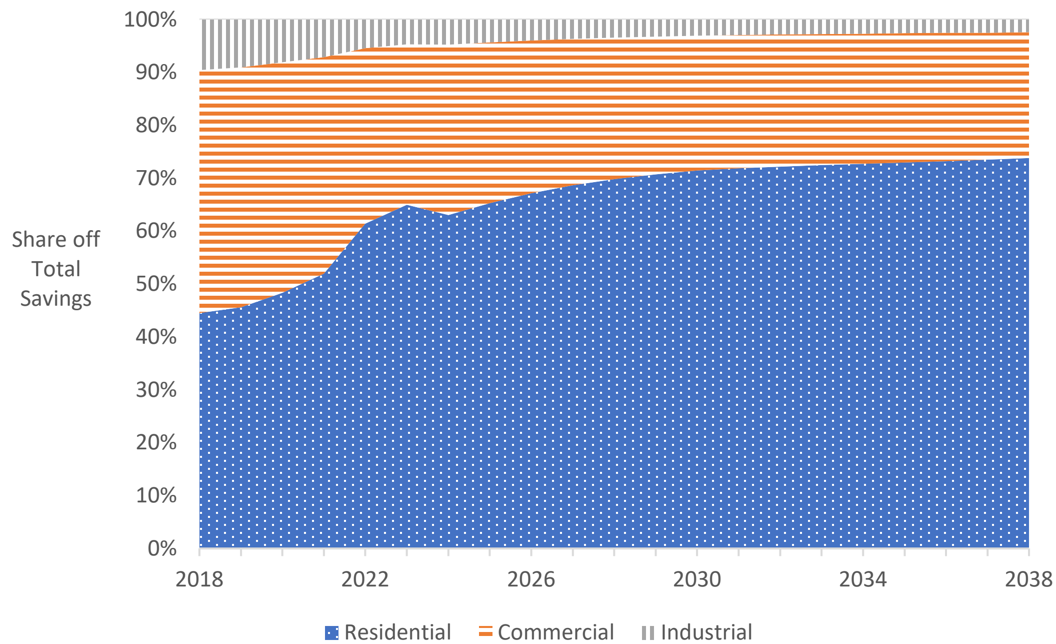
Scenario	2018	2019	2020	2022	2028	2038
Baseline Forecast (thousand therms)	253,869	256,413	259,098	264,884	282,830	319,800
Cumulative Savings (thousand therms)						
UCT Achievable Economic Potential	658	1,404	2,382	6,758	29,035	63,358
RVT Achievable Economic Estimate	618	1,305	2,235	6,683	29,770	66,169
Achievable Technical Potential	1,314	2,691	4,316	10,667	39,459	75,884
Technical Potential	3,361	6,560	9,945	19,760	52,882	88,728
Energy Savings (% of Baseline)						
UCT Achievable Economic Potential	0.3%	0.5%	0.9%	2.6%	10.3%	19.8%
RVT Achievable Economic Estimate	0.2%	0.5%	0.9%	2.5%	10.5%	20.7%
Achievable Technical Potential	0.5%	1.0%	1.7%	4.0%	14.0%	23.7%
Technical Potential	1.3%	2.6%	3.8%	7.5%	18.7%	27.7%

As part of this analysis, we also summarize RVT estimates by market sector. The table and figure below display RVT estimates for the residential, commercial, and industrial sectors for select years. Compared to the UCT, RVT estimates are higher in the residential sector, and comparable to UCT in the commercial and industrial sectors. A large portion of commercial and industrial potential is already cost-effective, muting these impacts.

Table C-3 Preliminary RVT Potential Estimates by Sector (thousand therms)

Sector	2018	2019	2020	2022	2028	2038
Residential	275	596	1,080	4,106	20,792	48,850
Commercial	284	592	975	2,218	7,962	15,732
Industrial	59	118	180	359	1,016	1,587
Total	618	1,305	2,235	6,683	29,770	66,169

Figure C-1 Annual Share of Preliminary RVT Estimates by Sector



D

MARKET PROFILES

This appendix contains detailed market profiles supplementing the sector-wide versions present in Section 3. We first present the residential profiles, followed by commercial, and finally industrial.

Residential Market Profiles

Table D-1 Average Market Profile for the Single-Family Segment in Climate Zone 1, 2016

End Use	Technology	Saturation	UEC (Therms)	Intensity (Therms/HH)	Usage (Thousand Therms)
Space Heating	Furnace - Direct Fuel	84.7%	504	426.9	29,505
	Boiler - Direct Fuel	1.9%	448	8.3	577
Secondary Heating	Fireplace	32.7%	108	35.3	2,439
Water Heating	Water Heater <= 55 gal.	70.1%	181	126.6	8,751
	Water Heater > 55 gal.	1.6%	199	3.2	224
Appliances	Clothes Dryer	13.1%	28	3.7	254
	Stove/Oven	27.4%	54	14.9	1,032
Miscellaneous	Pool Heater	1.0%	380	3.8	263
	Miscellaneous	100.0%	3	2.5	174
Total				**625.3**	**43,217**

Table D-2 Average Market Profile for the Multi-Family Segment in Climate Zone 1, 2016

End Use	Technology	Saturation	UEC (Therms)	Intensity (Therms/HH)	Usage (Thousand Therms)
Space Heating	Furnace - Direct Fuel	84.7%	504	426.9	29,505
	Boiler - Direct Fuel	1.9%	448	8.3	577
Secondary Heating	Fireplace	32.7%	108	35.3	2,439
Water Heating	Water Heater <= 55 gal.	70.1%	181	126.6	8,751
	Water Heater > 55 gal.	1.6%	199	3.2	224
Appliances	Clothes Dryer	13.1%	28	3.7	254
	Stove/Oven	27.4%	54	14.9	1,032
Miscellaneous	Pool Heater	1.0%	380	3.8	263
	Miscellaneous	100.0%	3	2.5	174
Total				**334.1**	**7,175**

Table D-3 Average Market Profile for the Single-Family Segment in Climate Zone 2, 2016

End Use	Technology	Saturation	UEC (Therms)	Intensity (Therms/HH)	Usage (Thousand Therms)
Space Heating	Furnace - Direct Fuel	78.2%	533	416.9	14,952
	Boiler - Direct Fuel	3.6%	467	17.0	611
Secondary Heating	Fireplace	29.2%	108	31.5	1,129
Water Heating	Water Heater <= 55 gal.	65.3%	180	117.3	4,207
	Water Heater > 55 gal.	1.5%	197	3.0	108
Appliances	Clothes Dryer	9.3%	28	2.6	94
	Stove/Oven	26.2%	54	14.3	512
Miscellaneous	Pool Heater	1.0%	380	3.8	136
	Miscellaneous	100.0%	2	1.9	68
Total				**608.3**	**21,815**

Table D-4 Average Market Profile for the Multi-Family Segment in Climate Zone 2, 2016

End Use	Technology	Saturation	UEC (Therms)	Intensity (Therms/HH)	Usage (Thousand Therms)
Space Heating	Furnace - Direct Fuel	68.4%	251	171.6	702
	Boiler - Direct Fuel	3.2%	433	13.8	56
Secondary Heating	Fireplace	13.2%	69	9.1	37
Water Heating	Water Heater <= 55 gal.	62.3%	112	69.8	286
	Water Heater > 55 gal.	0.0%	123	0.0	0
Appliances	Clothes Dryer	8.5%	20	1.7	7
	Stove/Oven	33.9%	55	18.5	76
Miscellaneous	Pool Heater	0.0%	380	0.0	0
	Miscellaneous	100.0%	4	4.4	18
Total				**288.9**	**1,182**

Table D-5 Average Market Profile for the Single-Family Segment in Climate Zone 3, 2016

End Use	Technology	Saturation	UEC (Therms)	Intensity (Therms/HH)	Usage (Thousand Therms)
Space Heating	Furnace - Direct Fuel	87.2%	418	364.2	20,644
	Boiler - Direct Fuel	0.1%	371	0.3	19
Secondary Heating	Fireplace	31.4%	108	33.8	1,918
Water Heating	Water Heater <= 55 gal.	57.6%	178	102.5	5,809
	Water Heater > 55 gal.	1.3%	196	2.6	149
Appliances	Clothes Dryer	3.4%	28	1.0	55
	Stove/Oven	17.0%	54	9.3	526
Miscellaneous	Pool Heater	1.0%	380	3.8	215
	Miscellaneous	100.0%	5	4.7	264
Total				**522.1**	**29,599**

Table D-6 Average Market Profile for the Multi-Family Segment in Climate Zone 3, 2016

End Use	Technology	Saturation	UEC (Therms)	Intensity (Therms/HH)	Usage (Thousand Therms)
Space Heating	Furnace - Direct Fuel	84.5%	238	201.2	2,714
	Boiler - Direct Fuel	0.1%	153	0.1	2
Secondary Heating	Fireplace	11.5%	69	8.0	107
Water Heating	Water Heater <= 55 gal.	55.5%	111	61.8	834
	Water Heater > 55 gal.	0.0%	122	0.0	0
Appliances	Clothes Dryer	4.7%	20	1.0	13
	Stove/Oven	20.3%	55	11.1	149
Miscellaneous	Pool Heater	0.0%	380	0.0	0
	Miscellaneous	100.0%	2	2.2	30
Total				**285.3**	**3,848**

Commercial Market Profiles

Table D-7 Average Market Profile for the Office Segment, 2016

End Use	Technology	Saturation	EUI (Therms/ Sq Ft)	Intensity (Therms/ Sq Ft)	Usage (Thousand Therms)
Heating	Furnace	74.5%	0.66	0.49	6,160
	Boiler	16.7%	0.90	0.15	1,867
	Unit Heater	9.1%	0.51	0.05	577
Water Heating	Water Heater	31.1%	0.20	0.06	770
Food Preparation	Oven	0.9%	0.06	0.00	7
	Conveyor Oven	0.4%	0.11	0.00	6
	Double Rack Oven	0.4%	0.16	0.00	9
	Fryer	1.8%	0.10	0.00	23
	Broiler	0.4%	0.10	0.00	5
	Griddle	1.0%	0.07	0.00	9
	Range	5.3%	0.08	0.00	50
	Steamer	0.4%	0.13	0.00	6
	Commercial Food Prep Other	0.8%	0.09	0.00	9
Miscellaneous	Pool Heater	1.0%	0.01	0.00	1
	Miscellaneous	100.0%	0.01	0.01	131
Total				**0.77**	**9,629**

Table D-8 Average Market Profile for the Retail Segment, 2016

End Use	Technology	Saturation	EUI (Therms/ Sq Ft)	Intensity (Therms/ Sq Ft)	Usage (Thousand Therms)
Heating	Furnace	79.6%	0.68	0.54	5,666
	Boiler	4.7%	1.15	0.05	565
	Unit Heater	35.6%	0.65	0.23	2,427
Water Heating	Water Heater	32.7%	0.28	0.09	975
Food Preparation	Oven	3.8%	0.17	0.01	68
	Conveyor Oven	1.9%	0.30	0.01	58
	Double Rack Oven	1.9%	0.45	0.01	89
	Fryer	6.6%	0.28	0.02	194
	Broiler	1.2%	0.29	0.00	37
	Griddle	4.3%	0.20	0.01	92
	Range	5.8%	0.21	0.01	131
	Steamer	1.1%	0.35	0.00	42
	Commercial Food Prep Other	1.1%	0.25	0.00	30
Miscellaneous	Pool Heater	0.3%	0.02	0.00	0
	Miscellaneous	100.0%	0.01	0.01	108
Total				**1.00**	**10,480**

Table D-9 Average Market Profile for the Restaurant Segment, 2016

End Use	Technology	Saturation	EUI (Therms/ Sq Ft)	Intensity (Therms/ Sq Ft)	Usage (Thousand Therms)
Heating	Furnace	74.3%	0.47	0.35	1,099
	Boiler	2.9%	1.01	0.03	94
	Unit Heater	12.3%	0.57	0.07	220
Water Heating	Water Heater	73.3%	0.72	0.53	1,663
Food Preparation	Oven	14.6%	1.29	0.19	587
	Conveyor Oven	7.3%	2.20	0.16	502
	Double Rack Oven	7.3%	3.34	0.24	763
	Fryer	58.4%	2.08	1.21	3,805
	Broiler	23.1%	2.14	0.49	1,547
	Griddle	33.7%	1.52	0.51	1,601
	Range	51.5%	1.57	0.81	2,544
	Steamer	6.7%	2.63	0.18	552
	Commercial Food Prep Other	6.7%	1.87	0.13	393
Miscellaneous	Pool Heater	0.6%	0.05	0.00	1
	Miscellaneous	100.0%	0.05	0.05	157
Total				**4.95**	**15,527**

Table D-10 Average Market Profile for the Grocery Segment, 2016

End Use	Technology	Saturation	EUI (Therms/ Sq Ft)	Intensity (Therms/ Sq Ft)	Usage (Thousand Therms)
Heating	Furnace	84.0%	0.70	0.59	1,940
	Boiler	2.5%	1.19	0.03	97
	Unit Heater	48.9%	0.67	0.33	1,083
Water Heating	Water Heater	76.6%	0.30	0.23	762
Food Preparation	Oven	24.3%	0.14	0.03	114
	Conveyor Oven	12.1%	0.24	0.03	98
	Double Rack Oven	12.1%	0.37	0.05	148
	Fryer	51.7%	0.23	0.12	393
	Broiler	2.9%	0.24	0.01	22
	Griddle	6.4%	0.17	0.01	36
	Range	26.8%	0.17	0.05	154
	Steamer	2.0%	0.29	0.01	19
	Commercial Food Prep Other	2.0%	0.21	0.00	13
Miscellaneous	Pool Heater	0.2%	0.01	0.00	0
	Miscellaneous	100.0%	0.02	0.02	49
Total				**1.50**	**4,930**

Table D-11 Average Market Profile for the Education Segment, 2016

End Use	Technology	Saturation	EUI (Therms/ Sq Ft)	Intensity (Therms/ Sq Ft)	Usage (Thousand Therms)
Heating	Furnace	51.0%	0.20	0.10	2,916
	Boiler	49.0%	0.24	0.12	3,389
	Unit Heater	14.1%	0.13	0.02	552
Water Heating	Water Heater	80.8%	0.16	0.13	3,698
Food Preparation	Oven	6.0%	0.06	0.00	113
	Conveyor Oven	3.0%	0.11	0.00	97
	Double Rack Oven	3.0%	0.17	0.01	147
	Fryer	6.7%	0.10	0.01	204
	Broiler	2.6%	0.11	0.00	80
	Griddle	3.1%	0.08	0.00	68
	Range	15.9%	0.08	0.01	364
	Steamer	4.7%	0.13	0.01	182
	Commercial Food Prep Other	4.7%	0.09	0.00	129
Miscellaneous	Pool Heater	1.2%	0.01	0.00	3
	Miscellaneous	100.0%	0.01	0.01	252
Total				**0.42**	**12,194**

Table D-12 Average Market Profile for the Healthcare Segment, 2016

End Use	Technology	Saturation	EUI (Therms/ Sq Ft)	Intensity (Therms/ Sq Ft)	Usage (Thousand Therms)
Heating	Furnace	61.7%	0.39	0.24	1,431
	Boiler	34.0%	0.78	0.27	1,584
	Unit Heater	9.7%	0.44	0.04	255
Water Heating	Water Heater	75.1%	0.56	0.42	2,518
Food Preparation	Oven	7.9%	0.19	0.01	88
	Conveyor Oven	4.0%	0.32	0.01	75
	Double Rack Oven	4.0%	0.49	0.02	115
	Fryer	4.6%	0.30	0.01	82
	Broiler	2.5%	0.31	0.01	46
	Griddle	6.1%	0.22	0.01	81
	Range	35.8%	0.23	0.08	489
	Steamer	5.2%	0.38	0.02	119
	Commercial Food Prep Other	5.2%	0.27	0.01	84
Miscellaneous	Pool Heater	1.4%	0.05	0.00	4
	Miscellaneous	100.0%	0.04	0.04	230
Total				**1.21**	**7,201**

Table D-13 Average Market Profile for the Lodging Segment, 2016

End Use	Technology	Saturation	EUI (Therms/ Sq Ft)	Intensity (Therms/ Sq Ft)	Usage (Thousand Therms)
Heating	Furnace	51.9%	0.39	0.20	1,171
	Boiler	21.9%	0.79	0.17	1,005
	Unit Heater	8.1%	0.44	0.04	209
Water Heating	Water Heater	80.8%	0.49	0.39	2,303
Food Preparation	Oven	8.0%	0.12	0.01	58
	Conveyor Oven	4.0%	0.21	0.01	50
	Double Rack Oven	4.0%	0.32	0.01	75
	Fryer	10.6%	0.20	0.02	124
	Broiler	6.9%	0.21	0.01	83
	Griddle	10.0%	0.15	0.01	86
	Range	28.5%	0.15	0.04	253
	Steamer	5.0%	0.25	0.01	73
	Commercial Food Prep Other	5.0%	0.18	0.01	52
Miscellaneous	Pool Heater	42.9%	0.03	0.01	77
	Miscellaneous	100.0%	0.01	0.01	39
Total				**0.97**	**5,657**

Table D-14 Average Market Profile for the Warehouse Segment, 2016

End Use	Technology	Saturation	EUI (Therms/ Sq Ft)	Intensity (Therms/ Sq Ft)	Usage (Thousand Therms)
Heating	Furnace	42.9%	0.59	0.25	605
	Boiler	6.0%	1.12	0.07	159
	Unit Heater	53.4%	0.63	0.34	803
Water Heating	Water Heater	51.4%	0.09	0.05	111
Food Preparation	Oven	0.0%	0.03	0.00	0
	Conveyor Oven	0.0%	0.05	0.00	0
	Double Rack Oven	0.0%	0.08	0.00	0
	Fryer	0.7%	0.05	0.00	1
	Broiler	0.0%	0.05	0.00	0
	Griddle	0.0%	0.04	0.00	0
	Range	1.4%	0.04	0.00	1
	Steamer	0.0%	0.07	0.00	0
	Commercial Food Prep Other	0.0%	0.05	0.00	0
Miscellaneous	Pool Heater	0.0%	0.00	0.00	0
	Miscellaneous	100.0%	0.01	0.01	17
Total				**0.71**	**1,698**

Table D-15 Average Market Profile for the Miscellaneous Segment, 2016

End Use	Technology	Saturation	EUI (Therms/ Sq Ft)	Intensity (Therms/ Sq Ft)	Usage (Thousand Therms)
Heating	Furnace	74.1%	0.73	0.54	5,874
	Boiler	18.2%	1.28	0.23	2,539
	Unit Heater	15.6%	0.72	0.11	1,223
Water Heating	Water Heater	57.5%	0.37	0.21	2,288
Food Preparation	Oven	3.0%	0.13	0.00	41
	Conveyor Oven	1.5%	0.22	0.00	35
	Double Rack Oven	1.5%	0.33	0.00	53
	Fryer	4.8%	0.21	0.01	107
	Broiler	3.4%	0.21	0.01	78
	Griddle	4.2%	0.15	0.01	69
	Range	16.1%	0.16	0.02	272
	Steamer	1.2%	0.26	0.00	34
	Commercial Food Prep Other	1.2%	0.18	0.00	24
Miscellaneous	Pool Heater	7.0%	0.02	0.00	17
	Miscellaneous	100.0%	0.03	0.03	297
Total				**1.19**	**12,952**

Industrial Market Profiles

Table D-16 Average Market Profile for the Food Products Segment, 2016

End Use	Technology	Saturation	EUI (Therms/ Employee)	Intensity (Therms/ Employee)	Usage (Thousand Therms)
Heating	Furnace	37.0%	188	70	144
	Boiler	52.6%	35	18	38
	Unit Heater	18.0%	513	92	191
Process	Process Boiler	100.0%	1,580	1,580	3,277
	Process Heating	100.0%	1,157	1,157	2,400
	Process Cooling	100.0%	11	11	24
	Other Process	100.0%	62	62	129
Miscellaneous	Miscellaneous	100.0%	65	65	135
Total				**3,055.1**	**6,338**

Table D-17 Average Market Profile for the Agriculture Segment, 2016

End Use	Technology	Saturation	EUI (Therms/ Employee)	Intensity (Therms/ Employee)	Usage (Thousand Therms)
Heating	Furnace	35.1%	70	25	368
	Boiler	7.4%	87	6	96
	Unit Heater	32.8%	99	33	488
Process	Process Boiler	100.0%	71	71	1,057
	Process Heating	100.0%	57	57	854
	Process Cooling	100.0%	0	0	2
	Other Process	100.0%	3	3	43
Miscellaneous	Miscellaneous	100.0%	21	21	312
Total				**215.4**	**3,220**

Table D-18 Average Market Profile for the Primary Metals Segment, 2016

End Use	Technology	Saturation	EUI (Therms/ Employee)	Intensity (Therms/ Employee)	Usage (Thousand Therms)
Heating	Furnace	94.3%	149	140	37
	Boiler	0.0%	37	0	0
	Unit Heater	13.1%	1,422	186	49
Process	Process Boiler	100.0%	1,274	1,274	336
	Process Heating	100.0%	7,995	7,995	2,106
	Process Cooling	100.0%	6	6	2
	Other Process	100.0%	101	101	27
Miscellaneous	Miscellaneous	100.0%	432	432	114
Total				**10,134.8**	**2,670**

Table D-19 Average Market Profile for the Stone, Clay, and Glass Segment, 2016

End Use	Technology	Saturation	EUI (Therms/ Employee)	Intensity (Therms/ Employee)	Usage (Thousand Therms)
Heating	Furnace	54.1%	206	112	24
	Boiler	7.0%	417	29	6
	Unit Heater	31.7%	467	148	32
Process	Process Boiler	100.0%	191	191	41
	Process Heating	100.0%	5,376	5,376	1,158
	Process Cooling	100.0%	1	1	0
	Other Process	100.0%	62	62	13
Miscellaneous	Miscellaneous	100.0%	378	378	81
Total				**6,298.2**	**1,357**

Table D-20 Average Market Profile for the Petroleum Segment, 2016

End Use	Technology	Saturation	EUI (Therms/ Employee)	Intensity (Therms/ Employee)	Usage (Thousand Therms)
Heating	Furnace	3.2%	7,252	234	4
	Boiler	3.9%	1,560	61	1
	Unit Heater	1.0%	29,846	310	5
Process	Process Boiler	100.0%	24,398	24,398	392
	Process Heating	100.0%	46,419	46,419	745
	Process Cooling	100.0%	31	31	0
	Other Process	100.0%	690	690	11
Miscellaneous	Miscellaneous	100.0%	3,429	3,429	55
Total				**75,572.9**	**1,214**

Table D-21 Average Market Profile for the Paper and Printing Segment, 2016

End Use	Technology	Saturation	EUI (Therms/ Employee)	Intensity (Therms/ Employee)	Usage (Thousand Therms)
Heating	Furnace	83.7%	528	442	51
	Boiler	7.6%	1,525	116	13
	Unit Heater	24.6%	2,385	586	68
Process	Process Boiler	100.0%	2,536	2,536	295
	Process Heating	100.0%	2,347	2,347	273
	Process Cooling	100.0%	11	11	1
	Other Process	100.0%	397	397	46
Miscellaneous	Miscellaneous	100.0%	419	419	49
Total				**6,853.9**	**797**

Table D-22 Average Market Profile for the Instruments Segment, 2016

End Use	Technology	Saturation	EUI (Therms/ Employee)	Intensity (Therms/ Employee)	Usage (Thousand Therms)
Heating	Furnace	68.2%	35	24	68
	Boiler	6.8%	92	6	18
	Unit Heater	43.6%	72	31	91
Process	Process Boiler	100.0%	117	117	337
	Process Heating	100.0%	39	39	111
	Process Cooling	100.0%	0	0	1
	Other Process	100.0%	2	2	5
Miscellaneous	Miscellaneous	100.0%	26	26	75
Total				**245.5**	**706**

Table D-23 Average Market Profile for the Wood and Lumber Segment, 2016

End Use	Technology	Saturation	EUI (Therms/ Employee)	Intensity (Therms/ Employee)	Usage (Thousand Therms)
Heating	Furnace	58.5%	78	45	25
	Boiler	0.5%	2,228	12	7
	Unit Heater	47.2%	127	60	33
Process	Process Boiler	100.0%	288	288	158
	Process Heating	100.0%	528	528	291
	Process Cooling	100.0%	1	1	1
	Other Process	100.0%	16	16	9
Miscellaneous	Miscellaneous	100.0%	79	79	44
Total				**1,028.6**	**567**

Table D-24 Average Market Profile for the Other Industrial Segment, 2016

End Use	Technology	Saturation	EUI (Therms/ Employee)	Intensity (Therms/ Employee)	Usage (Thousand Therms)
Heating	Furnace	42.9%	57	25	397
	Boiler	6.0%	108	6	104
	Unit Heater	53.4%	61	33	526
Process	Process Boiler	100.0%	71	71	1,140
	Process Heating	100.0%	57	57	921
	Process Cooling	100.0%	0	0	2
	Other Process	100.0%	3	3	46
Miscellaneous	Miscellaneous	100.0%	21	21	337
Total				**215.4**	**3,473**

E

CUSTOMER ADOPTION FACTORS

As described in Section 2, to estimate the rate at which measures are phased into the study given market barriers such as customer preference, imperfect information, and commercial availability of technologies; we apply a set of customer adoption factors. These are also referred to as ramp rates or take rates. The values are the factors applied to the technical potential for a given measure in a given year to arrive at the achievable technical potential. These factors may be found in Table E-1 below.

AEG based these off the ramp rates developed for electric EE programs by the Council as part of the Seventh Northwest Conservation and Electric Power Plan. We adapted these ramp rates for use in estimating achievable natural gas EE potential using the first three of the following methods.

- Reassign an individual measure's ramp rate
- Accelerate or decelerate an existing ramp rate
- Dampen early-year measure ramping effects
- Design a new ramp rate

Ramp rates assignments for each measure permutation may be found in the measure summary documentation within Appendix G. More details on the approach for adapting ramp rates may be found in Section 8.

Measures are divided into two categories, each of which has its own timing and achievability considerations:

- Lost Opportunity potential occurs at the time of equipment burnout. When equipment is replaced, a unique opportunity exists to upgrade efficiency at incremental (above standard equipment), rather than full cost. If standard equipment is installed, the high-efficiency equipment would not be installed until the new equipment reaches the end of its normal life cycle, without early replacement (usually requiring a significantly higher incremental cost). The same applies for opportunities at the time of new construction. These "LO" ramp rate factors increase over time to values of either 85% or 55% and apply only to the subset of units which turn over in any given year.
- Retrofit potential is not subject to such stringent timing constraints and can, theoretically, be acquired at any point in the planning period assuming customer willingness and necessary delivery infrastructure. Since these ramp rates apply to all units in the market, "Retro" ramp rates instead sum to either 85% or 55% and are intended to phase in potential throughout the study period. The faster ramp rates (e.g. summing up to 85% sooner) will phase potential in over a shorter timeframe.

Table E-1 Ramp Rates Used in CPA Analysis

Ramp Rate	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
LO12Med	9%	14%	21%	29%	39%	48%	58%	67%	71%	75%	78%	80%	82%	83%	84%	85%	85%	85%	85%	85%
LO5Med	4%	6%	10%	15%	25%	34%	44%	54%	63%	71%	76%	81%	83%	84%	85%	85%	85%	85%	85%	85%
LO1Slow	0%	0%	1%	2%	5%	9%	13%	16%	22%	29%	37%	46%	54%	62%	69%	75%	79%	82%	84%	85%
LO50Fast	38%	47%	58%	67%	71%	76%	80%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
LO20Fast	19%	26%	34%	41%	48%	55%	62%	69%	72%	75%	78%	79%	81%	82%	83%	84%	84%	84%	85%	85%
LOEven20	4%	6%	10%	13%	18%	24%	29%	34%	38%	43%	47%	51%	55%	60%	64%	68%	72%	77%	81%	85%
LOMax60	1%	2%	3%	6%	10%	15%	19%	24%	28%	31%	34%	37%	40%	42%	45%	47%	49%	51%	53%	55%
LO3Slow	0%	1%	2%	4%	10%	17%	24%	31%	40%	49%	57%	65%	71%	75%	79%	81%	83%	84%	85%	85%
Retro12Med	9%	9%	9%	9%	7%	7%	7%	5%	4%	3%	3%	2%	2%	1%	1%	1%	0%	0%	0%	0%
Retro5Med	4%	4%	4%	4%	10%	10%	10%	9%	9%	8%	6%	4%	2%	1%	1%	0%	0%	0%	0%	0%
Retro1Slow	0%	0%	0%	1%	4%	4%	4%	5%	6%	7%	8%	8%	9%	8%	7%	6%	4%	3%	2%	1%
Retro50Fast	38%	18%	12%	8%	5%	3%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Retro20Fast	19%	13%	9%	7%	6%	5%	5%	4%	3%	3%	2%	2%	1%	1%	1%	1%	1%	0%	0%	0%
RetroEven20	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
RetroMax60	1%	1%	1%	2%	5%	5%	5%	4%	4%	3%	3%	3%	3%	3%	2%	2%	2%	2%	2%	2%
Retro3Slow	0%	0%	1%	1%	7%	7%	7%	8%	9%	9%	8%	7%	6%	5%	3%	2%	2%	1%	1%	0%

Applied Energy Group, Inc.
500 Ygnacio Valley Road, Suite 250
Walnut Creek, CA 94596

P: 510.982.3525

Cascade Natural Gas Company: Residential Measure List (Equipment)

Measure Code	Fuel	End Use	Technology	Equipment	Label	On Market	Off Market	Measure Description
RE001	Natural Gas	Space Heating	Furnace - Direct Fuel	E1	AFUE 80%		2023	Furnaces heat air and distribute the heated air through the building using ducts. Efficiency improvements can include: exhaust fan controls,
RE001	Natural Gas	Space Heating	Furnace - Direct Fuel	E2	AFUE 90%			electronic ignition (no pilot light), compact size and lighter weight to reduce cycling losses, smaller-diameter flue pipe, and sealed
RE001	Natural Gas	Space Heating	Furnace - Direct Fuel	E3	AFUE 92%			combustion. Very high efficiency units, or condensing units, condense the water vapor produced in the combustion process and also use the
RE001	Natural Gas	Space Heating	Furnace - Direct Fuel	E4	AFUE 95%			heat from this condensation.
RE001	Natural Gas	Space Heating	Furnace - Direct Fuel	E5	AFUE 98%			
RE001	Natural Gas	Space Heating	Furnace - Direct Fuel	E6	Convert to NG Air Source Heat Pump			
RE002	Natural Gas	Space Heating	Boiler - Direct Fuel	E1	AFUE 82%		2020	Boilers heat water, providing either hot water or steam to be distributed around the building for heating. Steam is distributed via pipes to
RE002	Natural Gas	Space Heating	Boiler - Direct Fuel	E2	AFUE 84%			steam radiators, and hot water can be distributed via baseboard radiators or radiant floor systems, or can heat air via a coil. Efficiency
RE002	Natural Gas	Space Heating	Boiler - Direct Fuel	E3	AFUE 85%			improvements can include: exhaust fan controls, electronic ignition (no pilot light), compact size and lighter weight to reduce cycling losses,
RE002	Natural Gas	Space Heating	Boiler - Direct Fuel	E4	AFUE 90%			smaller-diameter flue pipe, and sealed combustion. Very high efficiency units, or condensing units, condense the water vapor produced in
RE002	Natural Gas	Space Heating	Boiler - Direct Fuel	E5	AFUE 95%			the combustion process and also use the heat from this condensation.
RE002	Natural Gas	Space Heating	Boiler - Direct Fuel	E6	AFUE 96%			
RE002	Natural Gas	Space Heating	Boiler - Direct Fuel	E7	Convert to NG Heat Pump			
RE003	Natural Gas	Secondary Heating	Fireplace	E1	Baseline (50% to 60% FE Rating)			Natural gas fireplace or hearth. Efficiency is characterized either in fireplace efficiency (FE) or energy factor (EF). Per NEEA initiative, all three
RE003	Natural Gas	Secondary Heating	Fireplace	E2	Tier 1 (70% FE Rating)			tiers of efficient units are gaining market traction.
RE003	Natural Gas	Secondary Heating	Fireplace	E3	Tier 2 (77%+ FE Rating)			
RE004	Natural Gas	Water Heating	Water Heater <= 55 gal.	E1	Baseline (UEF 0.58)			For natural gas hot water heating, the most common type is a storage heater, which incorporates a burner, storage tank, outer jacket,
RE004	Natural Gas	Water Heating	Water Heater <= 55 gal.	E2	ENERGY STAR (UEF 0.64)			insulation, and controls in a single unit. Efficient units are characterized by a high recovery or thermal efficiency and low standby losses (the
RE004	Natural Gas	Water Heating	Water Heater <= 55 gal.	E3	ENERGY STAR + 10% (UEF 0.70)			ratio of heat lost per hour to the content of the stored water). A further efficiency gain is available in condensing units, which condense the
RE004	Natural Gas	Water Heating	Water Heater <= 55 gal.	E4	Instantaneous - Non-Condensing (UEF 0.81)			water vapor produced in the combustion process and also use the heat from this condensation.
RE004	Natural Gas	Water Heating	Water Heater <= 55 gal.	E5	Condensing (UEF 0.81)			
RE004	Natural Gas	Water Heating	Water Heater <= 55 gal.	E6	Instantaneous - ENERGY STAR (UEF 0.87)			
RE004	Natural Gas	Water Heating	Water Heater <= 55 gal.	E7	Storage Tank UEF 0.88			
RE004	Natural Gas	Water Heating	Water Heater <= 55 gal.	E8	Instantaneous - Condensing (UEF 0.92)			
RE004	Natural Gas	Water Heating	Water Heater <= 55 gal.	E9	NEEA Gas-Fired Absorption HPWH (EF 1.2)			
RE004	Natural Gas	Water Heating	Water Heater <= 55 gal.	E10	NEEA Gas-Fired Absorption HPWH (EF 1.7)	2023		
RE005	Natural Gas	Water Heating	Water Heater > 55 gal.	E1	Standard (UEF 0.76)			For natural gas hot water heating, the most common type is a storage heater, which incorporates a burner, storage tank, outer jacket,
RE005	Natural Gas	Water Heating	Water Heater > 55 gal.	E2	Instantaneous - Non-Condensing (UEF 0.84)			insulation, and controls in a single unit. Efficient units are characterized by a high recovery or thermal efficiency and low standby losses (the
RE005	Natural Gas	Water Heating	Water Heater > 55 gal.	E3	Condensing (UEF 0.82)			ratio of heat lost per hour to the content of the stored water). A further efficiency gain is available in condensing units, which condense the
RE005	Natural Gas	Water Heating	Water Heater > 55 gal.	E4	Instantaneous - ENERGY STAR (UEF 0.87)			water vapor produced in the combustion process and also use the heat from this condensation.
RE005	Natural Gas	Water Heating	Water Heater > 55 gal.	E5	Instantaneous - Condensing (UEF 0.92)			
RE005	Natural Gas	Water Heating	Water Heater > 55 gal.	E6	NEEA Gas-Fired Absorption HPWH (EF 1.3)			
RE005	Natural Gas	Water Heating	Water Heater > 55 gal.	E7	NEEA Gas-Fired Absorption HPWH (EF 1.7)	2023		
RE006	Natural Gas	Appliances	Clothes Dryer	E1	Standard			
RE006	Natural Gas	Appliances	Clothes Dryer	E2	NEEA/ENERGY STAR (CE >60%)			
RE007	Natural Gas	Appliances	Stove/Oven	E1	EF 0.399			These products have additional insulation in the oven compartment and tighter-fitting oven door gaskets and hinges to save energy.
RE007	Natural Gas	Appliances	Stove/Oven	E2	EF 0.42			Conventional ovens must first heat up about 35 pounds of steel and a large amount of air before they heat up the food. Higher efficiency
RE008	Natural Gas	Miscellaneous	Pool Heater	E1	Standard (EF .78)			Gas pool heaters have a burner to heat water in a loop. Efficiency improvements can include: exhaust fan controls, electronic ignition (no pilot light), compact size and lighter weight to reduce cycling losses, and sealed combustion. Very high efficiency units, or condensing units,
RE008	Natural Gas	Miscellaneous	Pool Heater	E2	Condensing (EF .90)			condense the water vapor produced in the combustion process and also use the heat from this condensation.
RE009	Natural Gas	Miscellaneous	Miscellaneous	E1	None			A catchall category used primarily to calibrate a forecast

Cascade Natural Gas Company: Residential Measure List (Non-Equipment)

Measure Code	Measure	Typical Savings Apply to:			Description
RM001	Insulation - Ceiling, Install	Natural Gas	Space Heating	All	Thermal insulation is material or combinations of materials that are used to inhibit the flow of heat energy by conductive, convective, and radiative transfer modes. Thus, thermal insulation above ceilings can conserve energy by reducing the heat loss or gain into attics and/or through roofs. The type of building construction defines insulating possibilities. Typical insulating materials include: loose-fill (blown) cellulose, loose-fill (blown) fiberglass, and rigid polystyrene.
RM002	Insulation - Ceiling, Upgrade	Natural Gas	Space Heating	All	Thermal insulation is material or combinations of materials that are used to inhibit the flow of heat energy by conductive, convective, and radiative transfer modes. Thus, thermal insulation above ceilings can conserve energy by reducing the heat loss or gain into attics and/or through roofs. The type of building construction defines insulating possibilities. Typical insulating materials include: loose-fill (blown) cellulose, loose-fill (blown) fiberglass, and rigid polystyrene.
RM003	Insulation - Slab Foundation	Natural Gas	Space Heating	Furnace	Thermal insulation is material or combinations of materials that are used to inhibit the flow of heat energy by conductive, convective, and radiative transfer modes. Thus, thermal insulation above ceilings can conserve energy by reducing the heat loss or gain into attics and/or through roofs. The type of building construction defines insulating possibilities. Typical insulating materials include: loose-fill (blown) cellulose, loose-fill (blown) fiberglass, and rigid polystyrene.
RM004	Insulation - Basement Sidewall	Natural Gas	Space Heating	Furnace	Thermal insulation is material or combinations of materials that are used to inhibit the flow of heat energy by conductive, convective, and radiative transfer modes. Thus, thermal insulation above ceilings can conserve energy by reducing the heat loss or gain into attics and/or through roofs. The type of building construction defines insulating possibilities. Typical insulating materials include: loose-fill (blown) cellulose, loose-fill (blown) fiberglass, and rigid polystyrene.
RM005	Insulation - Ducting	Natural Gas	Space Heating	Furnace	Air distribution ducts can be insulated to reduce heating or cooling losses. Best results can be achieved by covering the entire surface area with insulation. Several types of ducts and duct insulation are available, including flexible duct, pre-insulated duct, duct board, duct wrap, tacked, or glued rigid insulation, and waterproof hard shell materials for exterior ducts. This analysis assumes that installing duct insulation can reduce the temperature drop/gain in ducts by 50%.
RM006	Insulation - Infiltration Control (Air Sealing)	Natural Gas	Space Heating	All	Lowering the air infiltration rate by caulking small leaks and weather-stripping around window frames, doorframes, power outlets, plumbing, and wall corners can provide significant energy savings. Weather-stripping doors and windows will create a tight seal and further reduce air infiltration.
RM007	Insulation - Floor/Crawlspace	Natural Gas	Space Heating	All	Thermal insulation is material or combinations of materials that are used to inhibit the flow of heat energy by conductive, convective, and radiative transfer modes. Thus, thermal insulation can conserve energy by reducing heat loss or gain from a building. The type of building construction defines insulating possibilities. Typical insulating materials include: loose-fill (blown) cellulose, loose-fill (blown) fiberglass, and rigid polystyrene.
RM008	Insulation - Wall Cavity, Upgrade	Natural Gas	Space Heating	All	Lowering the air infiltration rate by caulking small leaks and weather-stripping around window frames, doorframes, power outlets, plumbing, and wall corners can provide significant energy savings. Weather-stripping doors and windows will create a tight seal and further reduce air infiltration.
RM009	Insulation - Wall Cavity, Installation	Natural Gas	Space Heating	All	Thermal insulation is material or combinations of materials that are used to inhibit the flow of heat energy by conductive, convective, and radiative transfer modes. Thus, thermal insulation can conserve energy by reducing heat loss or gain from a building. The type of building construction defines insulating possibilities. Typical insulating materials include: loose-fill (blown) cellulose, loose-fill (blown) fiberglass, and rigid polystyrene. Wall insulation is modeled for new construction / major retrofits only.
RM010	Insulation - Wall Sheathing	Natural Gas	Space Heating	All	Thermal insulation is material or combinations of materials that are used to inhibit the flow of heat energy by conductive, convective, and radiative transfer modes. Thus, thermal insulation can conserve energy by reducing heat loss or gain from a building. The type of building construction defines insulating possibilities. Typical insulating materials include: loose-fill (blown) cellulose, loose-fill (blown) fiberglass, and rigid polystyrene. Wall sheathing is modeled for new construction / major retrofits only.
RM011	Ducting - Repair and Sealing	Natural Gas	Space Heating	Furnace	Leakage in unsealed ducts varies considerably because of the differences in fabricating machinery used, the methods for assembly, installation workmanship, and age of the ductwork. Air leaks from the system to the outdoors result in a direct loss proportional to the amount of leakage and the difference in enthalpy between the outdoor air and the conditioned air. To seal ducts, a wide variety of sealing methods and products exist. Each has a relatively short shelf life, and no documented research has identified the aging characteristics of sealant applications.
RM012	Doors - Storm and Thermal	Natural Gas	Space Heating	All	Like other components of the shell, doors are subject to several types of heat loss: conduction, infiltration, and radiant losses. Similar to a storm window, a storm door creates an insulating air space between the storm and primary doors. A tight fitting storm door can also help reduce air leakage or infiltration. Thermal doors have exceptional thermal insulation properties and also are provided with weather-stripping on the doorframe to reduce air leakage.
RM013	Windows - High Efficiency	Natural Gas	Space Heating	All	High-efficiency windows, such as those labeled under the ENERGY STAR Program, are designed to reduce energy use and increase occupant comfort. High-efficiency windows reduce the amount of heat transfer through the glazing surface. For example, some windows have a low-E coating, a thin film of metallic oxide coating on the glass surface that allows passage of short-wave solar energy through glass and prevents long-wave energy from escaping. Another example is double-pane glass that reduces conductive and convective heat transfer. Some double-pane windows are gas-filled (usually argon) to further increase the insulating properties of the window.
RM014	Thermostat - Programmable	Natural Gas	Space Heating	All	Programmable thermostats are typically used during winter to lower temperatures at night and in summer to increase temperatures during the afternoon, units with Wi-Fi capability allow programming and adjusting remotely, increasing the convenience and potentially realizing better savings than the basic programmable units. As programmable thermostats have become ubiquitous, this analysis assumes that the baseline condition is a programmable thermostat.
RM015	Thermostat - Wi-Fi/Interactive	Natural Gas	Space Heating	All	Programmable thermostats are typically used during winter to lower temperatures at night and in summer to increase temperatures during the afternoon, units with Wi-Fi capability allow programming and adjusting remotely, increasing the convenience and potentially realizing better savings than the basic programmable units. As programmable thermostats have become ubiquitous, this analysis assumes that the baseline condition is a programmable thermostat.
RM016	Gas Furnace - Maintenance	Natural Gas	Space Heating	Furnace	A furnace's combustion controls, ventilation systems, and heat exchanger require regular checks and maintenance for the unit to function effectively and efficiently throughout its life. Neglecting necessary maintenance leads to a steady decline in performance, requiring the unit to use more energy for the same heating load.
RM017	Gas Boiler - Hot Water Reset	Natural Gas	Space Heating	Boiler	
RM018	Gas Boiler - Steam Trap Maintenance	Natural Gas	Space Heating	Boiler	
RM019	Gas Boiler - Maintenance	Natural Gas	Space Heating	Boiler	A boiler's combustion controls, circulation loops, and heat exchanger require regular checks and maintenance for the unit to function effectively and efficiently throughout its life. Neglecting necessary maintenance leads to a steady decline in performance, requiring the unit to use more energy for the same heating load.
RM020	Gas Boiler - Pipe Insulation	Natural Gas	Space Heating	Boiler	Insulating hot water pipes decreases energy losses from piping that distributes hot water throughout the building. It also results in quicker delivery of hot water and may allow the lowering of the hot water set point, which saves energy. The most common insulation materials for this purpose are polyethylene and neoprene.
RM021	Water Heater - Drainwater Heat Recovery	Natural Gas	Water Heating	All	This measure installs a heat recovery system at the drain point, returning some of that energy to the water heating system. It has limited applicability, requiring access to the area underneath the shower drain.
RM022	Water Heater - Faucet Aerators	Natural Gas	Water Heating	All	This measure involves installing a faucet aerator for bathroom use, reducing GPM from 2.5 to 1.0
RM023	Water Heater - Low Flow Showerhead (2.0 GPM)	Natural Gas	Water Heating	All	This measure involves installing a low flow showerhead, reducing GPM from 2.5 to 2.0 GPM
RM024	Water Heater - Low Flow Showerhead (1.5 GPM)	Natural Gas	Water Heating	All	This measure involves installing a low flow showerhead, reducing GPM from 2.5 to 1.5 GPM
RM025	Water Heater - Temperature Setback	Natural Gas	Water Heating	All	A thermostatic shower restriction (TSR) valve is installed between the shower arm and the shower-head, and can be coupled with a low-flow showerhead. The device works by slowing the shower flow down once the hot water reaches the valve, thus reducing the behavioral waste of the additional hot water used before the shower is actually in use by a customer.

RM026	Water Heater - Thermostatic Shower Restriction Valve	Natural Gas	Water Heating	All	A thermostatic shower restriction (TSR) valve is installed between the shower arm and the shower-head, and can be coupled with a low-flow showerhead. The device works by slowing the shower flow down once the hot water reaches the valve, thus reducing the behavioral waste of the additional hot water used before the shower is actually in use by a customer.
RM027	Water Heater - Pipe Insulation	Natural Gas	Water Heating	All	Insulating hot water pipes decreases energy losses from piping that distributes hot water throughout the building. It also results in quicker delivery of hot water and may allow the lowering of the hot water set point, which saves energy. The most common insulation materials for this purpose are polyethylene and neoprene.
RM028	Water Heater - Solar System	Natural Gas	Water Heating	All	Solar water heating systems can be used in residential buildings that have an appropriate near-south-facing roof or nearby unshaded grounds for installing a collector. Although system types vary, in general these systems use a solar absorber surface within a solar collector or an actual storage tank. Either a heat-transfer fluid or the actual potable water flows through tubes attached to the absorber and transfers heat from it. (Systems with a separate heat-transfer-fluid loop include a heat exchanger that then heats the potable water.) The heated water is stored in a separate preheat tank or a conventional water heater tank. If additional heat is needed, it is provided by a conventional water-heating system.
RM029	Pool Heater - Solar System	Natural Gas	Miscellaneous	Pool Heater	Similar to a solar water heating system above, this setup is typically smaller, and serves only the pool heating needs.
RM030	ENERGY STAR Dishwashers	Natural Gas	Water Heating	All	ENERGY STAR rated dishwashers not only have more options for shorter or less electricity-consuming wash and dry cycles, they also use less water. For this natural gas study, we are concerned with the water savings Non Energy Benefit and the gas fuel savings from the water heater.
RM031	ENERGY STAR Clothes Washers	Natural Gas	Water Heating	All	ENERGY STAR rated clothes washers not only have more options for shorter or less electricity-consuming wash cycles, they also use less water. For this natural gas study, we are concerned with the water savings Non Energy Benefit and the gas fuel savings from the water heater.
RM032	ENERGY STAR Homes	Natural Gas	Space Heating Water Heating	All All	Comprehensive energy efficient new home construction.
RM033	Built Green homes	Natural Gas	Space Heating Water Heating	All All	Comprehensive energy efficient new home construction.
RM034	Combined Boiler + DHW System (Storage Tank)	Natural Gas	Heating Water Heating	Boiler All	A combination unit can provide both household heating needs as a boiler and hot water for domestic use, which can lead to some savings by eliminating the redundant components.
RM035	Combined Boiler + DHW System (Tankless)	Natural Gas	Space Heating Water Heating	All All	A combination unit can provide both household heating needs as a boiler and hot water for domestic use, which can lead to some savings by eliminating the redundant components.

Cascade Natural Gas Company: Commercial Measure List (Equipment)

Measure Code	Fuel	End Use	Technology	Equipment	Label	On Market	Off Market	Measure Description
CE001	Natural Gas	Heating	Furnace	E1	AFUE 80% (Standard)			This measure covers the installation of a high efficiency gas furnace in lieu of a standard efficiency gas furnace. High efficiency gas furnaces achieve savings through the utilization of a sealed, super insulated combustion chamber, more efficient burners, and multiple heat exchangers that remove a significant portion of the waste heat from the flue gasses. Because multiple heat exchangers are used to remove waste heat from the escaping flue gasses, most of the flue gasses condense and must be drained. Furnaces equipped with ECM fan motors can save additional electric energy.
CE001	Natural Gas	Heating	Furnace	E2	AFUE 90%			
CE001	Natural Gas	Heating	Furnace	E3	AFUE 96%			
CE002	Natural Gas	Heating	Boiler	E1	AFUE 80% (Standard)			To qualify for this measure the installed equipment must be replacement of an irreparable existing boiler with a high efficiency, gas-fired steam or hot water boiler. High efficiency boilers achieve gas savings through the utilization of a sealed combustion chamber and multiple heat exchangers that remove a significant portion of the waste heat from flue gasses. Because multiple heat exchangers are used to remove waste heat from the escaping flue gasses, some of the flue gasses condense and must be drained.
CE002	Natural Gas	Heating	Boiler	E3	AFUE 85%			
CE002	Natural Gas	Heating	Boiler	E4	AFUE 97%			
CE002	Natural Gas	Heating	Boiler	E5	Convert to NG Air Source Heat Pump			
CE003	Natural Gas	Heating	Unit Heater	E1	Standard			In order for this characterization to apply, the efficient equipment is assumed to be a condensing unit heater up to 300 MBH with a Thermal Efficiency > 90% and the heater must be vented, and condensate drained per manufacturer specifications. The unit must be replacing existing natural gas equipment. In order for this characterization to apply, the baseline condition is assumed to be a non-condensing natural gas unit heater.
CE003	Natural Gas	Heating	Unit Heater	E2	Condensing			
CE003	Natural Gas	Heating	Unit Heater	E3	Infrared Radiant			
CE004	Natural Gas	Water Heating	Water Heater	E1	TE 0.80			This measure applies to installing a 67% EF gas-fired water heaters in a non-residential application that already had a gas fired water heater. Primary applications would include (but not limited to) hotels/motels, small commercial spaces, offices and restaurants. In order for this characterization to apply, the efficient equipment is assumed to be a gas-fired storage water heaters with 0.67 EF installed in a non-residential application.
CE004	Natural Gas	Water Heating	Water Heater	E2	TE 0.90			
CE004	Natural Gas	Water Heating	Water Heater	E3	TE 0.94			
CE004	Natural Gas	Water Heating	Water Heater	E4	Instantaneous TE 0.94			
CE004	Natural Gas	Water Heating	Water Heater	E5	Gas-Fired Absorption HPWH			
CE004	Natural Gas	Food Preparation	Oven	E1	Standard			This set of measures includes high-efficiency fryers, ovens, dishwashers, and hot food containers. Less common equipment, such as broilers and steamers, and assumed to be modeled with the other more common equipment types.
CE004	Natural Gas	Food Preparation	Oven	E2	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496			
CE005	Natural Gas	Food Preparation	Conveyor Oven	E1	Standard			This set of measures includes high-efficiency fryers, ovens, dishwashers, and hot food containers. Less common equipment, such as broilers and steamers, and assumed to be modeled with the other more common equipment types.
CE005	Natural Gas	Food Preparation	Conveyor Oven	E2	ENERGY STAR (EF ≥ 44%) Convection Oven utilizing ASTM Std F1496			
CE006	Natural Gas	Food Preparation	Double Rack Oven	E1	Standard			This set of measures includes high-efficiency fryers, ovens, dishwashers, and hot food containers. Less common equipment, such as broilers and steamers, and assumed to be modeled with the other more common equipment types.
CE006	Natural Gas	Food Preparation	Double Rack Oven	E2	FTSC Qualified (>50% Cooking Efficiency)			
CE007	Natural Gas	Food Preparation	Fryer	E1	Standard			This set of measures includes high-efficiency fryers, ovens, dishwashers, and hot food containers. Less common equipment, such as broilers and steamers, and assumed to be modeled with the other more common equipment types.
CE007	Natural Gas	Food Preparation	Fryer	E2	ENERGY STAR			
CE008	Natural Gas	Food Preparation	Broiler	E1	Standard			This set of measures includes high-efficiency cooking equipment, with improved design, additional insulation, tighter-fitting door gaskets and hinges, and electronic ignition (no pilot light) where applicable.
CE008	Natural Gas	Food Preparation	Broiler	E2	Infrared Burners			
CE009	Natural Gas	Food Preparation	Griddle	E1	Standard			This set of measures includes high-efficiency cooking equipment, with improved design, additional insulation, tighter-fitting door gaskets and hinges, and electronic ignition (no pilot light) where applicable.
CE009	Natural Gas	Food Preparation	Griddle	E2	ENERGY STAR			
CE010	Natural Gas	Food Preparation	Range	E1	Standard			This set of measures includes high-efficiency cooking equipment, with improved design, additional insulation, tighter-fitting door gaskets and hinges, and electronic ignition (no pilot light) where applicable.
CE010	Natural Gas	Food Preparation	Range	E2	High Efficiency			
CE011	Natural Gas	Food Preparation	Steamer	E1	Standard			This set of measures includes high-efficiency cooking equipment, with improved design, additional insulation, tighter-fitting door gaskets and hinges, and electronic ignition (no pilot light) where applicable.
CE011	Natural Gas	Food Preparation	Steamer	E2	ENERGY STAR			
CE012	Natural Gas	Food Preparation	Commercial Food Prep Other	E1	Standard			This set of measures includes high-efficiency cooking equipment, with improved design, additional insulation, tighter-fitting door gaskets and hinges, and electronic ignition (no pilot light) where applicable.
CE012	Natural Gas	Food Preparation	Commercial Food Prep Other	E2	ENERGY STAR			
CE013	Natural Gas	Miscellaneous	Pool Heater	E1	Standard (EF .82)			Gas pool heaters have a burner to heat water in a loop. Efficiency improvements can include: exhaust fan controls, electronic ignition (no pilot light), compact size and lighter weight to reduce cycling losses, and sealed combustion. Very high efficiency units, or condensing units, condense the water vapor produced in the combustion process and also use the heat from this condensation.
CE013	Natural Gas	Miscellaneous	Pool Heater	E2	Condensing (EF .90)			
CE014	Natural Gas	Miscellaneous	Miscellaneous	E1	Miscellaneous			A catchall category for miscellaneous natural gas uses.

Cascade Natural Gas Company: Commercial Measure List (Non-Equipment)

Measure Code	Measure	Typical Savings Apply to:			Description
CM001	Insulation - Roof/Ceiling	Natural Gas	Heating	All	Thermal insulation is material or combinations of materials that are used to inhibit the flow of heat energy by conductive, convective, and radiative transfer modes. Thus, thermal insulation can conserve energy by reducing the heat loss or gain of a building. The type of building construction defines insulating possibilities. Typical insulating materials include: loose-fill (blown) cellulose; loose-fill (blown) fiberglass; and rigid polystyrene.
CM002	Insulation - Wall Cavity	Natural Gas	Heating	All	Thermal insulation is material or combinations of materials that are used to inhibit the flow of heat energy by conductive, convective, and radiative transfer modes. Thus, thermal insulation can conserve energy by reducing the heat loss or gain of a building. The type of building construction defines insulating possibilities. Typical insulating materials include: loose-fill (blown) cellulose; loose-fill (blown) fiberglass; and rigid polystyrene.
CM003	Insulation - Ducting	Natural Gas	Heating	All	Air distribution ducts can be insulated to reduce heating or cooling losses. Best results can be achieved by covering the entire surface area with insulation. Insulation material inhibits the transfer of heat through the air-supply duct. Several types of ducts and duct insulation are available, including flexible duct, pre-insulated duct, duct board, duct wrap, tacked, or glued rigid insulation, and waterproof hard shell materials for exterior ducts.
CM004	HVAC - Duct Repair and Sealing	Natural Gas	Heating	All	Leakage in unsealed ducts varies considerably because of the differences in fabricating machinery used, the methods for assembly, installation workmanship, and age of the ductwork. Air leaks from the system to the outdoors result in a direct loss proportional to the amount of leakage and the difference in enthalpy between the outdoor air and the conditioned air. To seal ducts, a wide variety of sealing methods and products exist. Each has a relatively short shelf life, and no documented research has identified the aging characteristics of sealant applications.
CM005	Windows - High Efficiency	Natural Gas	Heating	All	High-efficiency windows, such as those labeled under the ENERGY STAR Program, are designed to reduce a building's energy bill while increasing comfort for the occupants at the same time. High-efficiency windows have reducing properties that reduce the amount of heat transfer through the glazing surface. For example, some windows have a low-E coating, which is a thin film of metallic oxide coating on the glass surface that allows passage of short-wave solar energy through glass and prevents long-wave energy from escaping. Another example is double-pane glass that reduces conductive and convective heat transfer. There are also double-pane glasses that are gas-filled (usually argon) to further increase the insulating properties of the window.
CM006	Gas Boiler - Maintenance	Natural Gas	Heating	Boiler	Regular cleaning and maintenance enables a natural gas boiler to function effectively and efficiently throughout its years of service. Neglecting necessary maintenance leads to a steady decline in performance while energy use increases. Maintenance can increase the efficiency of poorly performing equipment by as much as 10%.
CM007	Gas Furnace - Maintenance	Natural Gas	Heating	Furnace	Regular cleaning and maintenance enables a natural gas furnace to function effectively and efficiently throughout its years of service. Neglecting necessary maintenance leads to a steady decline in performance while energy use increases. Maintenance can increase the efficiency of poorly performing equipment by as much as 10%.
CM008	Gas Boiler - Hot Water Reset	Natural Gas	Heating	Boiler	This measure relates to improving combustion efficiency by adding controls to non-residential building heating boilers to vary the boiler water supply temperature relative to heating load as a function of the outdoor air temperature to save energy. Energy is saved by increasing the temperature difference between the supply water temperature in the boiler's heat exchanger and the boiler's burner flame temperature. The flame temperature remains the same while the heating supply water temperature decreases with the decrease in heating load due to an increase in outside air temperature. A lockout temperature is also set to prevent the boiler from turning on when it is above a certain temperature outdoors.
CM009	Steam Trap Maintenance	Natural Gas	Heating	All	Under normal operating conditions, the valve and seat area is subjected to hot high-pressure water flow. Water is corrosive and causes surface erosion. With no maintenance, eventually the valve will fail to close properly and the trap will fail to seal and will waste steam.
CM010	Gas Boiler - High Turndown	Natural Gas	Heating	Boiler	This measures is for non-residential boilers equipped with linkageless controls providing space heating with burners having a turndown less than 6:1. Turndown is the ratio of the high firing rate to the low firing rate. When boilers are subjected to loads below the low firing rate, the boiler must cycle on/off to meet the load requirements. A higher turndown ratio reduces burner startups, provides better load control, saves wear-and-tear on the burner, and reduces purge-air requirements, all of these benefits result in better overall efficiency.
CM011	Gas Boiler - Burner Control Optimization	Natural Gas	Heating	Boiler	Control of boiler air and natural gas dampers to optimize combustion. This may be accomplished through some combination of parallel positioning controls and oxygen trim.
CM012	HVAC - Shut Off Damper	Natural Gas	Heating	All	This measure is for non-residential atmospheric boilers or furnaces providing space heating without a shut off damper. When appliances are on standby mode warm room air is drawn through the stack via the draft hood or dilution air inlet at a rate proportional to the stack height, diameter, and outdoor temperature. More air is drawn through the vent immediately after the appliance shuts off and the flue is still hot. Installation of a new shut off damper can prevent heat from being drawn up the warm vent and reducing the amount of air that passes through the furnace or boiler heat exchanger. This reduction in air can slightly increase overall operating efficiency by reducing the time needed to achieve steady-state operating conditions.
CM013	HVAC - Demand Controlled Ventilation	Natural Gas	Heating	Furnace Boiler	Also known as Demand Controlled Ventilation, this measure uses carbon dioxide (CO2) levels to indicate the level of occupancy in a space. Sensors monitor CO2 levels so that air handling controls can adjust the amount of outside air the system needs to intake. Ventilation rates are thereby controlled based on occupancy, rather than a
CM014	Gas Boiler - Stack Economizer	Natural Gas	Heating	Boiler	Stack economizers are designed to recover heat from hot boiler flue gasses. Recovered heat is used to preheat boiler feed water. This measure describes the retrofit of HVAC boilers with stack economizers, HVAC boilers are defined as those used for space heating applications.
CM015	Gas Furnace Tube Inserts	Natural Gas	Heating	Boiler	
CM016	Gas Boiler - Insulate Steam Lines/Condensate Tank	Natural Gas	Heating	Boiler	Insulation to prevent heat loss from steam lines.
CM017	Gas Boiler - Insulate Hot Water Lines	Natural Gas	Heating	Boiler	Insulation to prevent heat loss from hot water lines.
CM018	Space Heating - Heat Recovery Ventilator	Natural Gas	Heating	All	Heat recovery ventilation uses a counter-flow, air-to-air heat exchanger between inbound and outbound air flow to selectively transfer heat and reduce space heating
CM019	Thermostat - Programmable	Natural Gas	Heating	All	This measure considers a standard programmable thermostat with no remote interactive capabilities. The baseline is a manual thermostat.
CM020	Thermostat - WiFi Enabled	Natural Gas	Heating	All	This measure considers a programmable thermostat with interactive features such as a remote control phone app. Many models also inclue "learning" algorithms that automatically adjust settings based on user preferences. The baseline for this measure is a standard programmable thermostat.
CM021	Water Heater - Ozone Laundry	Natural Gas	Water Heating	Water Heater	A new ozone laundry system is added-on to new or existing commercial washing machines using hot water heated with natural gas. The system generator ozone (O3), a naturally occurring molecule, which helps clean fabrics by chemically reacting with soils in cold water. Adding an ozone laundry system will reduce the amount of chemicals, detergents, and hot water needed to wash linens. Using ozone also reduces the total amount of water consumed, saving even more in energy.
CM022	Water Heater - High MEF Commercial Laundry Washers	Natural Gas	Water Heating	Water Heater	High efficiency commercial laundry equipment. Modeled as a non-equipment measure since savings are realized at the water heater rather than the electric washing equipment.
CM023	Water Heater - Motion Control Faucet	Natural Gas	Water Heating	Water Heater	A motion control sensor on a faucet
CM024	Water Heater - Faucet Aerator	Natural Gas	Water Heating	Water Heater	A faucet aerator or low flow nozzle spreads the stream from a faucet helping to reduce water usage. The amount of water passing through the aerator is measured in gallons per minute (GPM) and the lower the GPM the more water the aerator conserves.
CM025	Water Heater - Drainwater Heat Recovery	Natural Gas	Water Heating	Water Heater	
CM026	Water Heater - Efficient Dishwasher	Natural Gas	Water Heating	Water Heater	This measures includes all high temperature commercial dishwashers. They are the highest efficiency commercial dishwashers available (exceeds ENERGY STAR specs. for energy and water savings).
CM027	Water Heater - Pre-Rinse Spray Valve	Natural Gas	Water Heating	Water Heater	

CM028	Water Heater - Central Controls	Natural Gas	Water Heating	Water Heater	Demand control recirculation pumps seek to reduce inefficiency by combining control via temperature and demand inputs, whereby the controller will not activate the recirculation pump unless both (a) the recirculation loop return water has dropped below a prescribed temperature (e.g. 100 degrees F) and (b) a central domestic hot water heater (CDHW) demand is sensed as water flow through the CDHW system.
CM029	Water Heater - Solar System	Natural Gas	Water Heating	Water Heater	Solar water heating systems can be used in residential buildings that have an appropriate near-south-facing roof or nearby unshaded grounds for installing a collector. Although system types vary, in general these systems use a solar absorber surface within a solar collector or an actual storage tank. Either a heat-transfer fluid or the actual potable water flows through tubes attached to the absorber and transfers heat from it. (Systems with a separate heat-transfer-fluid loop include a heat exchanger that then heats the potable water.) The heated water is stored in a separate preheat tank or a conventional water heater tank. If additional heat is needed, it is provided by a conventional water-heating system.
CM030	Destratification Fans (HVLS)	Natural Gas	Heating	All	High volume low-speed (HVLS) ceiling fans are large (8-ft. to 20-ft. in diameter) can more effectively mix and circulate air within a given space to equalize temperature between ceiling and floor levels.
CM031	Kitchen Hood - DCV/MUA	Natural Gas	Heating	All	Controlling kitchen exhaust hoods to limit flow to actual needs. This will reduce heating loads as less conditioned air is rejected from the space.
CM032	Pool Heater - Night Covers	Natural Gas	Miscellaneous	Pool Heater	This measure refers to the installation of covers on commercial use pools that are heated with gas-fired equipment located either indoors or outdoors. By installing pool covers, the heating load on the pool boiler will be reduced by reducing the heat loss from the water to the environment and the amount of actual water lost due to evaporation (which then requires additional heated water to make up for it). The main source of energy loss is through evaporation. This is particularly true of outdoor pools where wind plays a larger role. The point of installing pool covers is threefold. First it will reduce the convective losses due to the wind by shielding the water surface. Second, it will insulate the water from the colder surrounding air. And third, it will reduce radiative losses to the night sky. In doing so, evaporative losses will also be minimized and the boiler will not need to work as hard in replenishing the pool with hot water to keep the desired temperature.
CM033	Building Automation System	Natural Gas	Heating Water Heating	All All	Centralized control system which monitors and optimizes equipment throughout an entire building, leading to efficient operation and improved maintenance.
CM034	Steam System Efficiency Improvements	Natural Gas	Heating	All	Customized improvements to steam system efficiency.
CM035	Commissioning - HVAC	Natural Gas	All	All	For new construction and major renovations, commissioning ensures that building systems are properly designed, specified, and installed to meet the design intent and provide high-efficiency performance. Commissioning begins during the design process.
CM036	Retrocommissioning - HVAC	Natural Gas	All	All	In existing buildings, the retrocommissioning process identifies low-cost or no cost measures, including controls adjustments, to improve building performance and reduce operating costs. Retrocommissioning addresses HVAC, lighting, DHW, and other major building systems.
CM037	Strategic Energy Management	Natural Gas	All	All	This measure models savings available through programs such as BPA's HPEM or Energy Manager offerings. Optimization and strategic energy management integrates best practices of system analysis, equipment improvements, and operational improvements into a sustaining energy program. A facility that implements such a practice treats its energy program in a similar manner to safety or quality control programs: an individual or team is tasked with developing and enforcing standards, goals are set, regular reports are generated and reported to management, and all plant employees are engaged and held accountable. This measure models savings available through programs such as BPA's HPEM or Energy Manager offerings.

Cascade Natural Gas Company: Industrial Measure List (Equipment)

Measure Code	Fuel	End Use	Technology	Equipment	Label	On Market	Off Market	Measure Description
IE001	Natural Gas	Heating	Furnace	E1	AFUE 80% (Standard)			This measure covers the installation of a high efficiency gas furnace in lieu of a standard efficiency gas furnace. High efficiency gas furnaces achieve savings through the utilization of a sealed, super insulated combustion chamber, more efficient burners, and multiple heat exchangers that remove a significant portion of the waste heat from the flue gasses. Because multiple heat exchangers are used to remove waste heat from the escaping flue gasses, most of the flue gasses condense and must be drained. Furnaces equipped with ECM fan motors can save additional electric energy.
IE001	Natural Gas	Heating	Furnace	E2	AFUE 90%			
IE001	Natural Gas	Heating	Furnace	E3	AFUE 95%			
IE002	Natural Gas	Heating	Boiler	E1	AFUE 80% (Standard)			To qualify for this measure the installed equipment must be replacement of an irreparable existing boiler with a high efficiency, gas-fired steam or hot water boiler. High efficiency boilers achieve gas savings through the utilization of a sealed combustion chamber and multiple heat exchangers that remove a significant portion of the waste heat from flue gasses. Because multiple heat exchangers are used to remove waste heat from the escaping flue gasses, some of the flue gasses condense and must be drained.
IE002	Natural Gas	Heating	Boiler	E2	AFUE 85%			
IE002	Natural Gas	Heating	Boiler	E3	AFUE 98%			
IE002	Natural Gas	Heating	Boiler	E4	Convert to NG Air Source Heat Pump			
IE003	Natural Gas	Heating	Unit Heater	E1	Standard			In order for this characterization to apply, the efficient equipment is assumed to be a condensing unit heater up to 300 MBH with a Thermal Efficiency > 90% and the heater must be vented, and condensate drained per manufacturer specifications. The unit must be replacing existing natural gas equipment. In order for this characterization to apply, the baseline condition is assumed to be a non-condensing natural gas unit heater.
IE003	Natural Gas	Heating	Unit Heater	E2	Condensing			
IE003	Natural Gas	Heating	Unit Heater	E3	Infrared Radiant			
IE004	Natural Gas	Process	Process Boiler	E1	Standard			Industrial process where boilers are used to provide hot water or steam
IE005	Natural Gas	Process	Process Heating	E1	Standard			Industrial process other than process boilers where heating is applied
IE006	Natural Gas	Process	Process Cooling	E1	Standard			Industrial process where cooling is applied
IE007	Natural Gas	Process	Other Process	E1	Standard			This category is a "catch all" for the many unique process applications in the broader industrial sector.
IE008	Natural Gas	Miscellaneous	Miscellaneous	E1	Miscellaneous			A catchall category for miscellaneous natural gas uses.

Cascade Natural Gas Company: Industrial Measure List (Non-Equipment)

Measure Code	Measure	Typical Savings Apply to:			Description
IM001	Insulation - Roof/Ceiling	Natural Gas	Heating	All	Thermal insulation is material or combinations of materials that are used to inhibit the flow of heat energy by conductive, convective, and radiative transfer modes. Thus, thermal insulation can conserve energy by reducing the heat loss or gain of a building. The type of building construction defines insulating possibilities. Typical insulating materials include: loose-fill (blown) cellulose; loose-fill (blown) fiberglass; and rigid polystyrene.
IM002	Insulation - Wall Cavity	Natural Gas	Heating	All	Thermal insulation is material or combinations of materials that are used to inhibit the flow of heat energy by conductive, convective, and radiative transfer modes. Thus, thermal insulation can conserve energy by reducing the heat loss or gain of a building. The type of building construction defines insulating possibilities. Typical insulating materials include: loose-fill (blown) cellulose; loose-fill (blown) fiberglass; and rigid polystyrene.
IM003	Insulation - Ducting	Natural Gas	Heating	All	Air distribution ducts can be insulated to reduce heating or cooling losses. Best results can be achieved by covering the entire surface area with insulation. Insulation material inhibits the transfer of heat through the air-supply duct. Several types of ducts and duct insulation are available, including flexible duct, pre-insulated duct, duct board, duct wrap, tacked, or glued rigid insulation, and waterproof hard shell materials for exterior ducts.
IM004	HVAC - Duct Repair and Sealing	Natural Gas	Heating	All	Leakage in unsealed ducts varies considerably because of the differences in fabricating machinery used, the methods for assembly, installation workmanship, and age of the ductwork. Air leaks from the system to the outdoors result in a direct loss proportional to the amount of leakage and the difference in enthalpy between the outdoor air and the conditioned air. To seal ducts, a wide variety of sealing methods and products exist. Each has a relatively short shelf life, and no documented research has identified the aging characteristics of sealant applications.
IM005	Windows - High Efficiency	Natural Gas	Heating	All	High-efficiency windows, such as those labeled under the ENERGY STAR Program, are designed to reduce a building's energy bill while increasing comfort for the occupants at the same time. High-efficiency windows have reducing properties that reduce the amount of heat transfer through the glazing surface. For example, some windows have a low-E coating, which is a thin film of metallic oxide coating on the glass surface that allows passage of short-wave solar energy through glass and prevents long-wave energy from escaping. Another example is double-pane glass that reduces conductive and convective heat transfer. There are also double-pane glasses that are gas-filled (usually argon) to further increase the insulating properties of the window.
IM006	Boiler - Maintenance	Natural Gas	Heating Process	Boiler Process Boiler	Regular cleaning and maintenance enables a natural gas boiler to function effectively and efficiently throughout its years of service. Neglecting necessary maintenance leads to a steady decline in performance while energy use increases. Maintenance can increase the efficiency of poorly performing equipment by as much as 10%.
IM007	Gas Furnace - Maintenance	Natural Gas	Heating	Furnace	Regular cleaning and maintenance enables a natural gas furnace to function effectively and efficiently throughout its years of service. Neglecting necessary maintenance leads to a steady decline in performance while energy use increases. Maintenance can increase the efficiency of poorly performing equipment by as much as 10%.
IM008	Boiler - Hot Water Reset	Natural Gas	Heating Process	Boiler Process Boiler	This measure relates to improving combustion efficiency by adding controls to non-residential building heating boilers to vary the boiler water supply temperature relative to heating load as a function of the outdoor air temperature to save energy. Energy is saved by increasing the temperature difference between the supply water
IM009	Steam Trap Maintenance	Natural Gas	Heating	All	Under normal operating conditions, the valve and seat area is subjected to hot high-pressure water flow. Water is corrosive and causes surface erosion. With no maintenance, eventually the valve will fail to close properly and the trap will fail to seal and will waste steam.
IM010	Gas Boiler - High Turndown	Natural Gas	Heating Process	Boiler Process Boiler	This measures is for non-residential boilers equipped with linkageless controls providing space heating with burners having a turndown less than 6:1. Turndown is the ratio of the high firing rate to the low firing rate. When boilers are subjected to loads below the low firing rate, the boiler must cycle on/off to meet the load
IM011	Gas Boiler - Burner Control Optimization	Natural Gas	Heating Process	Boiler Process Boiler	Control of boiler air and natural gas dampers to optimize combustion. This may be accomplished through some combination of parallel positioning controls and oxygen trim.
IM012	HVAC - Demand Controlled Ventilation	Natural Gas	Heating	Furnace Boiler	Also known as Demand Controlled Ventilation, this measure uses carbon dioxide (CO_2) levels to indicate the level of occupancy in a space. Sensors monitor CO_2 levels so that air handling controls can adjust the amount of outside air the system needs to intake. Ventilation rates are thereby controlled based on occupancy, rather than a
IM013	Boiler - Stack Economizer	Natural Gas	Heating Process	Boiler Process Boiler	Stack economizers are designed to recover heat from hot boiler flue gasses. Recovered heat is used to preheat boiler feed water. This measure describes the retrofit of HVAC boilers with stack economizers, HVAC boilers are defined as those used for space heating applications.
IM014	Gas Furnace Tube Inserts	Natural Gas	Heating	Boiler	
IM015	Space Heating - Heat Recovery Ventilator	Natural Gas	Heating	All	Heat recovery ventilation uses a counter-flow, air-to-air heat exchanger between inbound and outbound air flow to selectively transfer heat and reduce space heating loads.
IM016	Thermostat - Programmable	Natural Gas	Heating	All	This measure considers a standard programmable thermostat with no remote interactive capabilities. The baseline is a manual thermostat.
IM018	Thermostat - WiFi Enabled	Natural Gas	Heating	All	This measure considers a programmable thermostat with interactive features such as a remote control phone app. Many models also inclue "learning" algorithms that automatically adjust settings based on user preferences. The baseline for this measure is a standard programmable thermostat.
IM017	Destratification Fans (HVLS)	Natural Gas	Heating	All	High volume low-speed (HVLS) ceiling fans are large (8-ft. to 20-ft. in diameter) can more effectively mix and circulate air within a given space to equalize temperature between ceiling and floor levels.
IM019	Boiler - Insulate Steam Lines/Condensate Tank	Natural Gas	Heating Process	Boiler Process Boiler	Insulation to prevent heat loss from steam lines.
IM020	Boiler - Insulate Hot Water Lines	Natural Gas	Heating Process	Boiler Process Boiler	Insulation to prevent heat loss from hot water lines.
IM021	Process - Insulate Heated Process Fluids	Natural Gas	Process	Process Heating	Insulation to prevent heat loss from process fluid lines.
IM022	Process Heat Recovery	Natural Gas	Process	All	Customized heat recovery projects for industrial processes.
IM023	Building Automation System	Natural Gas	Heating Water Heating	All All	Centralized control system which monitors and optimizes equipment throughout an entire building, leading to efficient operation and improved maintenance.
IM024	Steam System Efficiency Improvements	Natural Gas	Heating	All	Customized improvements to steam system efficiency.
IM025	Strategic Energy Management	Natural Gas	Heating Process Miscellaneous	All All All	This measure models savings available through programs such as BPA's HPEM or Energy Manager offerings. Optimization and strategic energy management integrates best practices of system analysis, equipment improvements, and operational improvements into a sustaining energy program. A facility that implements such a practice treats its energy program in a similar manner to safety or quality control programs: an individual or team is tasked with developing and enforcing standards, goals are set,
IM026	Commissioning	Natural Gas	Heating Process	All All	For new construction and major renovations, commissioning ensures that building systems are properly designed, specified, and installed to meet the design intent and provide high-efficiency performance. Commissioning begins during the design process.
IM027	Retrocommissioning	Natural Gas	Heating Process	All All	In existing buildings, the retrocommissioning process identifies low-cost or no cost measures, including controls adjustments, to improve building performance and reduce operating costs. Retrocommissioning addresses HVAC, lighting, DHW, and other major building systems.