

Commercial Analysis Appendix Tables

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#	End Use	Technology	Description	Market Type(s)
1	Cooking	Direct fired convection range/oven	Single integrated unit vs. standard range/oven unit; 30% more energy-efficient than standard models. Convection ovens use a small fan to circulate hot air within the oven cavity. Circulating air can heat food more efficiently than the still air found in co	NC/RR
2	Cooking	Exhaust Hood Makeup Air	Provide makeup air directly at exhaust hood instead of pulling conditioned air from occupied space. Energy savings equal to heat load created by outdoor air cfm draw equal to exhaust fan cfm.	NC/RR
3	Cooking	High efficiency ENERGY STAR infrared fryer	Deep fryer; up to 25% more energy-efficient than standard models; catalytic infrared fryers cook foods by submerging them in hot animal or vegetable oils. The oil is heated by gas-burners with the flame traveling through several tubes that are submerged	NC/RR
4	Cooking	High Efficiency ENERGY STAR steam cooker	ESTAR minimum 38% cooking efficiency; up to 60% more energy-efficient than standard model	NC/RR
	Cooking			RET
5	Cooking	High efficiency infrared griddle	Up to 15% more energy-efficient than standard models; rooved griddle replaces less efficient underfired broiler; infrared griddle is a thick slab of flat steel heated from below by gas burners. In an infrared (IR) griddle, standard burners are replaced with porous ceramic plate having about 200 holes per inch. Combustion is designed to take place very near the ceramic burner surface, causing it to glow red at a temperature of about 1,650° F. Efficiency is increased because the red-hot ceramic burner increases heat transfer to the griddle plate.	NC/RR
6	Cooking	Pre-Rinse Spray Valve	Spray used to remove particles before entering commercial dishwasher	RET
7	Cooking	Refrigeration heat recovery	Refrigeration heat recovery	NC/RR
	Cooking			RET
9	Cooling	Cooling system chilled water reset		NC/RR
	Cooling			RET
10	Cooling	Cooling system water side economizer		NC/RR
	Cooling			RET
11	Cooling	Cooling system oversized cooling tower		NC/RR
	Cooling			RET
12	DHW	Condensing DHW stand-alone tank	New high-efficiency residential-sized tank-type gas water heater.	NC/RR
	DHW			RET
13	DHW	Faucet aerator	Faucet Aerators: Standard non conserving faucet aerators have a flow rate of 3-5 gpm (at 40 to 60 psi). Water saving faucet aerators for bathroom applications have flow rates of 0.5-1.0 gpm and water saving faucet aerators for kitchen applications have av	RET
	DHW			NC/RR
14	DHW	Graywater heat exchanger/GFX	Transfers heat from exiting shower/sink water to incoming city/well water.	RET
	DHW			NC/RR
15	DHW	Indirect-fired DHW off space heating boiler	This measure applies to use of indirect DHW as compared to stand-alone tank-type heater.	RET
	DHW			NC/RR/RENO
16	DHW	Instantaneous. High-Modulating Water Heater	Gas water heating at point of use with no storage capacity.	RET
17	DHW	Low-flow shower heads	Low Flow Shower Heads: Standard non conserving shower heads have a flow rate of 3.5 to 6 gallons per minute (gpm at 80 psi). Typical water saving shower heads use 1 to 2.4 gpm and are designed to provide a good quality shower with less water. Water savi	NC/RR
	DHW			RET
18	DHW	Pipe insulation - water heating	DHW Pipe Insulation. Most systems likely already installed.	NC/RENO
19	DHW	Tank insulation	Tank Insulation: Commercial water heater insulation is available either by the blanket or by square foot of fiberglass insulation with protective facing. Insulation blankets range from 50 to 82 gallon tank sizes, with thicknesses of 2 to 4 inches, and R-	NC/RR
	DHW			RET
20	HVAC	Air sealing		NC/RENO
21	HVAC	Improved heating system high efficiency unit - Tier I	Condensing units capture latent heat from water vapor in the flue - care needs to be taken about acidity of condensate. Modulating units have a variable firing rate to match output to heat load. Other high efficiency units rely on other design features an	RET
		Improved heating system high efficiency unit - Tier II	See above	NC/RENO
24	HVAC	Demand-Controlled Ventilation (controller, sensor)	Carbon dioxide sensor controls inlet dampers to vary the amount of inside fresh air used to meet ASHRAE 62 15 or 20 cfm/person standard. Most effective in large, intermittently-occupied spaces.	NC/RR
				RET
25	HVAC	Outdoor air reset		NC/RR
				RET
26	HVAC	High Performance Glazing double pane, low-E, low conductivity frame - Tier I	Currently available high efficiency glazing. Includes double pane, low-E, gas filled and improved solar heat gain coefficient. U-value @ 0.3, SHGF = 0.44.	NC/RENO
27	HVAC	High Performance Glazing double pane, low-E, low conductivity frame - Tier II	Emerging technology. Could include things such as electrochromic glazing and super high R-value windows. Reflects best currently available but very expensive technology.	NC/RENO

#	End Use	Technology	Description	Market Type(s)
28	HVAC	Improved wall insulation	Ceiling Insulation: Installing fiberglass or cellulose insulation material in floor, wall or roof cavities will reduce heat transfer across these surfaces. The type of building construction limits insulation possibilities. Choice of insulation material	NC/RENO
29	HVAC	Improved below-grade insulation	Beyond code, involves use of rigid insulation along foundation walls, between slab and foundation walls, and under slabs.	NC/RENO
30	HVAC	Improved roof insulation	Ceiling Insulation: Installing fiberglass or cellulose insulation material in floor, wall or roof cavities will reduce heat transfer across these surfaces. The type of building construction limits insulation possibilities. Choice of insulation material	NC/RENO
31	HVAC	Sensible Heat Recovery	Efficiencies in heat transfer of 50-75%, depending on product; amount of savings depends upon percentage of heat load attributable to makeup/fresh ventilation air.	NC/RR
	RET			
32	HVAC	Pipe insulation - space heating	Boiler Pipe Insulation: Insulating accessible steam or hot water supply pipes in the boiler room is a cost-effective way to save energy. Savings will vary depending on the temperature of the hot water or steam and the ambient temperature.N Could include	RR/RENO
	HVAC			RET
33	Laundry	Energy Star washer	Tumbling uses less electrical energy and hot water than agitation, savings on gas drying.	NC/RR
	Laundry			RET
34	Swimming Pools	Swimming pool/spa covers	Pool Cover: Installing a pool cover is one of the most cost-effective ways to reduce energy use with a heated swimming pool. Pool covers typically save about 50 to 65% of the energy used to heat the pool if the cover is on 12 hours per day. A pool cover	NC/RR
	Swimming Pools			RET
35	Whole Building	Commissioning	Third party whole building commissioning of new buildings to ensure optimized design, installation and operation of systems.	NC/RR/RENO
36	Whole Building	Retrocommissioning	Optimizing energy usage of existing buildings and systems through better operation and maintenance, control calibration, facilities staff training, etc.	RET
37	Whole Building	Integrated Design - High Performance (30% > codes)	Reflects comprehensive, optimized design of new buildings addressing all end-uses and interactions between them on a systems basis. Includes, but is not limited to, improved shell measures reduce HVAC loads, proper sizing of HVAC equipment and optimized d	NC
38	Whole Building	Integrated Design - Ultra Low Energy Commercial Building (50%> codes)	Emerging technology. Reflects more aggressive level of than Tier I of comprehensive, optimized design of new buildings addressing all end-uses and interactions between them on a systems basis. Performance improvement of 20% better than Tier I. This measur	NC
39	HVAC	Steam trap maintenance	Steam trap leaks lose steam to the plant, lowering overall system efficiency. See www.oit.doe.gov/bestpractices/factsheets/velsicol.pdf	RET
40	HVAC	Oxygen Trim	For larger, "built-up" boilers, includes oxygen trim, tuning, etc.	NC/RR
	HVAC			RET
41	HVAC	Infrared heater	Gas fired radiant heaters are available in tube or plaque form. They radiate heat directly down to the space - typically used in warehouse or light industrial settings, parking lots, transportation terminals. These heaters do not use ductwork, so duct los	RR
	HVAC			RET

	A	C	D	E	F	G
1	Downstate Commercial Measures					
2	Total Resource Cost Test Benefit/Cost Ratio and Levelized Cost of Saved Energy					
3						
4						
5	Measure Name	Measure ID4 (e.g., Bldg type)	Measure ID5 (e.g., End Use)	Measure ID6 (e.g., Market: Retrofit, NC, ROB)	Total Resource BCR	TRC Levelized Cost per Saved Therm (\$/Therm)
6	Exhaust Hood Makeup Air	Office	Space Heating	New construction	16.55	(0.43)
7	Exhaust Hood Makeup Air	Office	Space Heating	Remodel/Replacement	21.24	(0.46)
8	High efficiency ENERGY STAR fryer	Office	Cooking	New construction	2.06	0.44
9	High efficiency ENERGY STAR fryer	Office	Cooking	Remodel/Replacement	2.06	0.44
10	Pre-Rinse Spray Valve	Office	Water Heating	Retrofit	34.30	0.00
11	Refrigeration heat recovery	Office	Water Heating	Retrofit	3.49	0.51
12	Refrigeration heat recovery	Office	Water Heating	New construction	2.80	0.31
13	Refrigeration heat recovery	Office	Water Heating	Remodel/Replacement	3.57	0.23
14	Cooling system chilled water reset	Office	Cooling	Retrofit	1.87	1.01
15	Cooling system chilled water reset	Office	Cooling	New construction	1.46	0.56
16	Cooling system chilled water reset	Office	Cooling	Remodel/Replacement	1.89	0.46
17	Cooling system water side economizer	Office	Cooling	Retrofit	1.54	0.65
18	Cooling system water side economizer	Office	Cooling	New construction	1.26	0.49
19	Cooling system water side economizer	Office	Cooling	Remodel/Replacement	1.55	0.29
20	Condensing DHW stand-alone	Office	Water Heating	Retrofit	3.13	0.69
21	Condensing DHW stand-alone	Office	Water Heating	New construction	3.88	0.25
22	Condensing DHW stand-alone	Office	Water Heating	Remodel/Replacement	5.01	0.19
23	Faucet aerator	Office	Water Heating	Retrofit	6.05	(2.96)
24	Indirect-fired DHW off space heating boiler	Office	Water Heating	Retrofit	2.70	0.92
25	Indirect-fired DHW off space heating boiler	Office	Water Heating	New construction	2.87	0.34
26	Indirect-fired DHW off space heating boiler	Office	Water Heating	Remodel/Replacement	3.70	0.26
27	Instantaneous. High-Modulating Water Heater	Office	Water Heating	Retrofit	3.00	0.73
28	Instantaneous. High-Modulating Water Heater	Office	Water Heating	New construction	6.59	0.15
29	Instantaneous. High-Modulating Water Heater	Office	Water Heating	Renovation	6.59	0.15
30	Instantaneous. High-Modulating Water Heater	Office	Water Heating	Remodel/Replacement	8.51	0.11
31	Low-flow shower heads	Office	Water Heating	Retrofit	36.80	(2.29)
32	Low-flow shower heads	Office	Water Heating	New construction	21.25	(0.99)
33	Low-flow shower heads	Office	Water Heating	Remodel/Replacement	27.43	(1.01)
34	Pipe insulation - water heating	Office	Water Heating	Retrofit	25.77	0.08
35	Pipe insulation - water heating	Office	Water Heating	New construction	20.30	0.05
36	Pipe insulation - water heating	Office	Water Heating	Renovation	20.30	0.05
37	Tank insulation	Office	Water Heating	Retrofit	1.90	1.11
38	Tank insulation	Office	Water Heating	New construction	1.50	0.65
39	Tank insulation	Office	Water Heating	Remodel/Replacement	1.93	0.50
40	Air Sealing	Office	Space Heating	Retrofit	6.60	(0.21)
41	Air Sealing	Office	Space Heating	New construction	3.85	0.13
42	Air Sealing	Office	Space Heating	Renovation	3.85	0.13
43	Improved heating system high efficiency unit - Tier 1	Office	Space Heating	New construction	1.03	1.56
44	Improved heating system high efficiency unit - Tier 1	Office	Space Heating	Remodel/Replacement	1.29	1.29
45	Improved heating system condensing unit - Tier 2	Office	Space Heating	New construction	1.03	1.56
46	Improved heating system condensing unit - Tier 2	Office	Space Heating	Remodel/Replacement	1.29	1.25
47	Programmable Thermostat	Office	Space Heating	Retrofit	3.08	0.98
48	Programmable Thermostat	Office	Space Heating	Renovation	1.99	0.75
49	Programmable Thermostat	Office	Space Heating	Remodel/Replacement	2.57	0.56
50	Demand-Controlled Ventilation (controller, sensor)	Office	Space Heating	Retrofit	7.96	0.23
51	Demand-Controlled Ventilation (controller, sensor)	Office	Space Heating	New construction	6.83	0.14
52	Demand-Controlled Ventilation (controller, sensor)	Office	Space Heating	Remodel/Replacement	8.05	0.10
53	Outdoor Air Reset	Office	Space Heating	Retrofit	2.18	1.57
54	Outdoor Air Reset	Office	Space Heating	New construction	1.21	1.39
55	Outdoor Air Reset	Office	Space Heating	Remodel/Replacement	1.56	1.08
56	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	Office	Space Heating	New construction	9.10	(0.13)
57	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	Office	Space Heating	Renovation	9.10	(0.13)
58	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	Office	Space Heating	New construction	1.47	1.00
59	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	Office	Space Heating	Renovation	1.47	1.00
60	Improved below-grade insulation	Office	Space Heating	New construction	2.55	0.63
61	Improved below-grade insulation	Office	Space Heating	Renovation	2.55	0.63
62	Pipe insulation - space heating	Office	Space Heating	Retrofit	74.47	0.05
63	Pipe insulation - space heating	Office	Space Heating	New construction	59.45	0.03
64	Pipe insulation - space heating	Office	Space Heating	Renovation	59.45	0.03
65	Commissioning	Office	Total	New construction	4.13	(1.97)
66	Commissioning	Office	Total	Renovation	4.13	(1.97)
67	Commissioning	Office	Total	Remodel/Replacement	5.34	(2.23)
68	Retrocommissioning	Office	Total	Retrofit	6.88	(1.83)
69	Integrated Design - High Performance (30% > codes) - Tier 1	Office	Total	New construction	2.41	0.00
70	Integrated Design - High Performance (50% > codes) Tier 2	Office	Total	New construction	2.41	0.00

Down

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1	Downstate Commercial Measures					
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5	Measure Name	Measure ID4 (e.g., Bldg type)	Measure ID5 (e.g., End Use)	Measure ID6 (e.g., Market: Retrofit, NC, ROB)	Total Resource BCR	TRC Levelized Cost per Saved Therm (\$/Therm)
71	Steam trap Maintenance	Office	Space Heating	Retrofit	3.44	0.48
72	Oxygen Trim	Office	Space Heating	Retrofit	47.39	0.08
73	Oxygen Trim	Office	Space Heating	New construction	68.26	0.02
74	Oxygen Trim	Office	Space Heating	Remodel/Replacement	62.00	0.03
75	Direct fired convection range/oven	Retail	Cooking	New construction	3.21	0.28
76	Direct fired convection range/oven	Retail	Cooking	Remodel/Replacement	3.21	0.28
77	Exhaust Hood Makeup Air	Retail	Space Heating	New construction	15.51	(0.28)
78	Exhaust Hood Makeup Air	Retail	Space Heating	Remodel/Replacement	17.60	(0.29)
79	High efficiency ENERGY STAR fryer	Retail	Cooking	New construction	2.06	0.44
80	High efficiency ENERGY STAR fryer	Retail	Cooking	Remodel/Replacement	2.06	0.44
81	High efficiency ENERGY STAR steam cooker	Retail	Cooking	Retrofit	1.06	1.57
82	High efficiency ENERGY STAR steam cooker	Retail	Cooking	New construction	13.50	(2.23)
83	High efficiency ENERGY STAR steam cooker	Retail	Cooking	Remodel/Replacement	13.50	(2.23)
84	Pre-Rinse Spray Valve	Retail	Water Heating	Retrofit	35.52	0.00
85	Refrigeration heat recovery	Retail	Water Heating	Retrofit	3.54	0.50
86	Refrigeration heat recovery	Retail	Water Heating	New construction	2.84	0.30
87	Refrigeration heat recovery	Retail	Water Heating	Remodel/Replacement	3.63	0.22
88	Cooling system chilled water reset	Retail	Cooling	Retrofit	1.84	1.03
89	Cooling system chilled water reset	Retail	Cooling	New construction	1.44	0.57
90	Cooling system chilled water reset	Retail	Cooling	Remodel/Replacement	1.86	0.47
91	Cooling system water side economizer	Retail	Cooling	Retrofit	1.55	0.63
92	Cooling system water side economizer	Retail	Cooling	New construction	1.26	0.49
93	Cooling system water side economizer	Retail	Cooling	Remodel/Replacement	1.56	0.29
94	Condensing DHW stand-alone	Retail	Water Heating	Retrofit	3.14	0.69
95	Condensing DHW stand-alone	Retail	Water Heating	New construction	3.88	0.25
96	Condensing DHW stand-alone	Retail	Water Heating	Remodel/Replacement	5.01	0.19
97	Faucet aerator	Retail	Water Heating	Retrofit	19.05	(3.65)
98	Indirect-fired DHW off space heating boiler	Retail	Water Heating	Retrofit	2.71	0.92
99	Indirect-fired DHW off space heating boiler	Retail	Water Heating	New construction	2.87	0.34
100	Indirect-fired DHW off space heating boiler	Retail	Water Heating	Remodel/Replacement	3.70	0.26
101	Instantaneous. High-Modulating Water Heater	Retail	Water Heating	Retrofit	3.02	0.72
102	Instantaneous. High-Modulating Water Heater	Retail	Water Heating	New construction	6.59	0.15
103	Instantaneous. High-Modulating Water Heater	Retail	Water Heating	Renovation	6.59	0.15
104	Instantaneous. High-Modulating Water Heater	Retail	Water Heating	Remodel/Replacement	8.51	0.11
105	Pipe insulation - water heating	Retail	Water Heating	Retrofit	26.24	0.08
106	Pipe insulation - water heating	Retail	Water Heating	New construction	20.63	0.05
107	Pipe insulation - water heating	Retail	Water Heating	Renovation	20.63	0.05
108	Tank insulation	Retail	Water Heating	Retrofit	1.94	1.09
109	Tank insulation	Retail	Water Heating	New construction	1.52	0.64
110	Tank insulation	Retail	Water Heating	Remodel/Replacement	1.97	0.49
111	Air Sealing	Retail	Space Heating	Retrofit	5.49	0.40
112	Air Sealing	Retail	Space Heating	New construction	4.73	0.21
113	Air Sealing	Retail	Space Heating	Renovation	4.73	0.21
114	Improved heating system high efficiency unit - Tier 1	Retail	Space Heating	New construction	1.41	1.14
115	Improved heating system high efficiency unit - Tier 1	Retail	Space Heating	Remodel/Replacement	1.76	0.91
116	Improved heating system condensing unit - Tier 2	Retail	Space Heating	New construction	0.95	1.70
117	Improved heating system condensing unit - Tier 2	Retail	Space Heating	Remodel/Replacement	1.18	1.36
118	Programmable Thermostat	Retail	Space Heating	Retrofit	9.07	0.39
119	Programmable Thermostat	Retail	Space Heating	Renovation	7.26	0.22
120	Programmable Thermostat	Retail	Space Heating	Remodel/Replacement	9.37	0.17
121	Demand-Controlled Ventilation (controller, sensor)	Retail	Space Heating	Retrofit	8.07	(3.93)
122	Demand-Controlled Ventilation (controller, sensor)	Retail	Space Heating	New construction	5.77	(1.62)
123	Demand-Controlled Ventilation (controller, sensor)	Retail	Space Heating	Remodel/Replacement	7.37	(1.76)
124	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	Retail	Space Heating	New construction	10.55	0.26
125	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	Retail	Space Heating	Renovation	10.55	0.26
126	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	Retail	Space Heating	New construction	2.34	0.68
127	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	Retail	Space Heating	Renovation	2.34	0.68
128	Improved below-grade insulation	Retail	Space Heating	New construction	1.99	0.81
129	Improved below-grade insulation	Retail	Space Heating	Renovation	1.99	0.81
130	Improved roof insulation	Retail	Space Heating	New construction	1.28	1.19
131	Improved roof insulation	Retail	Space Heating	Renovation	1.28	1.19
132	Sensible Heat Recovery	Retail	Space Heating	Retrofit	27.71	1.93
133	Sensible Heat Recovery	Retail	Space Heating	New construction	25.40	0.89
134	Sensible Heat Recovery	Retail	Space Heating	Remodel/Replacement	29.08	0.89
135	Pipe insulation - space heating	Retail	Space Heating	Retrofit	75.32	0.05

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136	Pipe insulation - space heating	Retail	Space Heating	New construction	60.06	0.03
137	Pipe insulation - space heating	Retail	Space Heating	Renovation	60.06	0.03
138	Commissioning	Retail	Total	New construction	4.33	(2.19)
139	Commissioning	Retail	Total	Renovation	4.33	(2.19)
140	Commissioning	Retail	Total	Remodel/Replacement	5.59	(2.45)
141	Retrocommissioning	Retail	Total	Retrofit	7.11	(2.02)
142	Integrated Design - High Performance (30% > codes) - Tier 1	Retail	Total	New construction	2.47	(0.07)
143	Integrated Design - High Performance (50% > codes) Tier 2	Retail	Total	New construction	2.47	(0.07)
144	Steam trap Maintenance	Retail	Space Heating	Retrofit	2.49	0.66
145	Oxygen Trim	Retail	Space Heating	Retrofit	34.39	0.10
146	Oxygen Trim	Retail	Space Heating	New construction	68.26	0.02
147	Oxygen Trim	Retail	Space Heating	Remodel/Replacement	46.30	0.04
148	Direct fired convection range/oven	Grocery	Cooking	New construction	3.21	0.28
149	Direct fired convection range/oven	Grocery	Cooking	Remodel/Replacement	3.21	0.28
150	Exhaust Hood Makeup Air	Grocery	Space Heating	New construction	15.70	(0.27)
151	Exhaust Hood Makeup Air	Grocery	Space Heating	Remodel/Replacement	14.14	(0.26)
152	High efficiency ENERGY STAR fryer	Grocery	Cooking	New construction	2.06	0.44
153	High efficiency ENERGY STAR fryer	Grocery	Cooking	Remodel/Replacement	2.06	0.44
154	High efficiency ENERGY STAR steam cooker	Grocery	Cooking	Retrofit	1.06	1.57
155	High efficiency ENERGY STAR steam cooker	Grocery	Cooking	New construction	13.50	(2.23)
156	High efficiency ENERGY STAR steam cooker	Grocery	Cooking	Remodel/Replacement	13.50	(2.23)
157	Pre-Rinse Spray Valve	Grocery	Water Heating	Retrofit	34.85	0.00
158	Refrigeration heat recovery	Grocery	Water Heating	Retrofit	3.49	0.52
159	Refrigeration heat recovery	Grocery	Water Heating	New construction	2.84	0.31
160	Refrigeration heat recovery	Grocery	Water Heating	Remodel/Replacement	3.59	0.23
161	Cooling system chilled water reset	Grocery	Cooling	Retrofit	1.95	0.95
162	Cooling system chilled water reset	Grocery	Cooling	New construction	1.54	0.53
163	Cooling system chilled water reset	Grocery	Cooling	Remodel/Replacement	1.96	0.44
164	Cooling system water side economizer	Grocery	Cooling	Retrofit	1.52	0.69
165	Cooling system water side economizer	Grocery	Cooling	New construction	1.25	0.50
166	Cooling system water side economizer	Grocery	Cooling	Remodel/Replacement	1.53	0.31
167	Condensing DHW stand-alone	Grocery	Water Heating	Retrofit	2.34	0.93
168	Condensing DHW stand-alone	Grocery	Water Heating	New construction	2.95	0.33
169	Condensing DHW stand-alone	Grocery	Water Heating	Remodel/Replacement	3.76	0.26
170	Faucet aerator	Grocery	Water Heating	Retrofit	18.83	(3.65)
171	Indirect-fired DHW off space heating boiler	Grocery	Water Heating	Retrofit	2.02	1.23
172	Indirect-fired DHW off space heating boiler	Grocery	Water Heating	New construction	2.18	0.44
173	Indirect-fired DHW off space heating boiler	Grocery	Water Heating	Remodel/Replacement	2.78	0.35
174	Pipe insulation - water heating	Grocery	Water Heating	Retrofit	25.93	0.08
175	Pipe insulation - water heating	Grocery	Water Heating	New construction	20.71	0.05
176	Pipe insulation - water heating	Grocery	Water Heating	Renovation	20.71	0.05
177	Tank insulation	Grocery	Water Heating	Retrofit	1.91	1.10
178	Tank insulation	Grocery	Water Heating	New construction	1.53	0.64
179	Tank insulation	Grocery	Water Heating	Remodel/Replacement	1.94	0.50
180	Improved heating system high efficiency unit - Tier 1	Grocery	Space Heating	New construction	1.44	1.11
181	Improved heating system high efficiency unit - Tier 1	Grocery	Space Heating	Remodel/Replacement	1.78	0.90
182	Improved heating system condensing unit - Tier 2	Grocery	Space Heating	New construction	0.70	2.29
183	Improved heating system condensing unit - Tier 2	Grocery	Space Heating	Remodel/Replacement	0.86	1.86
184	Programmable Thermostat	Grocery	Space Heating	Retrofit	5.01	0.71
185	Programmable Thermostat	Grocery	Space Heating	Renovation	7.05	0.23
186	Programmable Thermostat	Grocery	Space Heating	Remodel/Replacement	8.97	0.18
187	Demand-Controlled Ventilation (controller, sensor)	Grocery	Space Heating	Retrofit	14.49	(2.28)
188	Demand-Controlled Ventilation (controller, sensor)	Grocery	Space Heating	New construction	10.61	(0.98)
189	Demand-Controlled Ventilation (controller, sensor)	Grocery	Space Heating	Remodel/Replacement	13.34	(1.03)
190	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	Grocery	Space Heating	New construction	6.68	0.37
191	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	Grocery	Space Heating	Renovation	6.68	0.37
192	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	Grocery	Space Heating	New construction	9,999.00	0.00
193	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	Grocery	Space Heating	Renovation	9,999.00	0.00
194	Improved below-grade insulation	Grocery	Space Heating	New construction	18.26	0.09
195	Improved below-grade insulation	Grocery	Space Heating	Renovation	18.26	0.09
196	Sensible Heat Recovery	Grocery	Space Heating	Retrofit	12.31	1.97
197	Sensible Heat Recovery	Grocery	Space Heating	New construction	11.70	0.91
198	Sensible Heat Recovery	Grocery	Space Heating	Remodel/Replacement	13.82	0.90
199	Pipe insulation - space heating	Grocery	Space Heating	Retrofit	75.41	0.05
200	Pipe insulation - space heating	Grocery	Space Heating	New construction	61.03	0.03

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2	Total Resource Cost Test Benefit/Cost Ratio and Levelized Cost of Saved Energy					
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5	Measure Name	Measure ID4 (e.g., Bldg type)	Measure ID5 (e.g., End Use)	Measure ID6 (e.g., Market: Retrofit, NC, ROB)	Total Resource BCR	TRC Levelized Cost per Saved Therm (\$/Therm)
201	Pipe insulation - space heating	Grocery	Space Heating	Renovation	61.03	0.03
202	Commissioning	Grocery	Total	New construction	3.79	(1.53)
203	Commissioning	Grocery	Total	Renovation	3.79	(1.53)
204	Commissioning	Grocery	Total	Remodel/Replacement	4.82	(1.77)
205	Retrocommissioning	Grocery	Total	Retrofit	6.40	(1.44)
206	Integrated Design - High Performance (30% > codes) - Tier 1	Grocery	Total	New construction	2.27	0.16
207	Integrated Design - High Performance (50% > codes) Tier 2	Grocery	Total	New construction	2.27	0.16
208	Steam trap Maintenance	Grocery	Space Heating	Retrofit	1.95	0.84
209	Oxygen Trim	Grocery	Space Heating	Retrofit	28.02	0.13
210	Oxygen Trim	Grocery	Space Heating	New construction	68.26	0.02
211	Oxygen Trim	Grocery	Space Heating	Remodel/Replacement	36.56	0.04
212	Infrared Heater	Grocery	Space Heating	Retrofit	36.32	0.11
213	Infrared Heater	Grocery	Space Heating	Remodel/Replacement	126.35	0.01
214	Exhaust Hood Makeup Air	Warehouse	Space Heating	New construction	14.82	(0.16)
215	Exhaust Hood Makeup Air	Warehouse	Space Heating	Remodel/Replacement	14.71	(0.16)
216	High efficiency ENERGY STAR fryer	Warehouse	Cooking	New construction	2.06	0.44
217	High efficiency ENERGY STAR fryer	Warehouse	Cooking	Remodel/Replacement	2.06	0.44
218	Pre-Rinse Spray Valve	Warehouse	Water Heating	Retrofit	35.27	0.00
219	Refrigeration heat recovery	Warehouse	Water Heating	Retrofit	3.53	0.51
220	Refrigeration heat recovery	Warehouse	Water Heating	New construction	2.87	0.30
221	Refrigeration heat recovery	Warehouse	Water Heating	Remodel/Replacement	3.61	0.23
222	Cooling system chilled water reset	Warehouse	Cooling	Retrofit	1.94	0.96
223	Cooling system chilled water reset	Warehouse	Cooling	New construction	1.53	0.53
224	Cooling system chilled water reset	Warehouse	Cooling	Remodel/Replacement	1.95	0.44
225	Cooling system water side economizer	Warehouse	Cooling	Retrofit	1.52	0.69
226	Cooling system water side economizer	Warehouse	Cooling	New construction	1.25	0.50
227	Cooling system water side economizer	Warehouse	Cooling	Remodel/Replacement	1.53	0.31
228	Condensing DHW stand-alone	Warehouse	Water Heating	Retrofit	4.07	0.53
229	Condensing DHW stand-alone	Warehouse	Water Heating	New construction	3.94	0.25
230	Condensing DHW stand-alone	Warehouse	Water Heating	Remodel/Replacement	5.01	0.19
231	Faucet aerator	Warehouse	Water Heating	Retrofit	18.97	(3.65)
232	Indirect-fired DHW off space heating boiler	Warehouse	Water Heating	Retrofit	3.18	0.78
233	Indirect-fired DHW off space heating boiler	Warehouse	Water Heating	New construction	2.91	0.33
234	Indirect-fired DHW off space heating boiler	Warehouse	Water Heating	Remodel/Replacement	3.70	0.26
235	Instantaneous. High-Modulating Water Heater	Warehouse	Water Heating	Retrofit	4.90	0.44
236	Instantaneous. High-Modulating Water Heater	Warehouse	Water Heating	New construction	6.69	0.15
237	Instantaneous. High-Modulating Water Heater	Warehouse	Water Heating	Renovation	6.69	0.15
238	Instantaneous. High-Modulating Water Heater	Warehouse	Water Heating	Remodel/Replacement	8.51	0.11
239	Low-flow shower heads	Warehouse	Water Heating	Retrofit	37.71	(2.29)
240	Low-flow shower heads	Warehouse	Water Heating	New construction	21.92	(1.00)
241	Low-flow shower heads	Warehouse	Water Heating	Remodel/Replacement	27.89	(1.02)
242	Pipe insulation - water heating	Warehouse	Water Heating	Retrofit	26.23	0.08
243	Pipe insulation - water heating	Warehouse	Water Heating	New construction	20.93	0.05
244	Pipe insulation - water heating	Warehouse	Water Heating	Renovation	20.93	0.05
245	Tank insulation	Warehouse	Water Heating	Retrofit	1.94	1.09
246	Tank insulation	Warehouse	Water Heating	New construction	1.55	0.63
247	Tank insulation	Warehouse	Water Heating	Remodel/Replacement	1.97	0.49
248	Air Sealing	Warehouse	Space Heating	Retrofit	1.78	2.12
249	Air Sealing	Warehouse	Space Heating	New construction	2.02	0.74
250	Air Sealing	Warehouse	Space Heating	Renovation	2.02	0.74
251	Improved heating system high efficiency unit - Tier 1	Warehouse	Space Heating	Retrofit	1.05	3.82
252	Improved heating system high efficiency unit - Tier 1	Warehouse	Space Heating	New construction	2.88	0.56
253	Improved heating system high efficiency unit - Tier 1	Warehouse	Space Heating	Remodel/Replacement	3.55	0.45
254	Improved heating system condensing unit - Tier 2	Warehouse	Space Heating	Retrofit	1.75	2.30
255	Improved heating system condensing unit - Tier 2	Warehouse	Space Heating	New construction	1.40	1.15
256	Improved heating system condensing unit - Tier 2	Warehouse	Space Heating	Remodel/Replacement	1.72	0.93
257	Programmable Thermostat	Warehouse	Space Heating	Retrofit	52.62	0.07
258	Programmable Thermostat	Warehouse	Space Heating	Renovation	39.16	0.04
259	Programmable Thermostat	Warehouse	Space Heating	Remodel/Replacement	49.82	0.03
260	Demand-Controlled Ventilation (controller, sensor)	Warehouse	Space Heating	Retrofit	2.78	1.26
261	Demand-Controlled Ventilation (controller, sensor)	Warehouse	Space Heating	New construction	2.60	0.62
262	Demand-Controlled Ventilation (controller, sensor)	Warehouse	Space Heating	Remodel/Replacement	3.23	0.50
263	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	Warehouse	Space Heating	New construction	9.72	0.13
264	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	Warehouse	Space Heating	Renovation	9.72	0.13
265	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	Warehouse	Space Heating	New construction	9,999.00	0.00

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266	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	Warehouse	Space Heating	Renovation	9,999.00	0.00
267	Improved below-grade insulation	Warehouse	Space Heating	New construction	2.20	0.73
268	Improved below-grade insulation	Warehouse	Space Heating	Renovation	2.20	0.73
269	Improved roof insulation	Warehouse	Space Heating	New construction	1.16	1.38
270	Improved roof insulation	Warehouse	Space Heating	Renovation	1.16	1.38
271	Sensible Heat Recovery	Warehouse	Space Heating	Retrofit	1.35	3.09
272	Sensible Heat Recovery	Warehouse	Space Heating	New construction	1.37	1.41
273	Sensible Heat Recovery	Warehouse	Space Heating	Remodel/Replacment	1.66	1.31
274	Pipe insulation - space heating	Warehouse	Space Heating	Retrofit	75.41	0.05
275	Pipe insulation - space heating	Warehouse	Space Heating	New construction	61.03	0.03
276	Pipe insulation - space heating	Warehouse	Space Heating	Renovation	61.03	0.03
277	Commissioning	Warehouse	Total	New construction	3.92	(1.68)
278	Commissioning	Warehouse	Total	Renovation	3.92	(1.68)
279	Commissioning	Warehouse	Total	Remodel/Replacment	4.99	(1.92)
280	Retrocommissioning	Warehouse	Total	Retrofit	6.56	(1.57)
281	Integrated Design - High Performance (30% > codes) - Tier 1	Warehouse	Total	New construction	2.32	0.10
282	Integrated Design - High Performance (50% > codes) Tier 2	Warehouse	Total	New construction	2.32	0.10
283	Steam trap Maintenance	Warehouse	Space Heating	Retrofit	1.72	0.95
284	Oxygen Trim	Warehouse	Space Heating	Retrofit	26.12	0.14
285	Oxygen Trim	Warehouse	Space Heating	New construction	68.26	0.02
286	Oxygen Trim	Warehouse	Space Heating	Remodel/Replacment	43.58	0.04
287	Infrared Heater	Warehouse	Space Heating	Retrofit	22.44	0.18
288	Infrared Heater	Warehouse	Space Heating	Remodel/Replacment	139.20	0.01
289	Direct fired convection range/oven	Education	Cooking	New construction	3.21	0.28
290	Direct fired convection range/oven	Education	Cooking	Remodel/Replacment	3.21	0.28
291	Exhaust Hood Makeup Air	Education	Space Heating	New construction	16.32	(0.40)
292	Exhaust Hood Makeup Air	Education	Space Heating	Remodel/Replacment	15.55	(0.40)
293	High efficiency ENERGY STAR fryer	Education	Cooking	New construction	2.06	0.44
294	High efficiency ENERGY STAR fryer	Education	Cooking	Remodel/Replacment	2.06	0.44
295	High efficiency ENERGY STAR steam cooker	Education	Cooking	Retrofit	1.06	1.57
296	High efficiency ENERGY STAR steam cooker	Education	Cooking	New construction	13.50	(2.23)
297	High efficiency ENERGY STAR steam cooker	Education	Cooking	Remodel/Replacment	13.50	(2.23)
298	Pre-Rinse Spray Valve	Education	Water Heating	Retrofit	30.48	0.00
299	Refrigeration heat recovery	Education	Water Heating	Retrofit	3.43	0.52
300	Refrigeration heat recovery	Education	Water Heating	New construction	2.76	0.31
301	Refrigeration heat recovery	Education	Water Heating	Remodel/Replacment	3.31	0.25
302	Cooling system chilled water reset	Education	Cooling	Retrofit	1.74	1.11
303	Cooling system chilled water reset	Education	Cooling	New construction	1.35	0.61
304	Cooling system chilled water reset	Education	Cooling	Remodel/Replacment	1.75	0.51
305	Cooling system water side economizer	Education	Cooling	Retrofit	1.59	0.57
306	Cooling system water side economizer	Education	Cooling	New construction	1.29	0.46
307	Cooling system water side economizer	Education	Cooling	Remodel/Replacment	1.60	0.26
308	Condensing DHW stand-alone	Education	Water Heating	Retrofit	1.96	1.11
309	Condensing DHW stand-alone	Education	Water Heating	New construction	2.43	0.40
310	Condensing DHW stand-alone	Education	Water Heating	Remodel/Replacment	3.13	0.31
311	Faucet aerator	Education	Water Heating	Retrofit	5.60	(2.88)
312	Graywater heat exchanger/GFX	Education	Water Heating	Retrofit	2.71	0.88
313	Graywater heat exchanger/GFX	Education	Water Heating	New construction	2.14	0.45
314	Graywater heat exchanger/GFX	Education	Water Heating	Remodel/Replacment	2.76	0.35
315	Indirect-fired DHW off space heating boiler	Education	Water Heating	Retrofit	1.69	1.47
316	Indirect-fired DHW off space heating boiler	Education	Water Heating	New construction	1.79	0.54
317	Indirect-fired DHW off space heating boiler	Education	Water Heating	Remodel/Replacment	2.31	0.42
318	Instantaneous. High-Modulating Water Heater	Education	Water Heating	Retrofit	1.88	1.16
319	Instantaneous. High-Modulating Water Heater	Education	Water Heating	New construction	4.12	0.24
320	Instantaneous. High-Modulating Water Heater	Education	Water Heating	Renovation	4.12	0.24
321	Instantaneous. High-Modulating Water Heater	Education	Water Heating	Remodel/Replacment	5.32	0.18
322	Low-flow shower heads	Education	Water Heating	Retrofit	30.97	(2.27)
323	Low-flow shower heads	Education	Water Heating	New construction	25.14	(1.01)
324	Low-flow shower heads	Education	Water Heating	Remodel/Replacment	32.46	(1.03)
325	Pipe insulation - water heating	Education	Water Heating	Retrofit	25.42	0.08
326	Pipe insulation - water heating	Education	Water Heating	New construction	20.04	0.05
327	Pipe insulation - water heating	Education	Water Heating	Renovation	20.04	0.05
328	Tank insulation	Education	Water Heating	Retrofit	1.88	1.13
329	Tank insulation	Education	Water Heating	New construction	1.48	0.66
330	Tank insulation	Education	Water Heating	Remodel/Replacment	1.91	0.51

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331	Air Sealing	Education	Space Heating	Retrofit	2.09	1.83
332	Air Sealing	Education	Space Heating	New construction	5.04	0.27
333	Air Sealing	Education	Space Heating	Renovation	5.04	0.27
334	Improved heating system high efficiency unit - Tier 1	Education	Space Heating	Retrofit	0.81	4.95
335	Improved heating system high efficiency unit - Tier 1	Education	Space Heating	New construction	2.79	0.58
336	Improved heating system high efficiency unit - Tier 1	Education	Space Heating	Remodel/Replacement	3.49	0.46
337	Improved heating system condensing unit - Tier 2	Education	Space Heating	Retrofit	3.17	1.27
338	Improved heating system condensing unit - Tier 2	Education	Space Heating	New construction	2.50	0.64
339	Improved heating system condensing unit - Tier 2	Education	Space Heating	Remodel/Replacement	3.13	0.51
340	Programmable Thermostat	Education	Space Heating	Retrofit	22.69	(0.04)
341	Programmable Thermostat	Education	Space Heating	Renovation	13.58	0.03
342	Programmable Thermostat	Education	Space Heating	Remodel/Replacement	17.54	0.01
343	Demand-Controlled Ventilation (controller, sensor)	Education	Space Heating	Retrofit	3.21	1.07
344	Demand-Controlled Ventilation (controller, sensor)	Education	Space Heating	New construction	3.30	0.48
345	Demand-Controlled Ventilation (controller, sensor)	Education	Space Heating	Remodel/Replacement	4.22	0.37
346	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	Education	Space Heating	New construction	12.45	0.09
347	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	Education	Space Heating	Renovation	12.45	0.09
348	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	Education	Space Heating	New construction	1.83	0.84
349	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	Education	Space Heating	Renovation	1.83	0.84
350	Improved below-grade insulation	Education	Space Heating	New construction	1.84	0.87
351	Improved below-grade insulation	Education	Space Heating	Renovation	1.84	0.87
352	Sensible Heat Recovery	Education	Space Heating	Retrofit	3.27	1.67
353	Sensible Heat Recovery	Education	Space Heating	New construction	3.46	0.75
354	Sensible Heat Recovery	Education	Space Heating	Remodel/Replacement	4.28	0.68
355	Pipe insulation - space heating	Education	Space Heating	Retrofit	74.47	0.05
356	Pipe insulation - space heating	Education	Space Heating	New construction	59.45	0.03
357	Pipe insulation - space heating	Education	Space Heating	Renovation	59.45	0.03
358	Energy Star washer	Education	Water Heating	New construction	1.70	(2.10)
359	Energy Star washer	Education	Water Heating	Remodel/Replacement	1.97	(2.71)
360	Swimming pool/spa covers	Education	Miscellaneous	Retrofit	4.42	0.38
361	Swimming pool/spa covers	Education	Miscellaneous	New construction	4.17	0.24
362	Swimming pool/spa covers	Education	Miscellaneous	Remodel/Replacement	4.40	0.22
363	Commissioning	Education	Total	New construction	4.23	(2.08)
364	Commissioning	Education	Total	Renovation	4.23	(2.08)
365	Commissioning	Education	Total	Remodel/Replacement	5.46	(2.34)
366	Retrocommissioning	Education	Total	Retrofit	6.99	(1.92)
367	Integrated Design - High Performance (30% > codes) - Tier 1	Education	Total	New construction	2.44	(0.03)
368	Integrated Design - High Performance (50% > codes) Tier 2	Education	Total	New construction	2.44	(0.03)
369	Steam trap Maintenance	Education	Space Heating	Retrofit	1.96	0.84
370	Oxygen Trim	Education	Space Heating	Retrofit	27.04	0.13
371	Oxygen Trim	Education	Space Heating	New construction	68.26	0.02
372	Oxygen Trim	Education	Space Heating	Remodel/Replacement	41.26	0.04
373	Direct fired convection range/oven	Health	Cooking	New construction	3.21	0.28
374	Direct fired convection range/oven	Health	Cooking	Remodel/Replacement	3.21	0.28
375	Exhaust Hood Makeup Air	Health	Space Heating	New construction	15.88	(0.26)
376	Exhaust Hood Makeup Air	Health	Space Heating	Remodel/Replacement	18.27	(0.27)
377	High efficiency ENERGY STAR fryer	Health	Cooking	New construction	2.06	0.44
378	High efficiency ENERGY STAR fryer	Health	Cooking	Remodel/Replacement	2.06	0.44
379	High efficiency ENERGY STAR steam cooker	Health	Cooking	Retrofit	1.06	1.57
380	High efficiency ENERGY STAR steam cooker	Health	Cooking	New construction	13.50	(2.23)
381	High efficiency ENERGY STAR steam cooker	Health	Cooking	Remodel/Replacement	13.50	(2.23)
382	Pre-Rinse Spray Valve	Health	Water Heating	Retrofit	33.36	0.00
383	Refrigeration heat recovery	Health	Water Heating	Retrofit	3.41	0.53
384	Refrigeration heat recovery	Health	Water Heating	New construction	3.09	0.27
385	Refrigeration heat recovery	Health	Water Heating	Remodel/Replacement	3.50	0.23
386	Cooling system chilled water reset	Health	Cooling	Retrofit	1.96	0.94
387	Cooling system chilled water reset	Health	Cooling	New construction	1.72	0.48
388	Cooling system chilled water reset	Health	Cooling	Remodel/Replacement	1.97	0.43
389	Cooling system water side economizer	Health	Cooling	Retrofit	1.52	0.70
390	Cooling system water side economizer	Health	Cooling	New construction	1.36	0.42
391	Cooling system water side economizer	Health	Cooling	Remodel/Replacement	1.52	0.32
392	Condensing DHW stand-alone	Health	Water Heating	Retrofit	3.15	0.69
393	Condensing DHW stand-alone	Health	Water Heating	New construction	4.36	0.22
394	Condensing DHW stand-alone	Health	Water Heating	Remodel/Replacement	5.01	0.19
395	Faucet aerator	Health	Water Heating	Retrofit	5.94	(2.94)

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396	Graywater heat exchanger/GFX	Health	Water Heating	Retrofit	2.70	0.89
397	Graywater heat exchanger/GFX	Health	Water Heating	New construction	2.39	0.40
398	Graywater heat exchanger/GFX	Health	Water Heating	Remodel/Replacment	2.75	0.35
399	Indirect-fired DHW off space heating boiler	Health	Water Heating	Retrofit	2.72	0.92
400	Indirect-fired DHW off space heating boiler	Health	Water Heating	New construction	3.22	0.30
401	Indirect-fired DHW off space heating boiler	Health	Water Heating	Remodel/Replacment	3.70	0.26
402	Instantaneous. High-Modulating Water Heater	Health	Water Heating	Retrofit	3.04	0.72
403	Instantaneous. High-Modulating Water Heater	Health	Water Heating	New construction	7.41	0.13
404	Instantaneous. High-Modulating Water Heater	Health	Water Heating	Renovation	7.41	0.13
405	Instantaneous. High-Modulating Water Heater	Health	Water Heating	Remodel/Replacment	8.51	0.11
406	Low-flow shower heads	Health	Water Heating	Retrofit	1,990.68	(2.41)
407	Low-flow shower heads	Health	Water Heating	New construction	6.24	(0.76)
408	Low-flow shower heads	Health	Water Heating	Remodel/Replacment	7.17	(0.80)
409	Pipe insulation - water heating	Health	Water Heating	Retrofit	25.30	0.08
410	Pipe insulation - water heating	Health	Water Heating	New construction	22.44	0.04
411	Pipe insulation - water heating	Health	Water Heating	Renovation	22.44	0.04
412	Tank insulation	Health	Water Heating	Retrofit	1.87	1.13
413	Tank insulation	Health	Water Heating	New construction	1.66	0.59
414	Tank insulation	Health	Water Heating	Remodel/Replacment	1.90	0.51
415	Air Sealing	Health	Space Heating	Retrofit	11.57	(1.09)
416	Air Sealing	Health	Space Heating	New construction	4.25	(0.10)
417	Air Sealing	Health	Space Heating	Renovation	4.25	(0.10)
418	Improved heating system high efficiency unit - Tier 1	Health	Space Heating	Retrofit	5.78	0.92
419	Improved heating system high efficiency unit - Tier 1	Health	Space Heating	New construction	17.44	0.20
420	Improved heating system high efficiency unit - Tier 1	Health	Space Heating	Remodel/Replacment	19.40	0.19
421	Improved heating system condensing unit - Tier 2	Health	Space Heating	Retrofit	4.23	0.95
422	Improved heating system condensing unit - Tier 2	Health	Space Heating	New construction	3.75	0.43
423	Improved heating system condensing unit - Tier 2	Health	Space Heating	Remodel/Replacment	4.17	0.39
424	Outdoor Air Reset	Health	Space Heating	Retrofit	3.01	1.14
425	Outdoor Air Reset	Health	Space Heating	New construction	1.05	1.61
426	Outdoor Air Reset	Health	Space Heating	Remodel/Replacment	1.20	1.40
427	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	Health	Space Heating	New construction	20.10	(0.77)
428	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	Health	Space Heating	Renovation	20.10	(0.77)
429	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	Health	Space Heating	New construction	2.19	0.72
430	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	Health	Space Heating	Renovation	2.19	0.72
431	Improved wall insulation	Health	Space Heating	New construction	1.84	0.66
432	Improved wall insulation	Health	Space Heating	Renovation	1.84	0.66
433	Improved below-grade insulation	Health	Space Heating	New construction	1.27	1.26
434	Improved below-grade insulation	Health	Space Heating	Renovation	1.27	1.26
435	Sensible Heat Recovery	Health	Space Heating	Retrofit	7.33	2.30
436	Sensible Heat Recovery	Health	Space Heating	New construction	3.25	1.17
437	Sensible Heat Recovery	Health	Space Heating	Remodel/Replacment	3.59	1.15
438	Pipe insulation - space heating	Health	Space Heating	Retrofit	68.66	0.05
439	Pipe insulation - space heating	Health	Space Heating	New construction	62.28	0.03
440	Pipe insulation - space heating	Health	Space Heating	Renovation	62.28	0.03
441	Swimming pool/spa covers	Health	Miscellaneous	Retrofit	4.41	0.39
442	Swimming pool/spa covers	Health	Miscellaneous	New construction	4.29	0.23
443	Swimming pool/spa covers	Health	Miscellaneous	Remodel/Replacment	4.39	0.22
444	Commissioning	Health	Total	New construction	4.39	(1.83)
445	Commissioning	Health	Total	Renovation	4.39	(1.83)
446	Commissioning	Health	Total	Remodel/Replacment	5.04	(1.96)
447	Retrocommissioning	Health	Total	Retrofit	6.61	(1.60)
448	Integrated Design - High Performance (30% > codes) - Tier 1	Health	Total	New construction	2.33	0.09
449	Integrated Design - High Performance (50% > codes) Tier 2	Health	Total	New construction	9,999.00	0.00
450	Steam trap Maintenance	Health	Space Heating	Retrofit	3.30	0.50
451	Oxygen Trim	Health	Space Heating	Retrofit	45.50	0.08
452	Oxygen Trim	Health	Space Heating	New construction	68.26	0.02
453	Oxygen Trim	Health	Space Heating	Remodel/Replacment	55.36	0.03
454	Direct fired convection range/oven	Lodging	Cooking	New construction	3.21	0.28
455	Direct fired convection range/oven	Lodging	Cooking	Remodel/Replacment	3.21	0.28
456	Exhaust Hood Makeup Air	Lodging	Space Heating	New construction	15.59	(0.29)
457	Exhaust Hood Makeup Air	Lodging	Space Heating	Remodel/Replacment	19.02	(0.32)
458	High efficiency ENERGY STAR fryer	Lodging	Cooking	New construction	2.06	0.44
459	High efficiency ENERGY STAR fryer	Lodging	Cooking	Remodel/Replacment	2.06	0.44
460	High efficiency ENERGY STAR steam cooker	Lodging	Cooking	Retrofit	1.06	1.57

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1	Downstate Commercial Measures					
2	Total Resource Cost Test Benefit/Cost Ratio and Levelized Cost of Saved Energy					
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5	Measure Name	Measure ID4 (e.g., Bldg type)	Measure ID5 (e.g., End Use)	Measure ID6 (e.g., Market: Retrofit, NC, ROB)	Total Resource BCR	TRC Levelized Cost per Saved Therm (\$/Therm)
461	High efficiency ENERGY STAR steam cooker	Lodging	Cooking	New construction	13.50	(2.23)
462	High efficiency ENERGY STAR steam cooker	Lodging	Cooking	Remodel/Replacement	13.50	(2.23)
463	Pre-Rinse Spray Valve	Lodging	Water Heating	Retrofit	31.71	0.00
464	Refrigeration heat recovery	Lodging	Water Heating	Retrofit	3.41	0.53
465	Refrigeration heat recovery	Lodging	Water Heating	New construction	2.77	0.31
466	Refrigeration heat recovery	Lodging	Water Heating	Remodel/Replacement	3.38	0.25
467	Cooling system chilled water reset	Lodging	Cooling	Retrofit	1.85	1.02
468	Cooling system chilled water reset	Lodging	Cooling	New construction	1.46	0.56
469	Cooling system chilled water reset	Lodging	Cooling	Remodel/Replacement	1.87	0.47
470	Cooling system water side economizer	Lodging	Cooling	Retrofit	1.55	0.64
471	Cooling system water side economizer	Lodging	Cooling	New construction	1.27	0.48
472	Cooling system water side economizer	Lodging	Cooling	Remodel/Replacement	1.56	0.29
473	Condensing DHW stand-alone	Lodging	Water Heating	Retrofit	3.08	0.70
474	Condensing DHW stand-alone	Lodging	Water Heating	New construction	3.91	0.25
475	Condensing DHW stand-alone	Lodging	Water Heating	Remodel/Replacement	5.01	0.19
476	Faucet aerator	Lodging	Water Heating	Retrofit	8.68	(3.27)
477	Graywater heat exchanger/GFX	Lodging	Water Heating	Retrofit	1.40	1.71
478	Graywater heat exchanger/GFX	Lodging	Water Heating	New construction	1.11	0.87
479	Graywater heat exchanger/GFX	Lodging	Water Heating	Remodel/Replacement	1.42	0.68
480	Indirect-fired DHW off space heating boiler	Lodging	Water Heating	Retrofit	2.68	0.93
481	Indirect-fired DHW off space heating boiler	Lodging	Water Heating	New construction	2.89	0.33
482	Indirect-fired DHW off space heating boiler	Lodging	Water Heating	Remodel/Replacement	3.70	0.26
483	Low-flow shower heads	Lodging	Water Heating	Retrofit	561.96	(2.41)
484	Low-flow shower heads	Lodging	Water Heating	New construction	5.41	(0.71)
485	Low-flow shower heads	Lodging	Water Heating	Remodel/Replacement	6.94	(0.79)
486	Pipe insulation - water heating	Lodging	Water Heating	Retrofit	25.39	0.08
487	Pipe insulation - water heating	Lodging	Water Heating	New construction	20.17	0.05
488	Pipe insulation - water heating	Lodging	Water Heating	Renovation	20.17	0.05
489	Tank insulation	Lodging	Water Heating	Retrofit	1.87	1.13
490	Tank insulation	Lodging	Water Heating	New construction	1.49	0.65
491	Tank insulation	Lodging	Water Heating	Remodel/Replacement	1.91	0.51
492	Air Sealing	Lodging	Space Heating	Retrofit	3.35	1.19
493	Air Sealing	Lodging	Space Heating	New construction	2.94	0.55
494	Air Sealing	Lodging	Space Heating	Renovation	2.94	0.55
495	Improved heating system high efficiency unit - Tier 1	Lodging	Space Heating	New construction	4.36	0.37
496	Improved heating system high efficiency unit - Tier 1	Lodging	Space Heating	Remodel/Replacement	5.41	0.30
497	Improved heating system condensing unit - Tier 2	Lodging	Space Heating	New construction	3.84	0.42
498	Improved heating system condensing unit - Tier 2	Lodging	Space Heating	Remodel/Replacement	4.77	0.34
499	Programmable Thermostat	Lodging	Space Heating	Retrofit	2.92	1.23
500	Programmable Thermostat	Lodging	Space Heating	Renovation	2.70	0.60
501	Programmable Thermostat	Lodging	Space Heating	Remodel/Replacement	3.46	0.47
502	Demand-Controlled Ventilation (controller, sensor)	Lodging	Space Heating	Retrofit	2.43	1.45
503	Demand-Controlled Ventilation (controller, sensor)	Lodging	Space Heating	New construction	1.92	0.84
504	Demand-Controlled Ventilation (controller, sensor)	Lodging	Space Heating	Remodel/Replacement	2.45	0.66
505	Outdoor Air Reset	Lodging	Space Heating	Retrofit	2.06	1.66
506	Outdoor Air Reset	Lodging	Space Heating	New construction	1.64	1.03
507	Outdoor Air Reset	Lodging	Space Heating	Remodel/Replacement	2.10	0.80
508	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	Lodging	Space Heating	New construction	9.66	0.17
509	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	Lodging	Space Heating	Renovation	9.66	0.17
510	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	Lodging	Space Heating	New construction	1.57	1.02
511	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	Lodging	Space Heating	Renovation	1.57	1.02
512	Improved roof insulation	Lodging	Space Heating	New construction	1.00	1.60
513	Improved roof insulation	Lodging	Space Heating	Renovation	1.00	1.60
514	Sensible Heat Recovery	Lodging	Space Heating	Retrofit	5.78	0.75
515	Sensible Heat Recovery	Lodging	Space Heating	New construction	5.29	0.37
516	Sensible Heat Recovery	Lodging	Space Heating	Remodel/Replacement	6.52	0.32
517	Pipe insulation - space heating	Lodging	Space Heating	Retrofit	74.45	0.05
518	Pipe insulation - space heating	Lodging	Space Heating	New construction	59.88	0.03
519	Pipe insulation - space heating	Lodging	Space Heating	Renovation	59.88	0.03
520	Energy Star washer	Lodging	Water Heating	New construction	1.65	(1.87)
521	Energy Star washer	Lodging	Water Heating	Remodel/Replacement	1.95	(2.55)
522	Swimming pool/spa covers	Lodging	Miscellaneous	Retrofit	4.42	0.39
523	Swimming pool/spa covers	Lodging	Miscellaneous	New construction	4.18	0.24
524	Swimming pool/spa covers	Lodging	Miscellaneous	Remodel/Replacement	4.40	0.22
525	Commissioning	Lodging	Total	New construction	4.26	(2.09)

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526	Commissioning	Lodging	Total	Renovation	4.26	(2.09)
527	Commissioning	Lodging	Total	Remodel/Replacement	5.46	(2.34)
528	Retrocommissioning	Lodging	Total	Retrofit	6.99	(1.92)
529	Integrated Design - High Performance (30% > codes) - Tier 1	Lodging	Total	New construction	2.44	(0.03)
530	Integrated Design - High Performance (50% > codes) Tier 2	Lodging	Total	New construction	2.44	(0.03)
531	Steam trap Maintenance	Lodging	Space Heating	Retrofit	3.52	0.47
532	Oxygen Trim	Lodging	Space Heating	Retrofit	48.51	0.07
533	Oxygen Trim	Lodging	Space Heating	New construction	68.26	0.02
534	Oxygen Trim	Lodging	Space Heating	Remodel/Replacement	56.74	0.03
535	Direct fired convection range/oven	Restaurant	Cooking	New construction	3.21	0.28
536	Direct fired convection range/oven	Restaurant	Cooking	Remodel/Replacement	3.21	0.28
537	Exhaust Hood Makeup Air	Restaurant	Space Heating	New construction	16.55	(0.19)
538	Exhaust Hood Makeup Air	Restaurant	Space Heating	Remodel/Replacement	15.68	(0.18)
539	High efficiency ENERGY STAR fryer	Restaurant	Cooking	New construction	2.06	0.44
540	High efficiency ENERGY STAR fryer	Restaurant	Cooking	Remodel/Replacement	2.06	0.44
541	High efficiency ENERGY STAR steam cooker	Restaurant	Cooking	Retrofit	1.06	1.57
542	High efficiency ENERGY STAR steam cooker	Restaurant	Cooking	New construction	13.50	(2.23)
543	High efficiency ENERGY STAR steam cooker	Restaurant	Cooking	Remodel/Replacement	13.50	(2.23)
544	Pre-Rinse Spray Valve	Restaurant	Water Heating	Retrofit	29.72	0.00
545	Refrigeration heat recovery	Restaurant	Water Heating	Retrofit	3.49	0.52
546	Refrigeration heat recovery	Restaurant	Water Heating	New construction	3.15	0.27
547	Refrigeration heat recovery	Restaurant	Water Heating	Remodel/Replacement	3.24	0.26
548	Cooling system chilled water reset	Restaurant	Cooling	Retrofit	1.91	0.98
549	Cooling system chilled water reset	Restaurant	Cooling	New construction	1.67	0.50
550	Cooling system chilled water reset	Restaurant	Cooling	Remodel/Replacement	1.92	0.45
551	Cooling system water side economizer	Restaurant	Cooling	Retrofit	1.53	0.67
552	Cooling system water side economizer	Restaurant	Cooling	New construction	1.38	0.41
553	Cooling system water side economizer	Restaurant	Cooling	Remodel/Replacement	1.54	0.30
554	Condensing DHW stand-alone	Restaurant	Water Heating	Retrofit	2.30	0.94
555	Condensing DHW stand-alone	Restaurant	Water Heating	New construction	3.27	0.30
556	Condensing DHW stand-alone	Restaurant	Water Heating	Remodel/Replacement	3.76	0.26
557	Faucet aerator	Restaurant	Water Heating	Retrofit	16.95	(3.61)
558	Graywater heat exchanger/GFX	Restaurant	Water Heating	Retrofit	2.76	0.87
559	Graywater heat exchanger/GFX	Restaurant	Water Heating	New construction	2.45	0.39
560	Graywater heat exchanger/GFX	Restaurant	Water Heating	Remodel/Replacement	2.81	0.34
561	Indirect-fired DHW off space heating boiler	Restaurant	Water Heating	Retrofit	2.00	1.24
562	Indirect-fired DHW off space heating boiler	Restaurant	Water Heating	New construction	2.42	0.40
563	Indirect-fired DHW off space heating boiler	Restaurant	Water Heating	Remodel/Replacement	2.78	0.35
564	Pipe insulation - water heating	Restaurant	Water Heating	Retrofit	25.93	0.08
565	Pipe insulation - water heating	Restaurant	Water Heating	New construction	22.94	0.04
566	Pipe insulation - water heating	Restaurant	Water Heating	Renovation	22.94	0.04
567	Tank insulation	Restaurant	Water Heating	Retrofit	1.91	1.10
568	Tank insulation	Restaurant	Water Heating	New construction	1.69	0.57
569	Tank insulation	Restaurant	Water Heating	Remodel/Replacement	1.94	0.50
570	Air Sealing	Restaurant	Space Heating	Retrofit	5.11	0.64
571	Air Sealing	Restaurant	Space Heating	New construction	5.00	0.27
572	Air Sealing	Restaurant	Space Heating	Renovation	5.00	0.27
573	Improved heating system high efficiency unit - Tier 1	Restaurant	Space Heating	New construction	1.58	1.02
574	Improved heating system high efficiency unit - Tier 1	Restaurant	Space Heating	Remodel/Replacement	1.75	0.92
575	Improved heating system condensing unit - Tier 2	Restaurant	Space Heating	New construction	0.76	2.11
576	Improved heating system condensing unit - Tier 2	Restaurant	Space Heating	Remodel/Replacement	0.85	1.89
577	Programmable Thermostat	Restaurant	Space Heating	Retrofit	11.15	0.32
578	Programmable Thermostat	Restaurant	Space Heating	Renovation	9.61	0.17
579	Programmable Thermostat	Restaurant	Space Heating	Remodel/Replacement	11.04	0.15
580	Demand-Controlled Ventilation (controller, sensor)	Restaurant	Space Heating	Retrofit	4.41	0.76
581	Demand-Controlled Ventilation (controller, sensor)	Restaurant	Space Heating	New construction	3.57	0.44
582	Demand-Controlled Ventilation (controller, sensor)	Restaurant	Space Heating	Remodel/Replacement	3.94	0.39
583	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	Restaurant	Space Heating	New construction	7.34	0.28
584	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	Restaurant	Space Heating	Renovation	7.34	0.28
585	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	Restaurant	Space Heating	New construction	1.25	1.29
586	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	Restaurant	Space Heating	Renovation	1.25	1.29
587	Improved below-grade insulation	Restaurant	Space Heating	New construction	1.66	0.97
588	Improved below-grade insulation	Restaurant	Space Heating	Renovation	1.66	0.97
589	Sensible Heat Recovery	Restaurant	Space Heating	Retrofit	14.43	1.58
590	Sensible Heat Recovery	Restaurant	Space Heating	New construction	14.30	0.73

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591	Sensible Heat Recovery	Restaurant	Space Heating	Remodel/Replacment	14.44	0.73
592	Pipe insulation - space heating	Restaurant	Space Heating	Retrofit	75.41	0.05
593	Pipe insulation - space heating	Restaurant	Space Heating	New construction	67.61	0.02
594	Pipe insulation - space heating	Restaurant	Space Heating	Renovation	67.61	0.02
595	Commissioning	Restaurant	Total	New construction	4.35	(1.80)
596	Commissioning	Restaurant	Total	Renovation	4.35	(1.80)
597	Commissioning	Restaurant	Total	Remodel/Replacment	5.00	(1.93)
598	Retrocommissioning	Restaurant	Total	Retrofit	6.57	(1.57)
599	Integrated Design - High Performance (30% > codes) - Tier 1	Restaurant	Total	New construction	2.32	0.10
600	Integrated Design - High Performance (50% > codes) Tier 2	Restaurant	Total	New construction	9,999.00	0.00
601	Steam trap Maintenance	Restaurant	Space Heating	Retrofit	2.06	0.80
602	Oxygen Trim	Restaurant	Space Heating	Retrofit	28.39	0.13
603	Oxygen Trim	Restaurant	Space Heating	New construction	68.26	0.02
604	Oxygen Trim	Restaurant	Space Heating	Remodel/Replacment	39.74	0.04
605	Exhaust Hood Makeup Air	Other	Space Heating	New construction	12.31	(0.21)
606	Exhaust Hood Makeup Air	Other	Space Heating	Remodel/Replacment	17.53	(0.26)
607	High efficiency ENERGY STAR fryer	Other	Cooking	New construction	2.06	0.44
608	High efficiency ENERGY STAR fryer	Other	Cooking	Remodel/Replacment	2.06	0.44
609	High efficiency ENERGY STAR steam cooker	Other	Cooking	Retrofit	1.06	1.57
610	High efficiency ENERGY STAR steam cooker	Other	Cooking	New construction	13.50	(2.23)
611	High efficiency ENERGY STAR steam cooker	Other	Cooking	Remodel/Replacment	13.50	(2.23)
612	Pre-Rinse Spray Valve	Other	Water Heating	Retrofit	33.23	0.00
613	Refrigeration heat recovery	Other	Water Heating	Retrofit	3.48	0.52
614	Refrigeration heat recovery	Other	Water Heating	New construction	2.28	0.39
615	Refrigeration heat recovery	Other	Water Heating	Remodel/Replacment	3.49	0.24
616	Cooling system chilled water reset	Other	Cooling	Retrofit	1.90	0.99
617	Cooling system chilled water reset	Other	Cooling	New construction	1.21	0.65
618	Cooling system chilled water reset	Other	Cooling	Remodel/Replacment	1.92	0.45
619	Cooling system water side economizer	Other	Cooling	Retrofit	1.53	0.67
620	Cooling system water side economizer	Other	Cooling	New construction	1.05	0.70
621	Cooling system water side economizer	Other	Cooling	Remodel/Replacment	1.54	0.30
622	Condensing DHW stand-alone	Other	Water Heating	Retrofit	3.07	0.71
623	Condensing DHW stand-alone	Other	Water Heating	New construction	3.17	0.31
624	Condensing DHW stand-alone	Other	Water Heating	Remodel/Replacment	5.01	0.19
625	Faucet aerator	Other	Water Heating	Retrofit	8.95	(3.29)
626	Graywater heat exchanger/GFX	Other	Water Heating	Retrofit	1.42	1.68
627	Graywater heat exchanger/GFX	Other	Water Heating	Remodel/Replacment	1.44	0.67
628	Indirect-fired DHW off space heating boiler	Other	Water Heating	Retrofit	2.67	0.93
629	Indirect-fired DHW off space heating boiler	Other	Water Heating	New construction	2.35	0.41
630	Indirect-fired DHW off space heating boiler	Other	Water Heating	Remodel/Replacment	3.70	0.26
631	Instantaneous. High-Modulating Water Heater	Other	Water Heating	Retrofit	2.90	0.75
632	Instantaneous. High-Modulating Water Heater	Other	Water Heating	New construction	5.39	0.18
633	Instantaneous. High-Modulating Water Heater	Other	Water Heating	Renovation	5.39	0.18
634	Instantaneous. High-Modulating Water Heater	Other	Water Heating	Remodel/Replacment	8.51	0.11
635	Low-flow shower heads	Other	Water Heating	Retrofit	44.77	(2.31)
636	Low-flow shower heads	Other	Water Heating	New construction	10.87	(0.90)
637	Low-flow shower heads	Other	Water Heating	Remodel/Replacment	17.17	(0.97)
638	Pipe insulation - water heating	Other	Water Heating	Retrofit	25.82	0.08
639	Pipe insulation - water heating	Other	Water Heating	New construction	16.63	0.06
640	Pipe insulation - water heating	Other	Water Heating	Renovation	16.63	0.06
641	Tank insulation	Other	Water Heating	Retrofit	1.91	1.11
642	Tank insulation	Other	Water Heating	New construction	1.23	0.79
643	Tank insulation	Other	Water Heating	Remodel/Replacment	1.94	0.50
644	Air Sealing	Other	Space Heating	Retrofit	5.89	0.38
645	Air Sealing	Other	Space Heating	New construction	2.50	0.56
646	Air Sealing	Other	Space Heating	Renovation	2.50	0.56
647	Improved heating system high efficiency unit - Tier 1	Other	Space Heating	New construction	1.35	1.20
648	Improved heating system high efficiency unit - Tier 1	Other	Space Heating	Remodel/Replacment	2.06	0.79
649	Improved heating system condensing unit - Tier 2	Other	Space Heating	New construction	0.94	1.71
650	Improved heating system condensing unit - Tier 2	Other	Space Heating	Remodel/Replacment	1.44	1.12
651	Programmable Thermostat	Other	Space Heating	Retrofit	10.04	0.26
652	Programmable Thermostat	Other	Space Heating	Renovation	3.58	0.42
653	Programmable Thermostat	Other	Space Heating	Remodel/Replacment	5.66	0.25
654	Demand-Controlled Ventilation (controller, sensor)	Other	Space Heating	Retrofit	4.47	(0.41)
655	Demand-Controlled Ventilation (controller, sensor)	Other	Space Heating	New construction	5.00	(0.25)

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656	Demand-Controlled Ventilation (controller, sensor)	Other	Space Heating	Remodel/Replacement	7.78	(0.41)
657	Outdoor Air Reset	Other	Space Heating	Retrofit	1.52	2.25
658	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	Other	Space Heating	New construction	8.02	0.11
659	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	Other	Space Heating	Renovation	8.02	0.11
660	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	Other	Space Heating	New construction	1.51	1.05
661	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	Other	Space Heating	Renovation	1.51	1.05
662	Improved below-grade insulation	Other	Space Heating	New construction	1.65	0.97
663	Improved below-grade insulation	Other	Space Heating	Renovation	1.65	0.97
664	Sensible Heat Recovery	Other	Space Heating	Retrofit	4.69	2.21
665	Sensible Heat Recovery	Other	Space Heating	New construction	1.24	1.47
666	Sensible Heat Recovery	Other	Space Heating	Remodel/Replacement	1.87	1.26
667	Pipe insulation - space heating	Other	Space Heating	Retrofit	74.13	0.05
668	Pipe insulation - space heating	Other	Space Heating	New construction	48.44	0.03
669	Pipe insulation - space heating	Other	Space Heating	Renovation	48.44	0.03
670	Energy Star washer	Other	Water Heating	New construction	1.40	(1.15)
671	Energy Star washer	Other	Water Heating	Remodel/Replacement	2.07	(2.86)
672	Swimming pool/spa covers	Other	Miscellaneous	Retrofit	4.43	0.38
673	Swimming pool/spa covers	Other	Miscellaneous	New construction	3.96	0.25
674	Swimming pool/spa covers	Other	Miscellaneous	Remodel/Replacement	4.41	0.22
675	Commissioning	Other	Total	New construction	3.25	(1.53)
676	Commissioning	Other	Total	Renovation	3.25	(1.53)
677	Commissioning	Other	Total	Remodel/Replacement	5.13	(2.05)
678	Retrocommissioning	Other	Total	Retrofit	6.69	(1.67)
679	Integrated Design - High Performance (30% > codes) - Tier 1	Other	Total	New construction	2.35	0.06
680	Integrated Design - High Performance (50% > codes) Tier 2	Other	Total	New construction	2.35	0.06
681	Steam trap Maintenance	Other	Space Heating	Retrofit	2.74	0.60
682	Oxygen Trim	Other	Space Heating	Retrofit	38.54	0.09
683	Oxygen Trim	Other	Space Heating	New construction	68.26	0.02
684	Oxygen Trim	Other	Space Heating	Remodel/Replacement	50.72	0.03
685	Infrared Heater	Other	Space Heating	Retrofit	36.31	0.11
686	Infrared Heater	Other	Space Heating	Remodel/Replacement	160.94	0.01
687	Faucet aerator	Multifamily	Water Heating	Retrofit	10.35	(3.38)
688	Graywater heat exchanger/GFX	Multifamily	Water Heating	Retrofit	1.67	1.44
689	Graywater heat exchanger/GFX	Multifamily	Water Heating	New construction	1.30	0.74
690	Graywater heat exchanger/GFX	Multifamily	Water Heating	Remodel/Replacement	1.67	0.58
691	Low-flow shower heads	Multifamily	Water Heating	Retrofit	9,999.00	(2.44)
692	Low-flow shower heads	Multifamily	Water Heating	New construction	6.34	(0.76)
693	Low-flow shower heads	Multifamily	Water Heating	Remodel/Replacement	8.13	(0.84)
694	Pipe insulation - water heating	Multifamily	Water Heating	Retrofit	30.29	0.07
695	Pipe insulation - water heating	Multifamily	Water Heating	New construction	23.63	0.04
696	Pipe insulation - water heating	Multifamily	Water Heating	Renovation	23.63	0.04
697	Tank insulation	Multifamily	Water Heating	Retrofit	2.24	0.94
698	Tank insulation	Multifamily	Water Heating	New construction	1.74	0.56
699	Tank insulation	Multifamily	Water Heating	Remodel/Replacement	2.24	0.43
700	Air Sealing	Multifamily	Space Heating	Retrofit	3.56	1.12
701	Air Sealing	Multifamily	Space Heating	New construction	2.94	0.55
702	Air Sealing	Multifamily	Space Heating	Renovation	2.94	0.55
703	Improved heating system high efficiency unit - Tier 1	Multifamily	Space Heating	New construction	4.36	0.37
704	Improved heating system high efficiency unit - Tier 1	Multifamily	Space Heating	Remodel/Replacement	5.41	0.30
705	Improved heating system condensing unit - Tier 2	Multifamily	Space Heating	New construction	3.84	0.42
706	Improved heating system condensing unit - Tier 2	Multifamily	Space Heating	Remodel/Replacement	4.77	0.34
707	Programmable Thermostat	Multifamily	Space Heating	Retrofit	2.92	1.23
708	Programmable Thermostat	Multifamily	Space Heating	Renovation	2.70	0.60
709	Programmable Thermostat	Multifamily	Space Heating	Remodel/Replacement	3.46	0.47
710	Outdoor Air Reset	Multifamily	Space Heating	Retrofit	2.19	1.57
711	Outdoor Air Reset	Multifamily	Space Heating	New construction	1.72	0.98
712	Outdoor Air Reset	Multifamily	Space Heating	Remodel/Replacement	2.20	0.76
713	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	Multifamily	Space Heating	New construction	10.12	0.16
714	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	Multifamily	Space Heating	Renovation	10.12	0.16
715	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	Multifamily	Space Heating	New construction	1.65	0.97
716	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	Multifamily	Space Heating	Renovation	1.65	0.97
717	Improved roof insulation	Multifamily	Space Heating	New construction	1.05	1.53
718	Improved roof insulation	Multifamily	Space Heating	Renovation	1.05	1.53
719	Sensible Heat Recovery	Multifamily	Space Heating	Retrofit	6.13	0.72
720	Sensible Heat Recovery	Multifamily	Space Heating	New construction	5.54	0.36

	A	C	D	E	F	G
1	Downstate Commercial Measures					
2	Total Resource Cost Test Benefit/Cost Ratio and Levelized Cost of Saved Energy					
3						
4						
5	Measure Name	Measure ID4 (e.g., Bldg type)	Measure ID5 (e.g., End Use)	Measure ID6 (e.g., Market: Retrofit, NC, ROB)	Total Resource BCR	TRC Levelized Cost per Saved Therm (\$/Therm)
721	Sensible Heat Recovery	Multifamily	Space Heating	Remodel/Replacment	6.81	0.31
722	Pipe insulation - space heating	Multifamily	Space Heating	Retrofit	74.45	0.05
723	Pipe insulation - space heating	Multifamily	Space Heating	New construction	59.88	0.03
724	Pipe insulation - space heating	Multifamily	Space Heating	Renovation	59.88	0.03
725	Energy Star washer	Multifamily	Water Heating	New construction	1.93	(2.51)
726	Energy Star washer	Multifamily	Water Heating	Remodel/Replacment	2.29	(3.09)
727	Swimming pool/spa covers	Multifamily	Miscellaneous	Retrofit	4.58	0.37
728	Swimming pool/spa covers	Multifamily	Miscellaneous	New construction	4.35	0.23
729	Swimming pool/spa covers	Multifamily	Miscellaneous	Remodel/Replacment	4.54	0.22
730	Commissioning	Multifamily	Total	New construction	4.26	(2.09)
731	Commissioning	Multifamily	Total	Renovation	4.26	(2.09)
732	Commissioning	Multifamily	Total	Remodel/Replacment	5.46	(2.34)
733	Retrocommissioning	Multifamily	Total	Retrofit	6.99	(1.92)
734	Integrated Design - High Performance (30% > codes) - Tier 1	Multifamily	Total	New construction	2.44	(0.03)
735	Integrated Design - High Performance (50% > codes) Tier 2	Multifamily	Total	New construction	2.44	(0.03)
736	Steam trap Maintenance	Multifamily	Space Heating	Retrofit	3.74	0.44
737	Oxygen Trim	Multifamily	Space Heating	Retrofit	51.57	0.07
738	Oxygen Trim	Multifamily	Space Heating	New construction	68.26	0.02
739	Oxygen Trim	Multifamily	Space Heating	Remodel/Replacment	59.45	0.03
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Subtracted Cost Effective Measures -- Downstate -- Low Avoided Costs

#	Measure Name	Measure ID4 (e.g., Bldg type)	Measure ID5 (e.g., End Use)	Measure ID6 (e.g., Market: Retrofit, NC, ROB)	Total Resource BCR	TRC Levelized Cost per Saved Therm (\$/Therm)
52	Improved heating system high efficiency unit - Tier 1	Office	Space Heating	New construction	0.74	1.56
53	Improved heating system high efficiency unit - Tier 1	Office	Space Heating	Remodel/Replacment	0.93	1.29
55	Improved heating system condensing unit - Tier 2	Office	Space Heating	New construction	0.77	1.56
56	Improved heating system condensing unit - Tier 2	Office	Space Heating	Remodel/Replacment	0.97	1.25
64	Outdoor Air Reset	Office	Space Heating	New construction	0.91	1.39
105	High efficiency ENERGY STAR steam cooker	Retail	Cooking	Retrofit	0.99	1.57
153	Improved heating system condensing unit - Tier 2	Retail	Space Heating	New construction	0.71	1.70
154	Improved heating system condensing unit - Tier 2	Retail	Space Heating	Remodel/Replacment	0.89	1.36
203	High efficiency ENERGY STAR steam cooker	Grocery	Cooking	Retrofit	0.99	1.57
251	Improved heating system condensing unit - Tier 2	Grocery	Space Heating	New construction	0.53	2.29
252	Improved heating system condensing unit - Tier 2	Grocery	Space Heating	Remodel/Replacment	0.65	1.86
345	Improved heating system high efficiency unit - Tier 1	Warehouse	Space Heating	Retrofit	0.79	3.82
348	Improved heating system condensing unit - Tier 2	Warehouse	Space Heating	Retrofit	1.31	2.30
368	Improved roof insulation	Warehouse	Space Heating	New construction	0.87	1.38
369	Improved roof insulation	Warehouse	Space Heating	Renovation	0.87	1.38
370	Sensible Heat Recovery	Warehouse	Space Heating	Retrofit	0.64	3.09
371	Sensible Heat Recovery	Warehouse	Space Heating	New construction	0.65	1.41
372	Sensible Heat Recovery	Warehouse	Space Heating	Remodel/Replacment	0.79	1.31
399	High efficiency ENERGY STAR steam cooker	Education	Cooking	Retrofit	0.99	1.57
409	Cooling system chilled water reset	Education	Cooling	New construction	0.92	0.61
443	Improved heating system high efficiency unit - Tier 1	Education	Space Heating	Retrofit	0.61	4.95
446	Improved heating system condensing unit - Tier 2	Education	Space Heating	Retrofit	2.38	1.27
497	High efficiency ENERGY STAR steam cooker	Health	Cooking	Retrofit	0.99	1.57
554	Outdoor Air Reset	Health	Space Heating	New construction	0.79	1.61
555	Outdoor Air Reset	Health	Space Heating	Remodel/Replacment	0.90	1.40
562	Improved below-grade insulation	Health	Space Heating	New construction	0.95	1.26
563	Improved below-grade insulation	Health	Space Heating	Renovation	0.95	1.26
595	High efficiency ENERGY STAR steam cooker	Lodging	Cooking	Retrofit	0.99	1.57
618	Graywater heat exchanger/GFX	Lodging	Water Heating	New construction	0.83	0.87
662	Improved roof insulation	Lodging	Space Heating	New construction	0.75	1.60
663	Improved roof insulation	Lodging	Space Heating	Renovation	0.75	1.60
693	High efficiency ENERGY STAR steam cooker	Restaurant	Cooking	Retrofit	0.99	1.57
741	Improved heating system condensing unit - Tier 2	Restaurant	Space Heating	New construction	0.57	2.11
742	Improved heating system condensing unit - Tier 2	Restaurant	Space Heating	Remodel/Replacment	0.64	1.89
754	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	Restaurant	Space Heating	New construction	0.93	1.29
755	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	Restaurant	Space Heating	Renovation	0.93	1.29
889	High efficiency ENERGY STAR steam cooker	Other	Cooking	Retrofit	0.99	1.57
899	Cooling system chilled water reset	Other	Cooling	New construction	0.86	0.65
902	Cooling system water side economizer	Other	Cooling	New construction	0.90	0.70
928	Tank insulation	Other	Water Heating	New construction	0.92	0.79
937	Improved heating system condensing unit - Tier 2	Other	Space Heating	New construction	0.71	1.71
959	Sensible Heat Recovery	Other	Space Heating	New construction	0.58	1.47
960	Sensible Heat Recovery	Other	Space Heating	Remodel/Replacment	0.88	1.26

Added Cost Effective Measures -- Downstate -- High Avoided Costs

#	Measure Name	Measure ID4 (e.g., Bldg type)	Measure ID5 (e.g., End Use)	Measure ID6 (e.g., Market: Retrofit, NC, ROB)	Total Resource BCR	TRC Levelized Cost per Saved Therm (\$/Therm)
29	Graywater heat exchanger/GFX	Office	Water Heating	Retrofit	1.19	2.50
31	Graywater heat exchanger/GFX	Office	Water Heating	Remodel/Replacment	1.21	0.99
70	Improved wall insulation	Office	Space Heating	New construction	1.06	1.86
71	Improved wall insulation	Office	Space Heating	Renovation	1.06	1.86
149	Improved heating system high efficiency unit - Tier 1	Retail	Space Heating	Retrofit	0.92	5.46
152	Improved heating system condensing unit - Tier 2	Retail	Space Heating	Retrofit	1.50	3.35
161	Outdoor Air Reset	Retail	Space Heating	Retrofit	1.02	4.20
168	Improved wall insulation	Retail	Space Heating	New construction	1.17	1.70
169	Improved wall insulation	Retail	Space Heating	Renovation	1.17	1.70
270	Improved roof insulation	Grocery	Space Heating	New construction	1.03	1.95
271	Improved roof insulation	Grocery	Space Heating	Renovation	1.03	1.95
323	Graywater heat exchanger/GFX	Warehouse	Water Heating	Retrofit	1.22	2.46
325	Graywater heat exchanger/GFX	Warehouse	Water Heating	Remodel/Replacment	1.23	0.98
760	Improved roof insulation	Restaurant	Space Heating	New construction	1.14	1.74
761	Improved roof insulation	Restaurant	Space Heating	Renovation	1.14	1.74
912	Graywater heat exchanger/GFX	Other	Water Heating	New construction	1.14	1.05
933	Improved heating system high efficiency unit - Tier 1	Other	Space Heating	Retrofit	1.05	4.77
936	Improved heating system condensing unit - Tier 2	Other	Space Heating	Retrofit	1.82	2.76
947	Outdoor Air Reset	Other	Space Heating	Remodel/Replacment	1.19	1.77

Natural Gas Sales Used in Master Com Eff ('000 dTh)

SALES_Used	1	2	3	4	5	6	7	8	9	10		TOTAL
	Office	Retail	Grocery	Warehouse	Education	Health	Lodging	Restaurant	Multifamily	Other		
EXISTING END USE SALES FORECAST ('000 dTh): 2007 ESALES_Used												
1 Space Heating	24,750	18,197	2,776	4,097	7,485	9,388	2,506	4,697	26,320	1,354		101570.4958
2 Water Heating	16,038	17,766	1,761	1,153	4,301	10,242	3,485	5,278	10,545	1,181		71748.27379
3 Cooking	11,703	17,099	1,292	222	2,369	4,402	1,560	7,620	1,308	906		48480.68659
4 Cooling	1,963	333	191	20	149	512	132	377	0	59		3736.186004
5 Miscellaneous	0	0	0	154	424	596	330	0	241	47		1791.569467
6 Total	54,454	53,395	6,019	5,646	14,728	25,140	8,014	17,972	38,415	3,547		227,327
New Construction Sales in ('000 dTh): 2007 NSALES_Used												
1 Space Heating	199.6	146.8	22.4	33.0	60.4	75.7	20.2	37.9	794.0	10.9		1400.861349
2 Water Heating	129.3	143.3	14.2	9.3	34.7	82.6	28.1	42.6	318.1	9.5		811.6975597
3 Cooking	94.4	137.9	10.4	1.8	19.1	35.5	12.6	61.4	39.5	7.3		419.8933763
4 Cooling	15.8	2.7	1.5	0.2	1.2	4.1	1.1	3.0	0.0	0.5		19.78107712
5 Miscellaneous	0.0	0.0	0.0	1.2	3.4	4.8	2.7	0.0	7.3	0.4		2.682
6 Total	439.1	430.6	48.5	45.5	118.8	202.7	64.6	144.9	1,158.9	28.6		
											230,010	
Growth Factors — Annual percents apply to 2007 gas sales to get each years new and existing sales.												
Existing	E_Growth_Used	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
1 Office		100.0%	100.8%	101.7%	102.5%	103.4%	104.2%	105.1%	105.9%	106.8%	107.7%	
2 Retail		100.0%	100.8%	101.7%	102.5%	103.4%	104.2%	105.1%	105.9%	106.8%	107.7%	
3 Grocery		100.0%	100.8%	101.7%	102.5%	103.4%	104.2%	105.1%	105.9%	106.8%	107.7%	
4 Warehouse		100.0%	100.8%	101.7%	102.5%	103.4%	104.2%	105.1%	105.9%	106.8%	107.7%	
5 Education		100.0%	100.8%	101.7%	102.5%	103.4%	104.2%	105.1%	105.9%	106.8%	107.7%	
6 Health		100.0%	100.8%	101.7%	102.5%	103.4%	104.2%	105.1%	105.9%	106.8%	107.7%	
7 Lodging		100.0%	100.8%	101.7%	102.5%	103.4%	104.2%	105.1%	105.9%	106.8%	107.7%	
8 Restaurant		100.0%	100.8%	101.7%	102.5%	103.4%	104.2%	105.1%	105.9%	106.8%	107.7%	
9 Multifamily		100.0%	100.8%	101.7%	102.5%	103.4%	104.2%	105.1%	105.9%	106.8%	107.7%	
10 Other		100.0%	100.8%	101.7%	102.5%	103.4%	104.2%	105.1%	105.9%	106.8%	107.7%	
NC	N_Growth_Used											
1 Office		100.0%	100.8%	101.6%	102.4%	103.2%	104.1%	105.1%	106.2%	107.2%	108.3%	
2 Retail		100.0%	100.8%	101.6%	102.4%	103.2%	104.1%	105.1%	106.2%	107.2%	108.3%	
3 Grocery		100.0%	100.8%	101.6%	102.4%	103.2%	104.1%	105.1%	106.2%	107.2%	108.3%	
4 Warehouse		100.0%	100.8%	101.6%	102.4%	103.2%	104.1%	105.1%	106.2%	107.2%	108.3%	
5 Education		100.0%	100.8%	101.6%	102.4%	103.2%	104.1%	105.1%	106.2%	107.2%	108.3%	
6 Health		100.0%	100.8%	101.6%	102.4%	103.2%	104.1%	105.1%	106.2%	107.2%	108.3%	
7 Lodging		100.0%	100.8%	101.6%	102.4%	103.2%	104.1%	105.1%	106.2%	107.2%	108.3%	
8 Restaurant		100.0%	100.8%	101.6%	102.4%	103.2%	104.1%	105.1%	106.2%	107.2%	108.3%	
9 Multifamily		100.0%	102.5%	105.1%	107.8%	110.5%	113.3%	116.3%	119.3%	122.5%	125.7%	
10 Other		100.0%	100.8%	101.6%	102.4%	103.2%	104.1%	105.1%	106.2%	107.2%	108.3%	

Measure	Life	Enduse	Existing Life	NG Loadshape Name	Elec Loadshape Name
Direct fired convection range/oven	8	Cooking	8	NG Base	None
Exhaust Hood Makeup Air	20	Space Heating	20	NG Com Space Heat	Com Cooling
High efficiency ENERGY STAR fryer	8	Cooking	8	NG Base	None
High efficiency ENERGY STAR steam cooker	10	Cooking	10	NG Base	None
High efficiency griddle	8	Cooking	8	NG Base	None
Pre-Rinse Spray Valve	5	Water Heating	5	NG DHW	None
Refrigeration heat recovery	15	Water Heating	15	NG DHW	Com Refrigeration
					None
Cooling system chilled water reset	15	Cooling	15	NG Cooling	Com Cooling
Cooling system water side economizer	15	Cooling	15	NG Cooling	Com Cooling
Cooling system oversized cooling tower	20	Cooling	20	NG Cooling	Com Cooling
Condensing DHW stand-alone	15	Water Heating	15	NG DHW	None
Faucet aerator	10	Water Heating	10	NG DHW	None
Graywater heat exchanger/GFX	20	Water Heating	20	NG DHW	None
Indirect-fired DHW off space heating boiler	25	Water Heating	25	NG DHW	None
Instantaneous. High-Modulating Water Heater	15	Water Heating	15	NG DHW	None
Low-flow shower heads	10	Water Heating	10	NG DHW	None
Pipe insulation - water heating	15	Water Heating	15	NG DHW	None
Tank insulation	15	Water Heating	15	NG DHW	None
Air Sealing	20	Space Heating	20	NG Com Space Heat	Com Ventilation
Improved heating system high efficiency unit - Tier 1	25	Space Heating	25	NG Com Space Heat	Com Heating
Improved heating system condensing unit - Tier 2	25	Space Heating	25	NG Com Space Heat	None
Programmable Thermostat	10	Space Heating	10	NG Com Space Heat	Com Cooling
Demand-Controlled Ventilation (controller, sensor)	15	Space Heating	15	NG Com Space Heat	Com Cooling
Outdoor Air Reset	2	Space Heating	2	NG Com Space Heat	None
High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	30	Space Heating	30	NG Com Space Heat	Com Cooling
High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	30	Space Heating	30	NG Com Space Heat	Com Cooling
Improved wall insulation	30	Space Heating	30	NG Com Space Heat	Com Cooling
Improved below-grade insulation	30	Space Heating	30	NG Com Space Heat	None
Improved roof insulation	30	Space Heating	30	NG Com Space Heat	Com Cooling
Sensible Heat Recovery	15	Space Heating	15	NG Com Space Heat	Com Economizer
Pipe insulation - space heating	15	Space Heating	15	NG Com Space Heat	None
Energy Star washer	11	Water Heating	11	NG DHW	Com Water Heating
Swimming pool/spa covers	5	Miscellaneous	5	NG DHW	None
Commissioning	7	Total	7	NG Com Space Heat	Com Total Building
Retrocommissioning	7	Total	7	NG Com Space Heat	Com Total Building
Integrated Design - High Performance (30% > codes) - Tier 1	25	Total	25	NG Com Space Heat	Com Total Building
Integrated Design - High Performance (50% > codes) Tier 2	25	Total	25	NG Com Space Heat	Com Total Building
Steam trap Maintenance	1	Space Heating	1	NG Com Space Heat	None
Oxygen Trim	10	Space Heating	10	NG Com Space Heat	None
Infrared Heater	20	Space Heating	20	NG Com Space Heat	None

Development Of Measure Factors

Applicability factors represent the share of end-use level gas usage that is attributable to a particular technology. The analysis drew on a variety of sources to develop applicability factors for each measure by building type. In general, data on market shares for different types and sizes of technologies are weighted based on overall energy consumption or capacity. For example, the applicability factor for condensing boilers reflects the share of total commercial square feet heated by gas that uses hot water boilers of less than approximately 3 million British thermal units per hour (Btuh) capacity. This reflects that condensing boilers are only applicable for hydronic (not steam) systems, and are currently available only up to about 3 million Btuh capacity. Where possible, separate applicability factors for each building type were developed. Where building type data was not available, average data for the total commercial market was used for all building types. New York-specific data was used when available. Alternatively, data from the Northeast or Mid-Atlantic states were used if possible. These data reflect a variety of baseline and market assessment data, including studies done for Long Island Power Authority (LIPA), NYSERDA, proprietary analyses for a number of New York and New Jersey utilities, the Commercial Building Energy Consumption survey (CBECS) developed by EIA, ACEEE, and published market assessments and other potential studies.

Feasibility factors are the fraction of the applicable end use technically feasible for conversion to the high-efficiency technology. Feasibility is not reduced for economic or behavioral barriers. Rather, feasibility reflects only technical or physical constraints that would make measure adoption inappropriate. For example, it is not feasible to install refrigeration heat recovery to supplement domestic hot water usage in buildings that do not have walk-in or other large refrigeration systems and relatively constant hot water loads. In most cases, it is feasible to replace baseline technology with an efficient alternative, resulting in a 100% feasibility factor. These data are based on various studies or engineering judgment. Major sources of data include a number of proprietary U.S. potential studies conducted in the past 5-years.

Measure savings factors are calculated based on individual measure data and assumptions about existing stock efficiency (for retrofit measures), standard practice for construction and purchases (for market-driven measures), and high-efficiency options. Measure-savings characteristics were developed using public and private information sources, including NYSERDA, CBECS, California Energy Commission, Efficiency Vermont, American Council for an Energy Efficient Economy (ACEEE), Lawrence Berkeley Laboratory (LBL), National Fenestration Rating Council (NFRC), various Northeastern U.S. baseline and market assessment studies, recent gas potential studies, and communications with manufacturers and vendors. Measure savings are expressed in % of baseline energy usage.

Baseline adjustment factors were used to adjust long term savings downward for retrofit measures. The initial savings for retrofit measures is the difference between the typical existing stock efficiency and the high-efficiency alternative. However, the long-term savings are the difference between the typical baseline efficiency of new construction and equipment and the high-efficiency alternative, which is typically lower. If retrofits were not considered, the existing stock eventually would get replaced with new baseline efficiency measures anyway. In most cases, the current baseline efficiency is more efficient than the average existing stock. For example, clothes washing equipment meeting U.S. Energy Policy Act (EPA) efficiency levels are baseline for new clothes washer purchases. However, the average efficiency of clothes washers existing today in commercial buildings falls short of EPA levels. The baseline adjustment factor adjusts the savings downward in future years for retrofit measures. The analysis assumes the vintage of all measures replaced in retrofit markets is half of its estimated measure life. Therefore, the baseline adjustment applies in the year immediately following half of the measure life. Baseline adjustment factors were developed based on the relative baseline efficiencies of new and existing stock, from current and historical technology, baseline and market assessment studies. Baseline adjustment factors are expressed in % of first year energy savings.

Electric and water savings factors (kWh/Dth-yr) and (gallons/Dth-yr) were developed based on engineering calculations or simulation modeling to calculate non-gas resource impacts.

Annual to peak-day ratios were used to estimate the measure peak-day impacts. The analysis relies on 8,760 hourly end-use and building-type specific load shape data to estimate these ratios, separately for each building type and measure. Load shape data is from Regional Economic Research.

Measure lives were developed from various sources including prior potential studies, NYSERDA, DOE, EPA, ACEEE, ASHRAE, Efficiency Vermont, NFRC, equipment manufacturers and professional judgment. The estimated measure lives reflect both engineering service life and estimated remodel activity.

Measure costs for each of the 40 technologies were developed based on a variety of sources, including but not limited to proprietary studies or data from northeastern United States utilities, R.S. Means, Efficiency Vermont, Grainger, and a California Energy Commission database of equipment costs, and discussions with equipment vendors. Measure costs obtained outside the Northeast region were adjusted based on R.S. Means location factors to better reflect New York costs. Retrofit measure costs include the total material and labor cost. Market-driven measure costs reflect the incremental material and labor cost of high efficiency as compared to standard practice.

Measure costs per Dth annual savings (\$/Dth) were developed for each building type for each of the 40 technologies analyzed, based on building-type-specific data, and the market applied to.

O&M cost impacts are considered in addition to measure installation costs. These reflect any incremental effects on O&M costs for each measure over its lifetime. O&M cost impacts reflect changes in measure and replacement component lives and costs for both the high- and standard-efficiency options.

Deferral credits were captured to properly estimate the long-term societal costs of retrofit measures. Related to O&M costs, the analysis accounts for the time value of permanently deferring the equipment purchase cycle for early-retirement (retrofit) measures. For example, a high-efficiency space heating unit typically lasts 25-years. If an existing space heating unit expected to last another 10-years is retrofitted with a new, high-efficiency model, the customer no longer has to purchase a new one in 10-years. Rather, the next space heating purchase will be in 25-years. Thus, all future space heating purchases have now been shifted out by fifteen years in perpetuity. This deferral of future capital investments provides a societal benefit by lowering present-value replacement costs. This societal value is captured through a “deferral credit.” The analysis assumed the remaining life of all existing measures to be retrofitted was, on average, equal to one half of the total measure life (for example, for an HVAC unit with a 25- year life, it was assumed the average existing unit was 12.5-years old and would normally be replaced 12.5-years hence).

Base-case penetrations were used to estimate the current and future market penetration of measures without any program intervention. The potential efficiency for any given measure is a function of the size of the market, the measure characteristics and the base-case penetration that would occur absent any market intervention. Base-case penetrations for each of the 40 technologies were separately estimated. In some cases, differing estimates by building-type are used, but in many cases, this level of disaggregation was not supported by the data. The base-case represents the existing and forecast measure penetrations that are assumed to underlie the forecast, which assumes no gas program interventions, but does take into account current and expected codes and standards, as well as current and expected New York electric efficiency programs. For retrofit measures, 5% of existing stock is assumed to likely be modified for retrofit reasons over the 10-year planning horizon (equivalent to assuming a 5% freeridership for the economic potential). Base-case penetrations for each of the market-driven measures were estimated to reflect expectations about likely market adoptions, based on expert judgment, review of market assessments, and knowledge of likely codes and standards changes over the planning period.

“Not complete” factors were used to eliminate any opportunities in the retrofit market where efficient equipment already exists rather than relying on base-case penetrations. These factors represent the remaining share of existing stock that has not already adopted the efficient measures. In other words, if 10% of existing buildings have condensing furnaces, the not complete factor for this measure would be 90%. Therefore, for retrofit measures base-case penetrations start at 0%.

Competing Technologies are accounted for with the economic potential penetrations. For the economic potential, by definition, 100% penetration is assumed whenever a measure is applicable and feasible. However, some of the technologies modeled are mutually exclusive -- that is, one or the other could be installed, but not both. For example, water heaters can be replaced with a stand-alone unit, an integrated system off a boiler, or point-of-use heaters. When two or more measures compete with one another, the adoption of the measure offering the highest per-unit savings or greatest anticipated cost-effectiveness is counted first. The penetration of the next competing measure was then estimated based on the remaining potential, taking into account the applicability, feasibility, and achievable penetration of the first measure. In other words, if 100% of water heaters could be replaced with condensing stand-alone units (and this measure is considered first), then 0% penetration opportunity remains for the other competing measures.

Interactions factors were used to account for interactions among measures. Individual measure savings are not additive. Because of interactions between measures, the total potential for all measures is less than the sum of individual measure opportunities taken independently. For example, installing high performance windows will reduce heating load and therefore lower the savings opportunities from installing a condensing boiler. Interaction factors are separately estimated for retrofit, existing building market-driven, and new construction markets. This is because some measures only apply to one market. For example, integrated high efficiency design applies only for new construction, retrocommissioning applies only for retrofit. As a result, the measures that interact with each other differ for each market. The measures within a group that interact, typically by end-use, are ranked based on priority. Although some measures, like commissioning, interact with all end uses. This ranking is based on per unit savings, or judgment about what measures are typically most cost-effective and likely to offer the greatest customer benefit. Each subsequent interacting measure is then adjusted for the potential savings captured by the prior measure.

It should be noted that the rank order does not affect ultimate total potential savings. However, it does effect the per measure savings and cost-effectiveness. A measure further down in the ranking would still cost the same amount to install, but is assumed to save less because of prior measures already assumed to be installed.

Note that both competing measure issues and interactions are not considered for the program scenario potential estimate. This is because the program scenario is sufficiently lower than likely maximum achievable potential that penetrations are not high enough to assume most customers are pursuing numerous measures at once.

APPLICABILITY		1	2	3	4	5	6	7	8	9	10
		Office	Retail	Grocery	Warehouse	Education	Health	Lodging	Restaurant	Multifamily	Other
1	Direct fired convection range/oven	0%	18%	18%	0%	18%	18%	18%	18%	0%	0%
2	Exhaust Hood Makeup Air	1%	2%	3%	6%	3%	1%	1%	20%	0%	1%
3	High efficiency ENERGY STAR fryer	54%	46%	46%	54%	46%	46%	46%	46%	0%	78%
4	High efficiency ENERGY STAR steam cooker	0%	6%	6%	0%	6%	6%	6%	6%	0%	5%
5	High efficiency griddle	46%	10%	10%	46%	10%	10%	10%	10%	0%	17%
6	Pre-Rinse Spray Valve	1%	1%	10%	1%	2%	2%	2%	40%	0%	1%
7	Refrigeration heat recovery	100%	100%	100%	100%	100%	100%	100%	100%	0%	100%
8											
9	Cooling system chilled water reset	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
10	Cooling system water side economizer	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
11	Cooling system oversized cooling tower	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
12	Condensing DHW stand-alone	62%	62%	62%	62%	62%	62%	62%	62%	0%	62%
13	Faucet aerator	50%	60%	5%	60%	15%	15%	5%	5%	5%	26%
14	Graywater heat exchanger/GFX	2%	0%	0%	2%	33%	2%	20%	50%	20%	13%
15	Indirect-fired DHW off space heating boiler	21%	6%	16%	6%	32%	36%	33%	16%	0%	20%
16	Instantaneous. High-Modulating Water Heater	62%	62%	62%	62%	62%	62%	62%	62%	0%	62%
17	Low-flow shower heads	2%	0%	0%	2%	33%	2%	20%	0%	20%	13%
18	Pipe insulation - water heating	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
19	Tank insulation	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
20	Air Sealing	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
21	Improved heating system high efficiency unit - Tier 1	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%
22	Improved heating system condensing unit - Tier 2	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%
23	Programmable Thermostat	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%
24	Demand-Controlled Ventilation (controller, sensor)	10%	100%	100%	100%	100%	100%	100%	100%	100%	100%
25	Outdoor Air Reset	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
26	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
27	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
28	Improved wall insulation	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
29	Improved below-grade insulation	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
30	Improved roof insulation	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
31	Sensible Heat Recovery	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%
32	Pipe insulation - space heating	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%
33	Energy Star washer	0%	0%	0%	0%	1%	0%	1%	0%	1%	0%
34	Swimming pool/spa covers	0%	0%	0%	0%	70%	20%	90%	0%	90%	20%
35	Commissioning	71%	71%	71%	71%	71%	71%	71%	71%	71%	71%
36	Retrocommissioning	54%	54%	54%	54%	54%	54%	54%	54%	54%	54%
37	Integrated Design - High Performance (30% > codes) - Tier 1	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%
38	Integrated Design - High Performance (50% > codes) Tier 2	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%
39	Steam trap Maintenance	26%	26%	26%	26%	26%	26%	26%	26%	26%	26%
40	Oxygen Trim	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%
41	Infrared Heater	0%	0%	50%	75%	0%	0%	0%	0%	0%	50%

FEASIBILITY		1	2	3	4	5	6	7	8	9	10
		Office	Retail	Grocery	Warehouse	Education	Health	Lodging	Restaurant	Multifamily	Other
1	Direct fired convection range/oven	100%	100%	100%	100%	100%	100%	100%	100%	0%	100%
2	Exhaust Hood Makeup Air	100%	100%	100%	100%	100%	100%	100%	100%	0%	100%
3	High efficiency ENERGY STAR fryer	100%	100%	100%	100%	100%	100%	100%	100%	0%	100%
4	High efficiency ENERGY STAR steam cooker	100%	100%	100%	100%	100%	100%	100%	100%	0%	100%
5	High efficiency griddle	100%	100%	100%	100%	100%	100%	100%	100%	0%	100%
6	Pre-Rinse Spray Valve	100%	100%	100%	100%	100%	100%	100%	100%	0%	100%
7	Refrigeration heat recovery	10%	5%	80%	10%	15%	80%	20%	80%	0%	5%
8											
9	Cooling system chilled water reset	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
10	Cooling system water side economizer	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
11	Cooling system oversized cooling tower	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%
12	Condensing DHW stand-alone	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%
13	Faucet aerator	95%	95%	25%	95%	50%	25%	50%	25%	50%	75%
14	Graywater heat exchanger/GFX	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
15	Indirect-fired DHW off space heating boiler	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%
16	Instantaneous. High-Modulating Water Heater	10%	10%	0%	10%	10%	10%	0%	0%	0%	10%
17	Low-flow shower heads	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
18	Pipe insulation - water heating	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
19	Tank insulation	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
20	Air Sealing	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
21	Improved heating system high efficiency unit - Tier 1	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
22	Improved heating system condensing unit - Tier 2	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%
23	Programmable Thermostat	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%
24	Demand-Controlled Ventilation (controller, sensor)	100%	100%	100%	100%	100%	0%	50%	100%	0%	100%
25	Outdoor Air Reset	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
26	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%
27	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	75%	75%	0%	0%	75%	75%	75%	75%	75%	75%
28	Improved wall insulation	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
29	Improved below-grade insulation	100%	100%	100%	100%	100%	100%	0%	100%	0%	100%
30	Improved roof insulation	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
31	Sensible Heat Recovery	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
32	Pipe insulation - space heating	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
33	Energy Star washer	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
34	Swimming pool/spa covers	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
35	Commissioning	71%	71%	71%	71%	71%	71%	71%	71%	71%	71%
36	Retrocommissioning	54%	54%	54%	54%	54%	54%	54%	54%	54%	54%
37	Integrated Design - High Performance (30% > codes) - Tier 1	80%	80%	80%	80%	80%	50%	80%	50%	80%	100%
38	Integrated Design - High Performance (50% > codes) Tier 2	13%	13%	5%	5%	13%	0%	9%	0%	9%	80%
39	Steam trap Maintenance	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
40	Oxygen Trim	42%	42%	42%	42%	42%	42%	42%	42%	42%	42%
41	Infrared Heater	0%	0%	65%	100%	0%	0%	0%	0%	0%	35%

% of retrofit measures not complete		1	2	3	4	5	6	7	8	9	10
RET_Not	Complete	Office	Retail	Grocery	Warehouse	Education	Health	Lodging	Restaurant	Multifamily	Other
1	Direct fired convection range/oven										
2	Exhaust Hood Makeup Air										
3	High efficiency ENERGY STAR fryer										
4	High efficiency ENERGY STAR steam cooker	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%
5	High efficiency griddle										
6	Pre-Rinse Spray Valve	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
7	Refrigeration heat recovery	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%
8											
9	Cooling system chilled water reset	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%
10	Cooling system water side economizer	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%
11	Cooling system oversized cooling tower	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%
12	Condensing DHW stand-alone	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
13	Faucet aerator	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
14	Graywater heat exchanger/GFX	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
15	Indirect-fired DHW off space heating boiler	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
16	Instantaneous. High-Modulating Water Heater	93%	89%	100%	94%	99%	92%	100%	97%	100%	93%
17	Low-flow shower heads	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
18	Pipe insulation - water heating	50%	73%	70%	76%	14%	33%	49%	75%	49%	59%
19	Tank insulation	89%	76%	100%	100%	25%	25%	25%	86%	25%	25%
20	Air Sealing	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
21	Improved heating system high efficiency unit - Tier 1	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%
22	Improved heating system condensing unit - Tier 2	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%
23	Programmable Thermostat	49%	79%	78%	38%	49%	49%	34%	50%	34%	42%
24	Demand-Controlled Ventilation (controller, sensor)	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%
25	Outdoor Air Reset	53%	79%	80%	78%	17%	75%	57%	100%	57%	17%
26	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1										
27	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2										
28	Improved wall insulation										
29	Improved below-grade insulation										
30	Improved roof insulation										
31	Sensible Heat Recovery	90%	90%	76%	69%	74%	90%	62%	78%	50%	50%
32	Pipe insulation - space heating	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%
33	Energy Star washer										
34	Swimming pool/spa covers	0%	0%	0%	0%	27%	50%	80%	0%	80%	63%
35	Commissioning										
36	Retrocommissioning	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
37	Integrated Design - High Performance (30% > codes) - Tier 1										
38	Integrated Design - High Performance (50% > codes) Tier 2										
39	Steam trap Maintenance	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
40	Oxygen Trim	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
41	Infrared Heater	100%	100%	100%	94%	100%	100%	100%	100%	100%	93%

Annual dTh saved/Peak day dTh saved											
kWh_kW_ratio	1	2	3	4	5	6	7	8	9	10	
	Office	Retail	Grocery	Warehouse	Education	Health	Lodging	Restaurant	Multifamily	Other	
1	Direct fired convection range/oven	268	363	363	281	226	351	365	363	365	344
2	Exhaust Hood Makeup Air	86	76	73	86	67	89	62	80	62	85
3	High efficiency ENERGY STAR fryer	268	363	363	281	226	351	365	363	365	344
4	High efficiency ENERGY STAR steam cooker	268	363	363	281	226	351	365	363	365	344
5	High efficiency griddle	268	363	363	281	226	351	365	363	365	344
6	Pre-Rinse Spray Valve	293	300	300	640	226	291	308	299	308	291
7	Refrigeration heat recovery	293	300	300	640	226	291	308	299	308	291
8											
9	Cooling system chilled water reset	999,999,999	999,999,999	999,999,999	999,999,999	999,999,999	999,999,999	999,999,999	999,999,999	999,999,999	999,999,999
10	Cooling system water side economizer	999,999,999	999,999,999	999,999,999	999,999,999	999,999,999	999,999,999	999,999,999	999,999,999	999,999,999	999,999,999
11	Cooling system oversized cooling tower	999,999,999	999,999,999	999,999,999	999,999,999	999,999,999	999,999,999	999,999,999	999,999,999	999,999,999	999,999,999
12	Condensing DHW stand-alone	293	300	300	640	226	291	308	299	308	291
13	Faucet aerator	293	300	300	640	226	291	308	299	308	291
14	Graywater heat exchanger/GFX	293	300	300	640	226	291	308	299	308	291
15	Indirect-fired DHW off space heating boiler	293	300	300	640	226	291	308	299	308	291
16	Instantaneous. High-Modulating Water Heater	293	300	300	640	226	291	308	299	308	291
17	Low-flow shower heads	293	300	300	640	226	291	308	299	308	291
18	Pipe insulation - water heating	293	300	300	640	226	291	308	299	308	291
19	Tank insulation	293	300	300	640	226	291	308	299	308	291
20	Air Sealing	86	76	73	86	67	89	62	80	62	85
21	Improved heating system high efficiency unit - Tier 1	86	76	73	86	67	89	62	80	62	85
22	Improved heating system condensing unit - Tier 2	86	76	73	86	67	89	62	80	62	85
23	Programmable Thermostat	86	76	73	86	67	89	62	80	62	85
24	Demand-Controlled Ventilation (controller, sensor)	86	76	73	86	67	89	62	80	62	85
25	Outdoor Air Reset	86	76	73	86	67	89	62	80	62	85
26	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	86	76	73	86	67	89	62	80	62	85
27	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	86	76	73	86	67	89	62	80	62	85
28	Improved wall insulation	86	76	73	86	67	89	62	80	62	85
29	Improved below-grade insulation	86	76	73	86	67	89	62	80	62	85
30	Improved roof insulation	86	76	73	86	67	89	62	80	62	85
31	Sensible Heat Recovery	86	76	73	86	67	89	62	80	62	85
32	Pipe insulation - space heating	86	76	73	86	67	89	62	80	62	85
33	Energy Star washer	293	300	300	640	226	291	308	299	308	291
34	Swimming pool/spa covers	293	300	300	640	226	291	308	299	308	291
35	Commissioning	86	76	73	86	67	89	62	80	62	85
36	Retrocommissioning	86	76	73	86	67	89	62	80	62	85
37	Integrated Design - High Performance (30% > codes) - Tier 1	86	76	73	86	67	89	62	80	62	85
38	Integrated Design - High Performance (50% > codes) Tier 2	86	76	73	86	67	89	62	80	62	85
39	Steam trap Maintenance	86	76	73	86	67	89	62	80	62	85
40	Oxygen Trim	86	76	73	86	67	89	62	80	62	85
41	Infrared Heater	86	76	73	86	67	89	62	80	62	85

% replacement/remodel interaction or overlap factor												rank order	interacts with
MD_Interactions	1	2	3	4	5	6	7	8	9	10			
	Office	Retail	Grocery	Warehouse	Education	Health	Lodging	Restaurant	Multifamily	Other			
1	Direct fired convection range/oven	100%	100%	100%	100%	100%	100%	100%	100%	100%	0		
2	Exhaust Hood Makeup Air	93%	83%	67%	74%	69%	87%	89%	78%	93%	10	2a,3,9	
3	High efficiency ENERGY STAR fryer	100%	100%	100%	100%	100%	100%	100%	100%	100%	0		
4	High efficiency ENERGY STAR steam cooker	100%	100%	100%	100%	100%	100%	100%	100%	100%	0		
5	High efficiency griddle	100%	100%	100%	100%	100%	100%	100%	100%	100%	0		
6	Pre-Rinse Spray Valve	100%	100%	100%	100%	100%	100%	100%	100%	100%	0		
7	Refrigeration heat recovery	85%	87%	86%	87%	79%	84%	81%	78%	95%	8	,1,2,4,6,7	
8													
9	Cooling system chilled water reset	95%	95%	95%	95%	95%	95%	95%	95%	95%	5	,2a,3	
10	Cooling system water side economizer	95%	95%	95%	95%	95%	95%	95%	95%	95%	4	,2a,3	
11	Cooling system oversized cooling tower	97%	97%	97%	97%	97%	97%	97%	97%	97%	3	,2a	
12	Condensing DHW stand-alone	100%	100%	100%	100%	100%	100%	100%	100%	100%	1		
13	Faucet aerator	100%	100%	100%	100%	100%	100%	100%	100%	100%	1		
14	Graywater heat exchanger/GFX	87%	88%	87%	88%	85%	85%	85%	87%	100%	87%	4	,1,2
15	Indirect-fired DHW off space heating boiler	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	2	
16	Instantaneous High-Modulating Water Heater	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	3	
17	Low-flow shower heads	86%	88%	87%	88%	80%	85%	82%	79%	96%	84%	5	,1,2,4
18	Pipe insulation - water heating	87%	88%	87%	88%	85%	85%	85%	87%	100%	87%	7	,1,2
19	Tank insulation	87%	88%	87%	88%	85%	85%	85%	87%	100%	87%	6	,1,2
20	Air Sealing	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0	
21	Improved heating system high efficiency unit - Tier 1	97%	97%	97%	97%	97%	97%	97%	97%	97%	97%	3	2a
22	Improved heating system condensing unit - Tier 2	97%	97%	97%	97%	97%	97%	97%	97%	97%	97%	3	2a
23	Programmable Thermostat	94%	95%	95%	95%	94%	87%	94%	95%	94%	93%	4	,2a,3
24	Demand-Controlled Ventilation (controller, sensor)	94%	95%	95%	95%	94%	87%	94%	95%	94%	93%	5	,2a,3
25	Outdoor Air Reset	93%	83%	67%	74%	69%	87%	89%	78%	93%	84%	7	,2a,3,4,5
26	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	93%	83%	67%	74%	69%	87%	89%	78%	93%	84%	12	,2a,3,5,9
27	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	93%	83%	67%	74%	69%	87%	89%	78%	93%	84%	12	,2a,3,5,9
28	Improved wall insulation	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		
29	Improved below-grade insulation	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		
30	Improved roof insulation	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		
31	Sensible Heat Recovery	92%	82%	66%	73%	68%	86%	88%	77%	92%	83%	8	2a,3,4,5,7
32	Pipe insulation - space heating	92%	82%	66%	73%	68%	86%	88%	77%	92%	83%	9	2a,3,4,5,7
33	Energy Star washer	83%	85%	84%	84%	77%	81%	79%	76%	92%	81%	9	2a,1,2,4,6,7
34	Swimming pool/spa covers	83%	85%	84%	84%	82%	82%	82%	84%	96%	83%	10	2a,1,2,6,7
35	Commissioning	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	2a	0
36	Retrocommissioning	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0	
37	Integrated Design - High Performance (30% > codes) - Tier 1	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0	0
38	Integrated Design - High Performance (50% > codes) Tier 2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0	0
39	Steam trap Maintenance	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0	
40	Oxygen Trim	91%	68%	54%	64%	60%	81%	83%	58%	87%	74%	11	2a,4,5,7,8,9
41	Infrared Heater	96%	85%	68%	75%	71%	97%	92%	80%	96%	87%	13	,2a,4,5

Interaction interim factors (prod of %savings, applicability, feasibility, and max pen)											
MD interim interactions		1	2	3	4	5	6	7	8	9	10
		Office	Retail	Grocery	Warehouse	Education	Health	Lodging	Restaurant	Multifamily	Other
1	Direct fired convection range/o	0%	5%	5%	0%	5%	5%	5%	5%	0%	0%
2	Exhaust Hood Makeup Air	0%	1%	1%	2%	1%	0%	0%	6%	0%	0%
3	High efficiency ENERGY STAR	14%	12%	12%	14%	12%	12%	12%	12%	0%	20%
4	High efficiency ENERGY STAR	0%	2%	2%	0%	2%	2%	2%	2%	0%	2%
5	High efficiency griddle	3%	1%	1%	3%	1%	1%	1%	1%	0%	1%
6	Pre-Rinse Spray Valve	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
7	Refrigeration heat recovery	0%	0%	10%	7%	3%	2%	1%	34%	0%	0%
8											
9	Cooling system chilled water re	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%
10	Cooling system water side ecoi	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
11	Cooling system oversized cooli	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
12	Condensing DHW stand-alone	11%	11%	11%	11%	11%	11%	11%	11%	0%	11%
13	Faucet aerator	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
14	Graywater heat exchanger/GF	0%	0%	0%	0%	6%	0%	4%	10%	4%	3%
15	Indirect-fired DHW off space ht	2%	1%	2%	1%	4%	4%	4%	2%	0%	2%
16	Instantaneous. High-Modulatin	-0.04%	0%	0%	0%	0%	0%	0%	0%	0%	0%
17	Low-flow shower heads	1%	0%	0%	1%	10%	1%	6%	0%	6%	4%
18	Pipe insulation - water heating	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
19	Tank insulation	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
20	Air Sealing	20%	13%	1%	7%	14%	12%	9%	11%	9%	14%
21	Improved heating system high	2%	2%	2%	2%	2%	9%	2%	2%	2%	3%
22	Improved heating system cond	1%	0%	0%	0%	1%	1%	1%	0%	1%	1%
23	Programmable Thermostat	1%	1%	1%	8%	3%	0%	0%	1%	0%	1%
24	Demand-Controlled Ventilation	0%	11%	29%	16%	24%	0%	5%	17%	0%	9%
25	Outdoor Air Reset	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
26	High Performance Glazing dou	5%	0%	0%	1%	2%	3%	2%	4%	2%	3%
27	High Performance Glazing tripl	11%	2%	0%	0%	4%	7%	3%	8%	3%	6%
28	Improved wall insulation	6%	5%	6%	8%	4%	9%	2%	6%	2%	6%
29	Improved below-grade insulatic	0%	1%	14%	2%	1%	0%	0%	2%	0%	1%
30	Improved roof insulation	1%	5%	6%	7%	3%	1%	1%	3%	1%	3%
31	Sensible Heat Recovery	4%	19%	21%	14%	14%	15%	8%	26%	8%	14%
32	Pipe insulation - space heating	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
33	Energy Star washer	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
34	Swimming pool/spa covers	0%	0%	0%	0%	17%	5%	22%	0%	22%	5%
35	Commissioning	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
36	Retrocommissioning	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
37	Integrated Design - High Perfor	21%	21%	21%	21%	21%	13%	21%	13%	21%	26%
38	Integrated Design - High Perfor	2%	2%	1%	1%	2%	0%	2%	0%	2%	15%
39	Steam trap Maintenance	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
40	Oxygen Trim	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
41	Infrared Heater	0%	0%	1%	3%	0%	0%	0%	0%	0%	1%

Interaction interim factors (prod of %savings, applicability, feasibility, and max pen)

NC Interim Interactions	1 Office	2 Retail	3 Grocery	4 Warehouse	5 Education	6 Health	7 Lodging	8 Restaurant	9 Multifamily	10 Other
1 Direct fired convection range/oven	0%	5%	5%	0%	5%	5%	5%	5%	0%	0%
2 Exhaust Hood Makeup Air	0%	1%	1%	2%	1%	0%	0%	6%	0%	0%
3 High efficiency ENERGY STAR fry	14%	12%	12%	14%	12%	12%	12%	12%	0%	20%
4 High efficiency ENERGY STAR st	0%	2%	2%	0%	2%	2%	2%	2%	0%	2%
5 High efficiency griddle	3%	1%	1%	3%	1%	1%	1%	1%	0%	1%
6 Pre-Rinse Spray Valve	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
7 Refrigeration heat recovery	0%	0%	10%	7%	3%	2%	1%	34%	0%	0%
8										
9 Cooling system chilled water reset	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%
10 Cooling system water side econon	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
11 Cooling system oversized cooling	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
12 Condensing DHW stand-alone	11%	11%	11%	11%	11%	11%	11%	11%	0%	11%
13 Faucet aerator	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
14 Graywater heat exchanger/GFX	0%	0%	0%	0%	6%	0%	4%	10%	4%	3%
15 Indirect-fired DHW off space heati	2%	1%	2%	1%	4%	4%	4%	2%	0%	2%
16 Instantaneous, High-Modulating W	-0.04%	0%	0%	0%	0%	0%	0%	0%	0%	0%
17 Low-flow shower heads	1%	0%	0%	1%	10%	1%	6%	0%	6%	4%
18 Pipe insulation - water heating	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
19 Tank insulation	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
20 Air Sealing	20%	13%	1%	7%	14%	12%	9%	11%	9%	14%
21 Improved heating system high effi	2%	2%	2%	2%	2%	9%	2%	2%	2%	3%
22 Improved heating system condens	1%	0%	0%	0%	1%	1%	1%	0%	1%	1%
23 Programmable Thermostat	1%	1%	1%	8%	3%	0%	0%	1%	0%	1%
24 Demand-Controlled Ventilation (cc	0%	11%	29%	16%	24%	0%	5%	17%	0%	9%
25 Outdoor Air Reset	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
26 High Performance Glazing double	5%	0%	0%	1%	2%	3%	2%	4%	2%	3%
27 High Performance Glazing triple pi	11%	2%	0%	0%	4%	7%	3%	8%	3%	6%
28 Improved wall insulation	6%	5%	6%	8%	4%	9%	2%	6%	2%	6%
29 Improved below-grade insulation	0%	1%	14%	2%	1%	0%	0%	2%	0%	1%
30 Improved roof insulation	1%	5%	6%	7%	3%	1%	1%	3%	1%	3%
31 Sensible Heat Recovery	4%	19%	21%	14%	14%	15%	8%	26%	8%	14%
32 Pipe insulation - space heating	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
33 Energy Star washer	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
34 Swimming pool/spa covers	0%	0%	0%	0%	17%	5%	22%	0%	22%	5%
35 Commissioning	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
36 Retrocommissioning	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
37 Integrated Design - High Performa	21%	21%	21%	21%	21%	13%	21%	13%	21%	26%
38 Integrated Design - High Performa	2%	2%	1%	1%	2%	0%	2%	0%	2%	15%
39 Steam trap Maintenance	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
40 Oxygen Trim	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
41 Infrared Heater	0%	0%	1%	3%	0%	0%	0%	0%	0%	1%

% retrofit interaction or overlap factor											rank order	interacts with	
RET_Interactions	1 Office	2 Retail	3 Grocery	4 Warehouse	5 Education	6 Health	7 Lodging	8 Restaurant	9 Multifamily	10 Other			
1	Direct fired convection range/oven	100%	100%	100%	100%	100%	100%	100%	100%	100%	0		
2	Exhaust Hood Makeup Air	100%	100%	100%	100%	100%	100%	100%	100%	100%	0	0	
3	High efficiency ENERGY STAR fryer	100%	100%	100%	100%	100%	100%	100%	100%	100%	0		
4	High efficiency ENERGY STAR steam cooker	100%	100%	100%	100%	100%	100%	100%	100%	100%	0		
5	High efficiency griddle	100%	100%	100%	100%	100%	100%	100%	100%	100%	0		
6	Pre-Rinse Spray Valve	83%	85%	84%	85%	77%	82%	79%	76%	94%	81%	10	1,2,4,7,8
7	Refrigeration heat recovery	83%	85%	84%	85%	82%	82%	82%	84%	98%	84%	9	1,2,7,8
8													
9	Cooling system chilled water reset	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	3	1a,1
10	Cooling system water side economizer	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	2	1a,1
11	Cooling system oversized cooling tower	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	1	1a
12	Condensing DHW stand-alone	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	1	
13	Faucet aerator	85%	87%	86%	86%	78%	83%	80%	77%	96%	83%	6	1,2,3,4
14	Graywater heat exchanger/GFX	85%	87%	86%	87%	84%	84%	84%	86%	100%	85%	4	1,2
15	Indirect-fired DHW off space heating boiler	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	2	
16	Instantaneous, High-Modulating Water Heater	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	3	
17	Low-flow shower heads	85%	87%	86%	86%	78%	83%	80%	77%	96%	83%	5	1,2,4
18	Pipe insulation - water heating	85%	87%	86%	87%	84%	84%	84%	86%	100%	85%	8	1,2
19	Tank insulation	85%	87%	86%	87%	84%	84%	84%	86%	100%	85%	7	1,2
20	Air Sealing	90%	76%	56%	50%	56%	86%	86%	70%	91%	78%	6	1a,2,3,4,5
21	Improved heating system high efficiency unit - Tier 1	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	2	1a
22	Improved heating system condensing unit - Tier 2	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	2	1a
23	Programmable Thermostat	95%	96%	96%	96%	95%	87%	95%	95%	95%	94%	3	1a,2
24	Demand-Controlled Ventilation (controller, sensor)	92%	91%	91%	64%	83%	87%	93%	91%	93%	90%	4	1a,2,3
25	Outdoor Air Reset	92%	78%	57%	51%	57%	87%	87%	71%	93%	79%	5	1a,2,3,4
26	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0	0
27	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0	0
28	Improved wall insulation	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0	0
29	Improved below-grade insulation	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0	0
30	Improved roof insulation	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0	0
31	Sensible Heat Recovery	71%	66%	56%	46%	47%	75%	78%	62%	83%	67%	7	1a,2,3,4,5,6
32	Pipe insulation - space heating	93%	94%	94%	94%	93%	86%	93%	94%	93%	92%	8	1a,2,5
33	Energy Star washer	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0	0
34	Swimming pool/spa covers	85%	87%	86%	87%	84%	84%	84%	86%	100%	85%	10	1,2
35	Commissioning	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0	0
36	Retrocommissioning	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	1a	
37	Integrated Design - High Performance (30% > codes) - Tier 1	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0	0
38	Integrated Design - High Performance (50% > codes) Tier 2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0	0
39	Steam trap Maintenance	71%	51%	40%	36%	40%	68%	73%	42%	77%	56%	10	1a,3,4,6,7,8,9
40	Oxygen Trim	69%	50%	41%	38%	40%	67%	71%	42%	76%	56%	9	1a,3,4,5,6,7,8
41	Infrared Heater	95%	93%	93%	66%	86%	98%	96%	93%	96%	93%	11	1a,3

Interaction interim factors (prod of %savings, applicability, feasibility, and max pen)											
RET	interim interactions	1	2	3	4	5	6	7	8	9	10
		Office	Retail	Grocery	Warehouse	Education	Health	Lodging	Restaurant	Multifamily	Other
1	Direct fired convection range/oven	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2	Exhaust Hood Makeup Air	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
3	High efficiency ENERGY STAR fry	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
4	High efficiency ENERGY STAR ste	0%	3%	3%	0%	3%	3%	3%	3%	0%	2%
5	High efficiency griddle	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
6	Pre-Rinse Spray Valve	0%	0%	5%	0%	1%	1%	1%	19%	0%	0%
7	Refrigeration heat recovery	1%	0%	11%	8%	3%	2%	1%	38%	0%	0%
8											
9	Cooling system chilled water reset	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
10	Cooling system water side econom	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%
11	Cooling system oversized cooling t	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
12	Condensing DHW stand-alone	13%	13%	13%	13%	13%	13%	13%	13%	0%	13%
13	Faucet aerator	35%	43%	1%	43%	4%	2%	2%	1%	2%	10%
14	Graywater heat exchanger/GFX	0%	0%	0%	0%	7%	0%	4%	10%	4%	3%
15	Indirect-fired DHW off space heatir	2%	1%	2%	1%	4%	4%	4%	2%	0%	2%
16	Instantaneous. High-Modulating W	0.00%	0%	0%	0%	0%	0%	0%	0%	0%	0%
17	Low-flow shower heads	1%	0%	0%	1%	16%	1%	10%	0%	10%	6%
18	Pipe insulation - water heating	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
19	Tank insulation	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
20	Air Sealing	21%	13%	1%	8%	15%	13%	9%	11%	9%	14%
21	Improved heating system high effic	3%	2%	2%	2%	3%	10%	3%	2%	3%	3%
22	Improved heating system condensi	1%	0%	0%	0%	1%	1%	1%	0%	1%	1%
23	Programmable Thermostat	3%	5%	5%	33%	13%	0%	2%	5%	2%	5%
24	Demand-Controlled Ventilation (coi	0%	15%	37%	21%	31%	0%	6%	22%	0%	12%
25	Outdoor Air Reset	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
26	High Performance Glazing double	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
27	High Performance Glazing triple pa	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
28	Improved wall insulation	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
29	Improved below-grade insulation	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
30	Improved roof insulation	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
31	Sensible Heat Recovery	5%	25%	27%	19%	18%	20%	11%	34%	11%	18%
32	Pipe insulation - space heating	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
33	Energy Star washer	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
34	Swimming pool/spa covers	0%	0%	0%	0%	42%	12%	54%	0%	54%	12%
35	Commissioning	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
36	Retrocommissioning	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
37	Integrated Design - High Performa	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
38	Integrated Design - High Performa	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
39	Steam trap Maintenance	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
40	Oxygen Trim	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
41	Infrared Heater	0%	0%	4%	9%	0%	0%	0%	0%	0%	2%

Elect_Loadshapes		% of Annual Energy Savings						Coincidence Factors	
		Summer On- Peak Energy	Summer Off- Peak Energy	Summer Shoulder Energy	Winter On- Peak Energy	Winter Off- Peak Energy	Winter Shoulder Energy	Summer Generation Capacity	Winter Generation Capacity
1	Com Cooling	21%	49%	25%	0%	4%	0%	99%	4%
2	Com Refrigeration	5%	38%	8%	6%	37%	6%	92%	86%
3	Com Ventilation	5%	32%	7%	7%	43%	7%	90%	94%
4	Com Heating	0%	1%	0%	14%	66%	18%	1%	69%
5	Com Economizer	25%	45%	28%	0%	1%	0%	62%	0%
6	Com Water Heating	6%	33%	8%	10%	37%	7%	69%	85%
7	Com Total Building	8%	38%	11%	6%	32%	5%	78%	45%

Market Driven Technical Penetrations											
RET_PEN_TECH	1	2	3	4	5	6	7	8	9	10	11
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Max Pen
1	Direct fired convection range/oven	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2	Exhaust Hood Makeup Air	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
3	High efficiency ENERGY STAR fryer	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
4	High efficiency ENERGY STAR steam cooker	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%
5	High efficiency griddle	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
6	Pre-Rinse Spray Valve	100%	0%	0%	0%	0%	0%	0%	0%	0%	100%
7	Refrigeration heat recovery	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%
8		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
9	Cooling system chilled water reset	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
10	Cooling system water side economizer	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%
11	Cooling system oversized cooling tower	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%
12	Condensing DHW stand-alone	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%
13	Faucet aerator	100%	0%	0%	0%	0%	0%	0%	0%	0%	100%
14	Graywater heat exchanger/GFX	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%
15	Indirect-fired DHW off space heating boiler	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%
16	Instantaneous. High-Modulating Water Heater	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
17	Low-flow shower heads	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%
18	Pipe insulation - water heating	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%
19	Tank insulation	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%
20	Air Sealing	100%	0%	0%	0%	0%	0%	0%	0%	0%	100%
21	Improved heating system high efficiency unit - Tier 1	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%
22	Improved heating system condensing unit - Tier 2	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%
23	Programmable Thermostat	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%
24	Demand-Controlled Ventilation (controller, sensor)	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%
25	Outdoor Air Reset	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%
26	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
27	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
28	Improved wall insulation	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
29	Improved below-grade insulation	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
30	Improved roof insulation	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
31	Sensible Heat Recovery	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%
32	Pipe insulation - space heating	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%
33	Energy Star washer	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
34	Swimming pool/spa covers	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%
35	Commissioning	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
36	Retrocommissioning	100%	0%	0%	0%	0%	0%	0%	0%	0%	100%
37	Integrated Design - High Performance (30% > codes) - Tier 1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
38	Integrated Design - High Performance (50% > codes) Tier 2	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
39	Steam trap Maintenance	100%	0%	0%	0%	0%	0%	0%	0%	0%	100%
40	Oxygen Trim	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%
41	Infrared Heater	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%

Market Driven Achievable Penetrations		Net Penetrations (Penetration above baseline)									
MD_PEN	TECH	1	2	3	4	5	6	7	8	9	10
1	Direct fired convection range/oven	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
2	Exhaust Hood Makeup Air	0.05	0.1	0.16	0.23	0.3	0.2	0.22	0.24	0.26	0.28
3	High efficiency ENERGY STAR fryer	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
4	High efficiency ENERGY STAR steam cooker	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
5	High efficiency griddle										
6	Pre-Rinse Spray Valve										
7	Refrigeration heat recovery	0.02	0.04	0.06	0.08	0.1	0.02	0.03	0.04	0.05	0.06
8											
9	Cooling system chilled water reset	0.04	0.08	0.12	0.16	0.2	0.08	0.09	0.1	0.11	0.12
10	Cooling system water side economizer	0.04	0.08	0.12	0.16	0.2	0.08	0.09	0.1	0.11	0.12
11	Cooling system oversized cooling tower										
12	Condensing DHW stand-alone	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
13	Faucet aerator										
14	Graywater heat exchanger/GFX	0.02	0.04	0.06	0.08	0.1	0.02	0.03	0.04	0.05	0.06
15	Indirect-fired DHW off space heating boiler	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
16	Instantaneous, High-Modulating Water Heater	0.02	0.04	0.06	0.08	0.1	0.02	0.03	0.04	0.05	0.06
17	Low-flow shower heads	0.04	0.08	0.12	0.16	0.2	0.08	0.09	0.1	0.11	0.12
18	Pipe insulation - water heating	0.04	0.08	0.12	0.16	0.2	0.1	0.12	0.14	0.16	0.18
19	Tank insulation	0.03	0.05	0.07	0.1	0.12	0.075	0.085	0.09	0.1	0.1
20	Air Sealing	0.04	0.08	0.12	0.16	0.2	0.08	0.09	0.1	0.11	0.12
21	Improved heating system high efficiency unit - Tier 1	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
22	Improved heating system condensing unit - Tier 2	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
23	Programmable Thermostat	0.03	0.05	0.07	0.1	0.12	0.075	0.085	0.09	0.1	0.1
24	Demand-Controlled Ventilation (controller, sensor)	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
25	Outdoor Air Reset	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
26	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
27	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	0.02	0.04	0.06	0.08	0.1	0.02	0.03	0.04	0.05	0.06
28	Improved wall insulation	0.01	0.02	0.03	0.04	0.05	0.01	0.02	0.03	0.04	0.05
29	Improved below-grade insulation	0.01	0.02	0.03	0.04	0.05	0.01	0.02	0.03	0.04	0.05
30	Improved roof insulation	0.01	0.02	0.03	0.04	0.05	0.01	0.02	0.03	0.04	0.05
31	Sensible Heat Recovery	0.04	0.08	0.12	0.16	0.2	0.08	0.09	0.1	0.11	0.12
32	Pipe insulation - space heating	0.03	0.05	0.07	0.1	0.12	0.075	0.085	0.09	0.1	0.1
33	Energy Star washer	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
34	Swimming pool/spa covers	0.03	0.05	0.08	0.11	0.13	0.05	0.06	0.07	0.08	0.09
35	Commissioning	0.02	0.04	0.06	0.08	0.1	0.02	0.03	0.04	0.05	0.06
36	Retrocommissioning										
37	Integrated Design - High Performance (30% > codes) - Tier 1	0.03	0.05	0.08	0.11	0.13	0.05	0.06	0.07	0.08	0.09
38	Integrated Design - High Performance (50% > codes) Tier 2	0.01	0.02	0.03	0.04	0.05	0.01	0.02	0.03	0.04	0.05
39	Steam trap Maintenance										
40	Oxygen Trim	0.04	0.08	0.12	0.16	0.2	0.08	0.09	0.1	0.11	0.12
41	Infrared Heater	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19

New Construction Achievable Penetrations		Net Penetrations (Penetration above baseline)									
NC_PEN_TECH		1	2	3	4	5	6	7	8	9	10
		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1	Direct fired convection range/oven	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
2	Exhaust Hood Makeup Air	0.05	0.1	0.16	0.23	0.3	0.2	0.22	0.24	0.26	0.28
3	High efficiency ENERGY STAR fryer	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
4	High efficiency ENERGY STAR steam cooker	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
5	High efficiency griddle	0.02	0.04	0.06	0.08	0.1	0.02	0.03	0.04	0.05	0.06
6	Pre-Rinse Spray Valve										
7	Refrigeration heat recovery	0.02	0.04	0.06	0.08	0.1	0.02	0.03	0.04	0.05	0.06
8											
9	Cooling system chilled water reset	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
10	Cooling system water side economizer	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
11	Cooling system oversized cooling tower	0.02	0.04	0.06	0.08	0.1	0.02	0.03	0.04	0.05	0.06
12	Condensing DHW stand-alone	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
13	Faucet aerator										
14	Graywater heat exchanger/GFX	0.04	0.08	0.12	0.16	0.2	0.08	0.09	0.1	0.11	0.12
15	Indirect-fired DHW off space heating boiler	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
16	Instantaneous, High-Modulating Water Heater	0.02	0.04	0.06	0.08	0.1	0.02	0.03	0.04	0.05	0.06
17	Low-flow shower heads	0.04	0.08	0.12	0.16	0.2	0.08	0.09	0.1	0.11	0.12
18	Pipe insulation - water heating	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
19	Tank insulation	0.03	0.05	0.07	0.1	0.12	0.075	0.085	0.09	0.1	0.1
20	Air Sealing	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
21	Improved heating system high efficiency unit - Tier 1	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
22	Improved heating system condensing unit - Tier 2	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
23	Programmable Thermostat	0.03	0.05	0.07	0.1	0.12	0.075	0.085	0.09	0.1	0.1
24	Demand-Controlled Ventilation (controller, sensor)	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
25	Outdoor Air Reset	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
26	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
27	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2	0.02	0.04	0.06	0.08	0.1	0.02	0.03	0.04	0.05	0.06
28	Improved wall insulation	0.02	0.04	0.06	0.08	0.1	0.02	0.03	0.04	0.05	0.06
29	Improved below-grade insulation	0.04	0.09	0.14	0.2	0.25	0.12	0.13	0.14	0.15	0.16
30	Improved roof insulation	0.02	0.04	0.06	0.08	0.1	0.02	0.03	0.04	0.05	0.06
31	Sensible Heat Recovery	0.04	0.08	0.12	0.16	0.2	0.08	0.09	0.1	0.11	0.12
32	Pipe insulation - space heating	0.03	0.05	0.07	0.1	0.12	0.075	0.085	0.09	0.1	0.1
33	Energy Star washer	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19
34	Swimming pool/spa covers	0.03	0.05	0.08	0.11	0.13	0.05	0.06	0.07	0.08	0.09
35	Commissioning	0.02	0.04	0.06	0.08	0.1	0.02	0.03	0.04	0.05	0.06
36	Retrocommissioning										
37	Integrated Design - High Performance (30% > codes) - Tier 1	0.04	0.08	0.12	0.16	0.2	0.08	0.09	0.1	0.11	0.12
38	Integrated Design - High Performance (50% > codes) Tier 2	0.01	0.02	0.03	0.04	0.05	0.01	0.02	0.03	0.04	0.05
39	Steam trap Maintenance										
40	Oxygen Trim	0.04	0.08	0.12	0.16	0.2	0.08	0.09	0.1	0.11	0.12
41	Infrared Heater	0.05	0.1	0.16	0.23	0.3	0.15	0.16	0.17	0.18	0.19

Retrofit Achievable Penetrations		Net Penetrations (Penetration above baseline)				
RET_PEN	TECH	1	2	3	4	5
		2007	2008	2009	2010	2011
1	Direct fired convection range/oven					
2	Exhaust Hood Makeup Air					
3	High efficiency ENERGY STAR fryer					
4	High efficiency ENERGY STAR steam cooker	0.00125	0.0025	0.0035	0.005	0.0075
5	High efficiency griddle					
6	Pre-Rinse Spray Valve	0.005	0.01	0.015	0.02	0.03
7	Refrigeration heat recovery	0.0025	0.0035	0.0045	0.005	0.005
8						
9	Cooling system chilled water reset	0.005	0.01	0.015	0.02	0.03
10	Cooling system water side economizer	0.0035	0.005	0.0075	0.01	0.0125
11	Cooling system oversized cooling tower	0.00125	0.0025	0.0035	0.005	0.0075
12	Condensing DHW stand-alone	0.0035	0.005	0.0075	0.01	0.0125
13	Faucet aerator	0.005	0.01	0.015	0.02	0.03
14	Graywater heat exchanger/GFX	0.00125	0.0025	0.0035	0.005	0.0075
15	Indirect-fired DHW off space heating boiler	0.0035	0.005	0.0075	0.01	0.0125
16	Instantaneous, High-Modulating Water Heater	0.0035	0.005	0.0075	0.01	0.0125
17	Low-flow shower heads	0.005	0.01	0.015	0.02	0.03
18	Pipe insulation - water heating	0.0035	0.005	0.0075	0.01	0.0125
19	Tank insulation	0.005	0.01	0.015	0.02	0.03
20	Air Sealing	0.005	0.01	0.015	0.02	0.03
21	Improved heating system high efficiency unit - Tier 1	0.00125	0.0025	0.0035	0.005	0.0075
22	Improved heating system condensing unit - Tier 2	0.00125	0.0025	0.0035	0.005	0.0075
23	Programmable Thermostat	0.005	0.01	0.015	0.02	0.03
24	Demand-Controlled Ventilation (controller, sensor)	0.005	0.01	0.015	0.02	0.03
25	Outdoor Air Reset	0.005	0.01	0.015	0.02	0.03
26	High Performance Glazing double pane, low-E, low conductivity frame - Tier 1					
27	High Performance Glazing triple pane, low-E, low conductivity frame - Tier 2					
28	Improved wall insulation					
29	Improved below-grade insulation					
30	Improved roof insulation					
31	Sensible Heat Recovery	0.0025	0.0035	0.0045	0.005	0.005
32	Pipe insulation - space heating	0.0035	0.005	0.0075	0.01	0.0125
33	Energy Star washer					
34	Swimming pool/spa covers	0.0025	0.0035	0.0045	0.005	0.005
35	Commissioning					
36	Retrocommissioning	0.005	0.01	0.015	0.02	0.03
37	Integrated Design - High Performance (30% > codes) - Tier 1					
38	Integrated Design - High Performance (50% > codes) Tier 2					
39	Steam trap Maintenance	0.005	0.01	0.015	0.02	0.03
40	Oxygen Trim	0.0035	0.005	0.0075	0.01	0.0125
41	Infrared Heater	0.0025	0.0035	0.0045	0.005	0.005