

**FORECAST 20**  
Electricity Savings in Vermont from 20 Years of  
Continued End-Use Efficiency Investment

**Appendix 3**  
**Commercial & Industrial Sector Analysis**

- a. **Commercial & Industrial Measure Characteristics, by End Use**
- b. **Commercial & Industrial Measure Characteristics, by Applicability, Feasibility, and Percent of Retrofit Measures Not Complete**
- c. **Commercial & Industrial Measure Penetration Projections, 2008 – 2027**
- d. **Commercial & Industrial Program Budget, 2008 – 2027**

**FORECAST 20**  
Electricity Savings in Vermont from 20 Years of  
Continued End-Use Efficiency Investment

**Appendix 3**

**Commercial & Industrial Sector Analysis**

- a. Commercial & Industrial Measure Characteristics,  
by End Use

**Forecast 20 Commercial/Industrial Measure Characteristics**

Proj Meas	End Use	Measure Name	Markets	Measure Description	Baseline Description	First Install Year	Last Install Year	Life (yr)	Units for KW / kWh / Cost Values	Baseline kW	Efficient kW	% Savings	Full Load Hours	Annual kWh Savings	Fossil Fuel Savings (MMBtu/yr)	Efficient Cost \$
	Indoor Lighting	Super T8 lamp/ballast (T12 baseline)	Ret	Install Super T8 lamps and low-ballast factor electronic ballast in existing fixtures, replacing T12 lighting	EE T12 with EEMAG ballast	2008	2017	15	Average of 4-ft, 2-lamp and 4-lamp fixtures	0.104	0.072	30.9%	3435	109.9		\$ 60.00
2	Indoor Lighting	Super T8 lamp/ballast (T8 baseline)	Ret	Install Super T8 lamps and low-ballast factor electronic ballast in existing fixtures, replacing standard T8 lighting	Standard T8s	2008	2018	15	Average of 4-ft, 2-lamp and 4-lamp fixtures	0.087	0.072	17.3%	3435	51.5		\$ 60.00
3	Indoor Lighting	Super T8 fixture (T12 baseline)	Ret	Super T8 fixture w/ Electronic Ballast and tandem wiring where appropriate, replacing T12	EE T12 with EE Mag ballast	2008	2017	15	Average of 4-ft, 2-lamp and 4-lamp fixtures	0.104	0.072	30.9%	3435	109.9		
4	Indoor Lighting	Super T8 fixture (standard T8 baseline)	NC, Reno, Repl	Super T8 fixture w/ Electronic Ballast and tandem wiring where appropriate, replacing standard T8	Standard T8s	2008	2027	15	Average of 4-ft, 2-lamp and 4-lamp fixtures	0.087	0.072	17.3%	3435	51.5		
4	Indoor Lighting	Super T8 fixture (standard T8 baseline)	Ret	Super T8 fixture w/ Electronic Ballast and tandem wiring where appropriate, replacing standard T8	Standard T8s	2008	2018	15	Average of 4-ft, 2-lamp and 4-lamp fixtures	0.087	0.072	17.3%	3435	51.5		
6	Indoor Lighting	High-efficiency fixtures/design Tier I (2004 baseline)	NC, Reno, Repl	High efficiency fixtures and design to reduce lighting power density. Generally reflects mid-level efficiency, typically including high efficiency fixtures and improved fixture layout, including use of indirect lighting. Does not include controls, which are covered elsewhere. Baseline of ASHRAE 90.1-2004.	ASHRAE 90.1-2004	2008	2027	15	Per sq ft, weighted average	0.00119	0.00086	27.3%	3435	1.12		
7	Indoor Lighting	High-efficiency fixtures/design Tier II	NC, Reno, Repl	High efficiency fixtures and design to reduce lighting power density. Generally reflects state-of-the-art systems to achieve maximum reductions. This can include numerous things, potentially including direct/indirect, auto dimming, low glare, T5s, specular reflectors, task lighting, distribution technologies (eg, light pipes, fiber optics), etc. Does not include controls, which are covered elsewhere.	HE fixtures/design Tier I	2008	2027	15	Per sq ft, weighted average, above Tier 1	0.00086	0.00075	13.8%	3435	0.41		
8	Indoor Lighting	High-efficiency fixtures/design Tier III	NC, Reno, Repl	Emerging technologies (e.g., LEDs, Organic LEDs, daylighting) combined with emphasis on increased overall system efficiency.	HE fixtures/design Tier II	2014	2027	15	Per sq ft, weighted average, above Tier II	0.00075	0.00067	10.0%	3435	0.26		
9	Indoor Lighting	Compact Fluorescent Lamp fixture - interior 2008-11	NC, Reno, Repl	Permanently installed Compact Fluorescent Lamp fixture	Incandescent fixture	2008	2010	15	Single fixture (average of 1-lamp, 2-lamp and dimmable CFL fixtures)	0.092	0.025	71.9%	3435	227.2		
9	Indoor Lighting	Compact Fluorescent Lamp fixture - interior 2008-11	Ret	Permanently installed Compact Fluorescent Lamp fixture	Incandescent fixture	2008	2010	15	Single fixture (average of 1-lamp, 2-lamp and dimmable CFL fixtures)	0.092	0.025	71.9%	3435	227.2		\$ 102.36
10	Indoor Lighting	Compact Fluorescent Lamp fixture - interior 2012-14	NC, Reno, Repl	Permanently installed Compact Fluorescent Lamp fixture	Incandescent fixture with meeting EISA 2007 lighting performance standards (e.g., efficient halogen lamp)	2011	2013	15	Single fixture (average of 1-lamp, 2-lamp and dimmable CFL fixtures)	0.062	0.025	59.0%	3435	123.3		
10	Indoor Lighting	Compact Fluorescent Lamp fixture - interior 2012-14	Ret	Permanently installed Compact Fluorescent Lamp fixture	Incandescent fixture with meeting EISA 2007 lighting performance standards (e.g., efficient halogen lamp)	2011	2013	15	Single fixture (average of 1-lamp, 2-lamp and dimmable CFL fixtures)	0.062	0.025	59.0%	3435	123.3		\$ 102.36
11	Indoor Lighting	Compact Fluorescent Lamp spiral - interior 2009-11	NC, Reno, Repl	Compact Fluorescent Lamp spiral, for interior	Incandescent	2008	2010	3.5	Single lamp	0.075	0.016	74.2%	3435	191.2		\$ 6.00

Forecast 20 Commercial/Industrial Measure

Characteristics

Proj Meas	End Use	Measure Name	Markets	Early-Retirement Retrofit Inputs								O&M Efficient Comp #1			O&M Efficient Comp #2			O&M Baseline Comp #1			O&M Baseline Comp #2			
				Baseline Cost	Incremental Cost	Incremental Cost/kWh Saved	Baseline Life	Baseline Age	Baseline Cost	Baseline Cost per kWh Saved	Baseline Shift Savings Factor	Efficient Component #1	Life (yr)	Cost (with labor)	Efficient Component #2	Life (yr)	Cost (with labor)	Baseline Component #1	Life (yr)	Cost (with labor)	Baseline Component #2	Life (yr)	Cost (with labor)	
	Indoor Lighting	Super T8 lamp/ballast (T12 baseline)	Ret	\$ -	\$ 60.00	\$ 0.55							Lamp	8.0	\$ 19.92	Ballast (no impact since ballast life exceeds measure life)	20.4		Lamp	5.8	\$ 12.42	Ballast	11.6	\$ 29.81
2	Indoor Lighting	Super T8 lamp/ballast (T8 baseline)	Ret	\$ -	\$ 60.00	\$ 1.16							Lamp	8.0	\$ 19.92	Ballast (no impact since ballast life exceeds measure life)	20.4		Lamp	5.8	\$ 13.02	Ballast	11.6	\$ 34.81
3	Indoor Lighting	Super T8 fixture (T12 baseline)	Ret	\$ -	\$ 87.68	\$ 0.80	15.0	9.0	\$ 77.68	\$ 0.71	56%		Lamp	7.0	\$ 19.92	Ballast (no impact since ballast life exceeds measure life)	20.4		Lamp	5.8	\$ 12.42	Ballast	11.6	\$ 29.81
4	Indoor Lighting	Super T8 fixture (standard T8 baseline)	NC, Reno, Repl		\$ 25.00	\$ 0.49							Lamp	7.0	\$ 19.92	Ballast (no impact since ballast life exceeds measure life)	20.4		Lamp	5.8	\$ 13.02	Ballast	11.6	\$ 34.81
4	Indoor Lighting	Super T8 fixture (standard T8 baseline)	Ret	\$ -	\$ 87.68	\$ 1.70	15.0	9.0	\$ 77.68	\$ 1.51	100%		Lamp	7.0	\$ 19.92	Ballast (no impact since ballast life exceeds measure life)	20.4		Lamp	5.8	\$ 13.02	Ballast	11.6	\$ 34.81
6	Indoor Lighting	High-efficiency fixtures/design Tier I (2004 baseline)	NC, Reno, Repl			\$ 0.17																		
7	Indoor Lighting	High-efficiency fixtures/design Tier II	NC, Reno, Repl			\$ 0.24																		
8	Indoor Lighting	High-efficiency fixtures/design Tier III	NC, Reno, Repl			\$ 0.24																		
9	Indoor Lighting	Compact Fluorescent Lamp fixture - interior 2008-11	NC, Reno, Repl		\$ 41.35	\$ 0.18							CFL Lamp	2.9	\$ 7.45	Ballast	11.6	\$ 25.85	Incandescent lamp	0.3	\$ 3.25			
9	Indoor Lighting	Compact Fluorescent Lamp fixture - interior 2008-11	Ret	\$ -	\$ 102.36	\$ 0.45	15.0	9.0	\$ 61.01	\$ 0.27	58%		CFL Lamp	2.9	\$ 7.45	Ballast	11.6	\$ 25.85	Halogen Lamp (assume new baseline starting ~2014)	0.3	\$ 3.25			
10	Indoor Lighting	Compact Fluorescent Lamp fixture - interior 2012-14	NC, Reno, Repl		\$ 41.35	\$ 0.34							CFL Lamp	2.9	\$ 7.45	Ballast	11.6	\$ 25.85	Halogen Lamp	0.9	\$ 4.62			
10	Indoor Lighting	Compact Fluorescent Lamp fixture - interior 2012-14	Ret	\$ -	\$ 102.36	\$ 0.83	15.0	9.0	\$ 61.01	\$ 0.49	58%		CFL Lamp	2.9	\$ 7.45	Ballast	11.6	\$ 25.85	Halogen Lamp	0.9	\$ 4.62			
11	Indoor Lighting	Compact Fluorescent Lamp spiral - interior 2009-11	NC, Reno, Repl	\$ 0.63	\$ 5.38	\$ 0.03													Standard incandescent lamp	0.3	\$ 3.25			

**Forecast 20 Commercial/Industrial Measure Characteristics**

Proj Meas	End Use	Measure Name	Markets	Measure Description	Baseline Description	First Install Year	Last Install Year	Life (yr)	Units for KW / kWh / Cost Values	Baseline kW	Efficient kW	% Savings	Full Load Hours	Annual kWh Savings	Fossil Fuel Savings (MMBtu/yr)	Efficient Cost \$
11	Indoor Lighting	Compact Fluorescent Lamp spiral - interior 2009-11	Ret	Compact Fluorescent Lamp spiral, for interior	Incandescent	2008	2010	3.5	Single lamp	0.075	0.016	74.7%	3435	123.6		\$ 6.00
12	Indoor Lighting	Compact Fluorescent Lamp spiral - interior 2012-14	NC, Reno, Repl	Compact Fluorescent Lamp spiral, for interior	High-efficiency halogen lamp	2011	2013	3.5	Single lamp	0.062	0.024	58.3%	3435	123.6		\$ 3.00
12	Indoor Lighting	Compact Fluorescent Lamp spiral - interior 2012-14	Ret	Compact Fluorescent Lamp spiral, for interior	High-efficiency halogen lamp	2011	2013	3.5	Single lamp	0.062	0.024	58.6%	3435	125.5		\$ 3.00
13	Indoor Lighting	Fluorescent high-low bay fixture (T8, T8HO) - Interior	NC, Reno, Repl	Fluorescent fixture for high and low bay applications (assume 4-lamp fixture). Generally for industrial warehouse applications. Low bay is 10-15 ft.	Standard Metal Halide	2008	2022	15	Single fixture	0.455	0.240	47.3%	4711	1,012.9		\$ 242.47
13	Indoor Lighting	Fluorescent high-low bay fixture (T8, T8HO) - Interior	Ret	Fluorescent fixture for high and low bay applications (assume 4-lamp fixture). Generally for industrial warehouse applications. Low bay is 10-15 ft.	Standard Metal Halide	2008	2022	15	Single fixture	0.455	0.240	47.3%	4711	1,012.9		\$ 317.47
14	Indoor Lighting	Occupancy sensor on/off	NC, Reno, Repl	On/off lighting control based on space occupancy	Manual control	2008	2027	10	Watts controlled by single control	0.350		30.0%	3435	360.7		\$ 39.32
14	Indoor Lighting	Occupancy sensor on/off	Ret	On/off lighting control based on space occupancy	Manual control	2008	2027	10	Watts controlled by single control	0.350		30.0%	3435	360.7		\$ 61.53
15	Indoor Lighting	Occupancy sensor h/w	NC, Reno, Repl	Multilevel lighting control based on space occupancy. For example, to reduce lighting in the aisles of a warehouse.	Manual control	2008	2027	10	Watts controlled by single control	0.455		30.0%	4711	643.1		
15	Indoor Lighting	Occupancy sensor h/w	Ret	Multilevel lighting control based on space occupancy. For example, to reduce lighting in the aisles of a warehouse.	Manual control	2008	2027	10	Watts controlled by single control	0.455		30.0%	4711	643.1		
16	Indoor Lighting	Daylight dimming	NC, Reno, Repl	Automatic dimming in response to daylight, lumen depreciation and task needs to maintain light levels. For NC, optimization of natural light through shell measures is included under integrated building design.	Manual control	2008	2027	20	Watts controlled by single ballast	0.073	0.073	35.0%	3435	87.8		
16	Indoor Lighting	Daylight dimming	Ret	Automatic dimming in response to daylight, lumen depreciation and task needs to maintain light levels. For NC, optimization of natural light through shell measures is included under integrated building design.	Manual control	2008	2027	20	Watts controlled by single ballast	0.073	0.073	35.0%	3435	87.8		
17	Indoor Lighting	Ceramic metal-halide lighting fixtures	NC, Reno, Repl	Ceramic Metal-Halide (CMH) lighting provides excellent light quality with a high color-rendering index and is typically used in place of halogen bulbs. CMH bulbs have high lumen output and thus can replace multiple halogen fixtures. Typical applications include track lighting, downlighting, highlighting of merchandise, and other special applications.	Standard halogen lamp	2009	2027	15	Single CMH fixture replacing 2 to 3 halogen fixtures	0.217	0.080	63.2%	3068	420.3		\$ 275.00
17	Indoor Lighting	Ceramic metal-halide lighting fixtures	Ret	Ceramic Metal-Halide (CMH) lighting provides excellent light quality with a high color-rendering index and is typically used in place of halogen bulbs. CMH bulbs have high lumen output and thus can replace multiple halogen fixtures. Typical applications include track lighting, downlighting, highlighting of merchandise, and other special applications.	Standard halogen lamp	2008	2023	15	Single fixture	0.217	0.080	63.2%	3068	420.3		\$ 289.81
18	Indoor Lighting	Interior LED Lighting	NC, Reno, Repl	This measure currently represents two types of fixtures: downlights and track lighting, for which	Weighted average of 65W BR30 & 50W PAR30 downlight lamps	2011	2027	16.3	Single fixture	0.059	0.010	82.4%	3068	149.1		\$ 92.00
18	Indoor Lighting	Interior LED Lighting	Ret	This measure currently represents two types of fixtures: downlights and track lighting, for which	Weighted average of 65W BR30 & 50W PAR30 downlight lamps	2010	2027	16.3	Single fixture	0.059	0.010	82.4%	3068	149.1		\$ 95.95
19	Outdoor Lighting	LED street lighting owned by utilities	Ret	LED street lighting owned by utilities	Combination of 250W MH and 250W HPS cobra heads	2008	2027	11.5	Single fixture	0.290	0.081	72.2%	4334	915.5		\$ 808.50
20	Outdoor Lighting	Pulse Start Metal Halide vs. Incandescent - exterior	Reno, Repl	Pulse Start Metal Halide wall pack to replace two-lamp halogen/incandescent building exterior fixture	Existing Incandescent lamps (e.g., halogen PARs, etc.)	2008	2016	15	Single MH fixture for two 75-watt halogens	0.150	0.080	46.7%	4025	281.7		\$ 253.00
20	Outdoor Lighting	Pulse Start Metal Halide vs. Incandescent - exterior	Ret	Pulse Start Metal Halide wall pack to replace two-lamp halogen/incandescent building exterior fixture	Existing Incandescent lamps (e.g., halogen PARs, etc.)	2008	2017	15	Single MH fixture for two 75-watt halogens	0.150	0.080	46.7%	4025	281.7		\$ 217.03
21	Outdoor Lighting	Compact Fluorescent Lamp - exterior 2009-2011	NC, Reno, Repl	Spiral CFL for exterior applications to replace incandescent, 2009-2011	Halogen PAR38 spot lamp	2008	2010	3.5	Single lamp	0.090	0.026	71.1%	3338	213.6		\$ 5.50
21	Outdoor Lighting	Compact Fluorescent Lamp - exterior 2009-2011	Ret	Spiral CFL for exterior applications to replace incandescent, 2009-2011	Halogen PAR38 spot lamp	2008	2010	3.5	Single lamp	0.090	0.026	71.1%	3338	213.6		\$ 5.50



**Forecast 20 Commercial/Industrial Measure Characteristics**

Proj Meas	End Use	Measure Name	Markets	Measure Description	Baseline Description	First Install Year	Last Install Year	Life (yr)	Units for KW / kWh / Cost Values	Baseline kW	Efficient kW	% Savings	Full Load Hours	Annual kWh Savings	Fossil Fuel Savings (MMBtu/yr)	Efficient Cost \$
22	Outdoor Lighting	Compact Fluorescent Lamp - exterior 2012-14	NC, Reno, Repl	Spiral CFL for exterior applications to replace incandescent, 2012-14	Halogen PAR38 spot lamp	2011	2013	3.5	Single lamp	0.069	0.026	62.1%	3338	142.5		\$ 5.50
22	Outdoor Lighting	Compact Fluorescent Lamp - exterior 2012-14	NC, Reno, Repl	Spiral CFL for exterior applications to replace incandescent, 2012-14	Halogen PAR38 spot lamp	2011	2013	3.5	Single lamp	0.069	0.026	62.1%	3338	142.5		\$ 5.50
23	Outdoor Lighting	LED area lighting for parking lots, pvt roadways, canopy lighting	NC, Reno	LED outdoor lighting for parking areas and general area lighting (not utility-owned). This includes cobra heads, other more decorative street lights and canopy lighting. It does not include facade or signage lighting.	Weighted average of 400W MH, 250W MH and 250W HPS, lamps and housing/fixtures	2011	2027	15	Single fixture	0.322	0.099	69.3%	3338	978.5		\$ 732.60
23	Outdoor Lighting	LED area lighting for parking lots, pvt roadways, canopy lighting	Ret	LED outdoor lighting for parking areas and general area lighting (not utility-owned). This includes cobra heads, other more decorative street lights and canopy lighting. It does not include facade or signage lighting.	Weighted average of 400W MH, 250W MH and 250W HPS lamps	2008	2027	15	Single fixture	0.322	0.099	69.3%	3338	978.5		\$ 814.00
24	Outdoor Lighting	Improved exterior lighting design	NC, Reno	Reduced light levels and better outdoor lighting design. Includes reduced wattage lamps, better spacing, and use of cut-offs and reflectors to better control light and minimize glare	Standard exterior lighting practice	2008	2027	15	Representative lighting			15.0%	3338	2,500.0		
24	Outdoor Lighting	Improved exterior lighting design	Ret	Reduced light levels and better outdoor lighting design. Includes reduced wattage lamps, better spacing, and use of cut-offs and reflectors to better control light and minimize glare	Standard exterior lighting practice	2008	2027	15	Representative lighting			15.0%	3338	2,500.0		
25	Cooling	High-efficiency Air Conditioning CEE Tier I	NC, Reno, Repl	Packaged or split system unitary air conditioner meeting CEE Tier I efficiency criteria (based on new CEE tiers adopted 1/16/09). High efficiency level reflects weighted average by size and type of units.	New unitary air conditioner meeting federal manufacturing standards. Baseline efficiency reflects weighted average by size and type.	2008	2027	20	per Ton	1.211	1.036	14.4%		139.8		
25	Cooling	High-efficiency Air Conditioning CEE Tier I	Ret	Packaged or split system unitary air conditioner meeting CEE Tier I efficiency criteria (based on new CEE tiers adopted 1/16/09). High efficiency level reflects weighted average by size and type of units.	Existing stock efficiency unitary air conditioner. Existing stock efficiency reflects weighted average by size and type.	2008	2027	20	per Ton	1.403	1.036	26.2%		293.6		
26	Cooling	High-efficiency Air Conditioning CEE Tier II	NC, Reno, Repl	Packaged or split system unitary air conditioner meeting CEE Tier II efficiency criteria (based on new CEE tiers adopted 1/16/09). High efficiency level reflects weighted average by size and type of units.	New unitary air conditioner meeting CEE Tier I efficiency criteria. Baseline efficiency reflects weighted average by size and type of units.	2008	2027	20	per Ton	1.038	0.993	3.5%		34.3		
26	Cooling	High-efficiency Air Conditioning CEE Tier II	Ret	Packaged or split system unitary air conditioner meeting CEE Tier II efficiency criteria (based on new CEE tiers adopted 1/16/09). High efficiency level reflects weighted average by size and type of units.	New unitary air conditioner meeting CEE Tier I efficiency criteria. Baseline efficiency reflects weighted average by size and type of units.	2008	2027	20	per Ton	1.038	0.993	3.1%		34.3		
27	Cooling	Water source HP v. air source-Cool	NC, Reno, Repl	Water cooled heat pump using a water loop as a heat sink.	Standard efficiency unitary heat pump.	2008	2027	15	Per ton cooling	1.240	0.741	40.2%	2088	1,041.8		\$ 1,877.70
28	Space Heating	Water source HP v. air source-Heat	NC, Reno, Repl	Water cooled heat pump using a water loop as a heat sink.	Standard efficiency unitary heat pump.	2008	2027	15	Per ton cooling	1.658	0.664	60.0%	2248	2,235.9		
29	Cooling	Ground Source HP -Cool	NC, Reno, Repl	Heat pump using ground as a heat sink. Either trench or well type.	Standard efficiency unitary heat pump.	2008	2027	20	Single cooling unit			54.2%				
30	Space Heating	Ground Source HP -Heat	NC, Reno, Repl	Heat pump using ground as a heat sink. Either trench or well type.	Standard efficiency unitary heat pump.	2008	2027	20	Single cooling unit			40.8%				
31	Cooling	High-efficiency Room AC	Reno, Repl	A 'room air conditioner' is defined as a consumer product, other than a 'packaged terminal air conditioner,' which is powered by a single phase electric current and which is an encased assembly designed as a unit for mounting in a window or through the wall for the purpose of providing delivery of conditioned air to an enclosed space. It includes a prime source of refrigeration and may include a means for ventilating and heating. Upgrade to EER 10.8 (consistent with ENERGY STAR criteria for typical unit as of 5/27/09)	Standard efficiency Room AC unit meeting federal manufacturing standards.	2008	2027	10	Single AC unit	1.224	1.111	9.3%	800	90.7		\$ 213.38
31	Cooling	High-efficiency Room AC	Ret	A 'room air conditioner' is defined as a consumer product, other than a 'packaged terminal air conditioner,' which is powered by a single phase electric current and which is an encased assembly designed as a unit for mounting in a window or through the wall for the purpose of providing delivery of conditioned air to an enclosed space. It includes a prime source of refrigeration and may include a means for ventilating and heating. Upgrade to EER 10.8 (consistent with ENERGY STAR criteria for typical unit as of 5/27/09)	Old window AC unit (7.5+ years old)	2008	2027	10	Single AC unit	1.224	1.111	9.3%	800	90.7		\$ 213.38
32	Cooling	High-efficiency chillers Tier I	NC, Reno, Repl	High efficiency water cooled chillers (represents weighted average of different types and sizes) - Tier I	Standard efficiency water cooled chiller	2008	2027	24	Per ton cooling	0.576	0.461	20.0%	800	92.0		\$ 309.97



**Forecast 20 Commercial/Industrial Measure Characteristics**

Proj Meas	End Use	Measure Name	Markets	Measure Description	Baseline Description	First Install Year	Last Install Year	Life (yr)	Units for kW / kWh / Cost Values	Baseline kW	Efficient kW	% Savings	Full Load Hours	Annual kWh Savings	Fossil Fuel Savings (MMBtu/yr)	Efficient Cost
32	Cooling	High-efficiency chillers Tier I	Ret	High efficiency water cooled chillers (represents weighted average of different types and sizes) - Tier I	Standard efficiency water cooled chiller	2008	2027	24	Per ton cooling	0.660	0.461	30.2%	800	169.2		\$ 380.49
33	Cooling	High-efficiency chillers Tier II	NC, Reno, Repl	High efficiency water cooled chillers (represents weighted average of different types and sizes) - Tier II	Standard efficiency water cooled chiller	2008	2027	24	Per ton cooling	0.461	0.390	12.3%	800	56.8		\$ 346.69
33	Cooling	High-efficiency chillers Tier II	Ret	High efficiency water cooled chillers (represents weighted average of different types and sizes) - Tier II	Standard efficiency water cooled chiller	2008	2027	24	Per ton cooling	0.461	0.390	10.8%	800	56.8		
34	Cooling	Optimized unitary HVAC distribution/control system -Cool	NC, Reno	High efficiency distribution system for unitary systems, based on mix of measures to optimize the total system efficiency. Potentially including controls, economizers, VFDs, VAV, better design, etc. This is mainly a design measure, applicable to NC and large renovation.	New construction standard efficiency unitary HVAC distribution system	2008	2027	15	Per square ft			30.0%	1000	0.5		
35	Space Heating	Optimized unitary HVAC distribution/control system -Heat	NC, Reno	See corresponding "Cool" measure.	New construction standard efficiency unitary HVAC distribution system	2008	2027	15	Per square ft			15.0%				
36	Cooling	Optimized chiller distribution/control system -Cool	NC, Reno	High efficiency distribution system for chiller systems, based on mix of measures to optimize the total system efficiency. Potentially including controls, economizers, VFDs, better design, etc.	New construction standard efficiency unitary HVAC distribution system	2008	2027	10	Per square ft			25.0%				
37	Cooling	EMS/Controls -Cool	Reno	Energy management system and/or other controls to optimize control of HVAC system. Could include scheduling, optimal start-stop, chiller reset control, dual enthalpy economizers, CO2 sensors, etc.	New standard efficiency HVAC control system	2008	2027	15	Per square ft			10.0%		0.18		\$ 0.89
37	Cooling	EMS/Controls -Cool	Ret	Energy management system and/or other controls to optimize control of HVAC system. Could include scheduling, optimal start-stop, chiller reset control, dual enthalpy economizers, CO2 sensors, etc.	New standard efficiency HVAC control system	2008	2027	15	Per square ft			10.0%		0.18		\$ 1.78
38	Space Heating	EMS/Controls -Heat	Reno, Repl	See corresponding "Cool" measure.	New standard efficiency HVAC control system	2008	2027	15	Per square ft			10.0%				
38	Space Heating	EMS/Controls -Heat	Ret	See corresponding "Cool" measure.	New standard efficiency HVAC control system	2008	2027	15	Per square ft			10.0%				
39	Ventilation	EMS/Controls -Vent	Reno, Repl	See corresponding "Cool" measure.	New standard efficiency HVAC control system	2008	2027	15	Per square ft			10.0%				
39	Ventilation	EMS/Controls -Vent	Ret	See corresponding "Cool" measure.	New standard efficiency HVAC control system	2008	2027	15	Per square ft			10.0%				\$ 0.89
40	Cooling	Dual enthalpy economizer with electronic controls	NC, Reno, Repl	Dual enthalpy economizers with electronic controls to optimize use of outside air to reduce cooling loads.	Standard efficiency economizers, represents a mix of dry-bulb and single enthalpy.	2008	2027	9.8	Per unit			25.7%		3,216.8		
40	Cooling	Dual enthalpy economizer with electronic controls	Ret	Dual enthalpy economizers with electronic controls to optimize use of outside air to reduce cooling loads.	Existing stock, represents a mix of dry-bulb and fixed dampers.	2008	2027	9.8	Per economizer unit			34.2%		4,813.1		
41	Cooling	Demand Controlled Ventilation -Cool	NC, Reno, Repl	Adjust ventilation rates based on indoor-air quality (typically by monitoring CO2 levels with sensors)	Ventilation system in which the outside air ventilation rate is fixed when the building is occupied	2008	2027	10	Per square ft			10.0%		0.18		\$ 0.17
41	Cooling	Demand Controlled Ventilation -Cool	Ret	Adjust ventilation rates based on indoor-air quality (typically by monitoring CO2 levels with sensors)	Ventilation system in which the outside air ventilation rate is fixed when the building is occupied	2008	2027	10	Per square ft			10.0%		0.18		\$ 0.48
42	Ventilation	Demand Controlled Ventilation -Vent	NC, Reno, Repl	See corresponding "Cool" measure.	Ventilation system in which the outside air ventilation rate is fixed when the building is occupied	2008	2027	10	Per square ft			10.0%				
42	Ventilation	Demand Controlled Ventilation -Vent	Ret	See corresponding "Cool" measure.	Ventilation system in which the outside air ventilation rate is fixed when the building is occupied	2008	2027	10	Per square ft			10.0%				
43	Cooling	HVAC tune-up -Cool	Ret	Optimize an existing HVAC system by adjusting refrigerant charge, air flow, and control set-points for maximum efficiency.	HVAC system with unoptimized airflow and refrigerant charge	2008	2027	6	Per square ft			7.5%		0.14		\$ 0.01
44	Space Heating	HVAC tune-up -Heat	Ret	See corresponding "Cool" measure.	HVAC system with unoptimized airflow and refrigerant charge	2008	2027	6	Per square ft			0.0%				
45	Cooling	Duct sealing -Cool	NC, Reno	Seal HVAC ductwork with aerosol-based sealant to reduce air leakage outside the conditioned space and the consequent energy loss.	Leaky and unsealed ducts	2008	2027	25	Per square ft			9.0%		0.16		\$ 0.33
45	Cooling	Duct sealing -Cool	Ret	Seal HVAC ductwork with aerosol-based sealant to reduce air leakage outside the conditioned space and the consequent energy loss.	Leaky and unsealed ducts	2008	2027	25	Per square ft			9.0%		0.16		\$ 0.33
46	Ventilation	Duct sealing -Vent	NC, Reno	See corresponding "Cool" measure.	Leaky and unsealed ducts	2008	2027	25	Per square ft			9.0%				
46	Ventilation	Duct sealing -Vent	Ret	See corresponding "Cool" measure.	Leaky and unsealed ducts	2008	2027	25	Per square ft			9.0%				
47	Cooling	High-efficiency Stove Hood -Cool	NC, Reno, Repl	Optimized stove hoods to minimize conditioned make-up air requirements.	Standard stove hoods	2008	2027	20	Representative stove hood			10.5%	4368			
47	Cooling	High-efficiency Stove Hood -Cool	Ret	Optimized stove hoods to minimize conditioned make-up air requirements.	Standard stove hoods	2008	2027	20	Representative stove hood			10.5%	4368			



**Forecast 20 Commercial/Industrial Measure Characteristics**

Proj Meas	End Use	Measure Name	Markets	Measure Description	Baseline Description	First Install Year	Last Install Year	Life (yr)	Units for KW / kWh / Cost Values	Baseline kW	Efficient kW	% Savings	Full Load Hours	Annual kWh Savings	Fossil Fuel Savings (MMBtu/yr)	Efficient Cost
48	Ventilation	High-efficiency Slove Hood - Vent	NC, Reno, Repl	See corresponding "Cool" measure.	Standard stove hoods	2008	2027	20	Representative stove hood			68.0%	4368		0.0348	
48	Ventilation	High-efficiency Slove Hood - Vent		See corresponding "Cool" measure.	Standard stove hoods	2008	2027	20	Representative stove hood			68.0%	4368		0.0348	
49	Ventilation	Premium Efficiency Motors	NC, Reno, Repl	High efficiency single and polyphase motors meeting or exceeding NEMA Premium efficiency levels, or similar level. Represents weighted average of types and sizes.	EPACT efficiency levels for ODP and TEFC non-fractional polyphase motors up to 200 HP. Representative motor based on weighted average of types and sizes	2008	2024	15	Representative motor, on per HP basis			1.5%	5108	38.9		
49	Ventilation	Premium Efficiency Motors		High efficiency single and polyphase motors meeting or exceeding NEMA Premium efficiency levels, or similar level. Represents weighted average of types and sizes.	Standard existing stock efficiency motors. Representative motor based on weighted average of types and sizes.	2008	2027	15	Representative motor, on per HP basis			5.1%	5108	137.4		
50	Ventilation	Variable Frequency Drive (VFD)	NC, Reno, Repl	Variable frequency drive on applicable fans and pumps	No control or manual control with Inlet/outlet dampers or throttle valves	2008	2027	15	VFD for representative motor/pump, on per HP basis			41.3%		1,054.0		
50	Ventilation	Variable Frequency Drive (VFD)		Variable frequency drive on applicable fans and pumps	No control or manual control with Inlet/outlet dampers or throttle valves	2008	2027	15	VFD for representative motor/pump, on per HP basis			41.3%		1,093.3		
51	Water & Sewer	Water and Wastewater Treatment Optimization	NC, Reno, Repl	Municipal water and wastewater treatment system optimization, including replacing coarse-bubble aeration with fine-pore aeration, right-sizing pump, impeller trimming, addition of pony pump for smaller loads or VFD, leak reduction, better O&M practices.	Existing practices including coarse-bubble aeration, oversized pumps with no VFD.	2008	2027	10	Representative project			15.0%				
51	Water & Sewer	Water and Wastewater Treatment Optimization		Municipal water and wastewater treatment system optimization, including replacing coarse-bubble aeration with fine-pore aeration, right-sizing pump, impeller trimming, addition of pony pump for smaller loads or VFD, leak reduction, better O&M practices.	Existing practices including coarse-bubble aeration, oversized pumps with no VFD.	2008	2027	10	Representative project			10.0%				
52	Water Heating	High-efficiency tank-type electric water heater	NC, Reno, Repl	Energy Star rated high-efficiency residential-sized tank type electric water heater	Standard efficiency residential-sized tank type electric water heater	2008	2027	13	Tank-type water heater			5.3%	3000	252.6		
53	Water Heating	Water heat fuel switch.		Water heater tank fuel switch from electric to natural gas or propane	Electric hot water tank	2008	2017	15	Per gallon			100.0%				
54	Water Heating	Point of use water heat	NC, Reno, Repl	Electric water heating at point of use with no storage capacity	Standard centrally located electric water heater	2008	2027	10	Point of use water heater			7.4%		355.2		\$ 700.92
54	Water Heating	Point of use water heat		Electric water heating at point of use with no storage capacity	Standard centrally located electric water heater	2008	2027	10	Point of use water heater			7.4%				\$ 700.92
55	Water Heating	Booster water heat for dishwashing		Temperature booster water heater for commercial dishwashing	Maintaining 180F in storage tank for commercial dishwashing	2008	2027	10	Booster water heater			12.5%		625.0		\$ 1,653.24
57	Water Heating	Electric Domestic Hot Water pipe insulation		Electric Domestic Hot Water pipe insulation	Uninsulated cold and hot pipe to and from the hot water heater.	2008	2027	15	Per foot			1.1%				
58	Water Heating	Electric water heater tank wrap insulation		Electric water heater tank wrap insulation	Hot water tank without a tank wrap.	2008	2027	15	Tank-type water heater			10.5%				
60	Water Heating	High-efficiency Clothes Washer	NC, Reno, Repl	High-efficiency commercial coin-op washers	Standard efficiency washer, mix of electric and gas DHW	2008	2027	10	Commercial clothes washer			41.5%		372.8	1.5725	\$ 727.42
60	Water Heating	High-efficiency Clothes Washer		High-efficiency commercial coin-op washers	Standard efficiency washer, mix of electric and gas DHW	2008	2021	10	Commercial clothes washer			41.5%		372.8	1.5725	\$ 727.42
61	Refrigeration	Vending Miser		Vending miser or equivalent control to reduce lighting and refrigeration energy during low use periods	No control	2008	2016	10	Vending machine			46.0%		1,635.0		
62	Refrigeration	EnergySTAR vending machine	NC, Reno, Repl	High-efficiency refrigerated vending machines. Includes better lighting, controls and refrigeration.	Standard efficiency new vending machine purchases.	2008	2017	14	Vending machine			42.0%		1,496.0		\$ 3,394.61
63	Refrigeration	High-efficiency refrigeration	NC, Reno, Repl	High-efficiency built-up refrigeration systems for grocery and refrigerated warehouses. This potentially includes HE compressors, better design and controls, HE motors and VFDs.	Standard efficiency built-up refrigeration systems	2008	2027	10	Large prototypical supermarket scenario			17.3%		273,231.6	970,000.0	
63	Refrigeration	High-efficiency refrigeration		High-efficiency built-up refrigeration systems for grocery and refrigerated warehouses. This potentially includes HE compressors, better design and controls, HE motors and VFDs.	Existing stock efficiency built-up refrigeration systems	2008	2027	10	Large prototypical supermarket scenario			17.3%		273,231.6	970,000.0	
64	Refrigeration	High-efficiency reach-in refrigeration & freezer units	NC, Reno, Repl	High-efficiency stand-alone reach-in refrigeration & freezer units for grocery, convenience stores, restaurants and cafeterias. Efficiency improvements include better door heater control, better lighting, HE compressors, greater insulation.	Standard efficiency new reach-in refrigeration units.	2008	2027	9	Representative walk-in cooler			45.2%		2,331.7		



**Forecast 20 Commercial/Industrial Measure Characteristics**

Proj Meas	End Use	Measure Name	Markets	Measure Description	Baseline Description	First Install Year	Last Install Year	Life (yr)	Units for KW / kWh / Cost Values	Baseline kW	Efficient kW	% Savings	Full Load Hours	Annual kWh Savings	Fossil Fuel Savings (MMBtu/yr)	Efficient Cost \$
65	Refrigeration	EnergySTAR mini refrigerator (< 7.75 ft3)	NC, Reno, Repl	EnergySTAR Mini Refrigerator (< 7.75 ft3)	Standard efficiency mini refrigerator	2008	2027	9	Mini Refrigerator			19.9%		64.0		\$ 189.13
65	Refrigeration	EnergySTAR mini refrigerator (< 7.75 ft3)	Ret	EnergySTAR Mini Refrigerator (< 7.75 ft3)	Standard efficiency mini refrigerator	2008	2027	9	Mini Refrigerator			19.9%		64.0		\$ 189.13
66	Refrigeration	High-efficiency residential-size refrigerator	NC, Reno, Repl	High-efficiency residential-size refrigerator	Standard efficiency residential refrigerator	2008	2027	15	Residential refrigerator			24.0%				
66	Refrigeration	High-efficiency residential-size refrigerator	Ret	High-efficiency residential-size refrigerator	Standard efficiency residential refrigerator	2008	2027	15	Residential refrigerator			60.1%				
67	Refrigeration	High-efficiency small walk-in	NC, Reno, Repl	High-efficiency small walk-in cooler with self-contained refrigeration system	Standard efficiency walk-in refrigeration system	2008	2027	13	Average of walk-in cooler & freezer			27.5%				
68	Refrigeration	High-efficiency ice makers	NC, Reno, Repl	High efficiency new ice machines	Standard efficiency new ice machines	2008	2027	10	Avg of air & water-cooled ice makers			13.9%				
69	Refrigeration	Walk-in refrigeration retrofit package	Ret	High efficiency walk-in refrigeration system retrofit improvements (includes economizer, humidistat, evaporator fan control, etc.)	Standard efficiency existing stock walk-in refrigeration systems	2008	2018	16	Representative walk-in cooler			16.8%				
70	Refrigeration	High-efficiency display coolers	NC, Reno, Repl	High-efficiency refrigerated display coolers	Standard efficiency display cooler	2008	2027	8.5	Representative display cooler			28.3%				
70	Refrigeration	High-efficiency display coolers	Ret	High-efficiency refrigerated display coolers	Standard efficiency existing stock display cooler	2008	2027	8.5	Representative display cooler			28.3%				
71	Water Heating	Heat pump water heating from refig waste heat -Water heat	NC, Reno, Repl	Heat pump water heating using waste heat recovery from refrigeration systems (water heating component)	Air cooled refrigeration, traditional gas or electric water heating (note some electric water heating savings result as well)	2008	2027	14	Representative refrigeration unit			43.0%		14,155.0		
71	Water Heating	Heat pump water heating from refig waste heat -Water heat	Ret	Heat pump water heating using waste heat recovery from refrigeration systems (water heating component)	Air cooled refrigeration, traditional gas or electric water heating (note some electric water heating savings result as well)	2008	2027	14	Representative refrigeration unit			50.0%		14,155.0		
72	Refrigeration	Heat pump water heating from refig waste heat -Refig	NC, Reno, Repl	Heat pump water heating using waste heat recovery from refrigeration systems (refrigeration component)	Air cooled refrigeration, traditional gas or electric water heating (note some electric water heating savings result as well)	2008	2027	14	Representative refrigeration unit			5.0%				
72	Refrigeration	Heat pump water heating from refig waste heat -Refig	Ret	Heat pump water heating using waste heat recovery from refrigeration systems (refrigeration component)	Air cooled refrigeration, traditional gas or electric water heating (note some electric water heating savings result as well)	2008	2027	14	Representative refrigeration unit			5.0%				
73	Industrial Process	Industrial process	NC, Repl	Represents a comprehensive suite of industrial energy efficiency measures addressing process energy.	Standard efficiency for aggregated measures	2008	2027	13.9				21.5%				
73	Industrial Process	Industrial process	Ret	Represents a comprehensive suite of industrial energy efficiency measures addressing process energy.	Standard efficiency for aggregated measures	2008	2027	13.9				21.5%				
74	Indoor Lighting	Industrial lighting	NC, Reno, Repl	Represents a comprehensive suite of industrial energy efficiency measures addressing indoor lighting.	Standard efficiency for aggregated measures	2008	2027	11.5				36.5%				
74	Indoor Lighting	Industrial lighting	Ret	Represents a comprehensive suite of industrial energy efficiency measures addressing indoor lighting.	Standard efficiency for aggregated measures	2008	2027	11.5				36.5%				
75	Cooling	Industrial space cooling	NC, Reno, Repl	Represents a comprehensive suite of industrial energy efficiency measures addressing space cooling	Standard efficiency for aggregated measures	2008	2027	10				6.0%				
75	Cooling	Industrial space cooling	Ret	Represents a comprehensive suite of industrial energy efficiency measures addressing space cooling	Standard efficiency for aggregated measures	2008	2027	10				6.0%				
76	Whole Building	Retrocommissioning	Ret	Optimizing energy usage of existing buildings and systems using O&M, control calibration, etc.	Existing efficiency and practices	2008	2027	7	Average of reported studies			10.0%				
77	Whole Building	Commissioning	NC, Reno	Whole building commissioning of new buildings to ensure optimized design, installation and operation of systems.	Standard efficiency	2008	2027	7	Average of reported studies			10.0%				
78	Whole Building	Integrated building design - Tier I (ASHRAE 90.1-2004 baseline)	NC, Reno	Reflects comprehensive, optimized design of new buildings addressing all end-uses and interactions between them on a systems basis. Costs and savings estimates are based on meeting the basic requirements of the VT Core Performance New Construction Program including, but not limited to, improved air barrier performance, minimum IAQ performance, lighting controls, improved lighting power density, improved mechanical equipment efficiency, and demand control ventilation.	ASHRAE 90.1-2004	2008	2027	15.3	Average of representative building, per sq ft			11.4%		1.64	0.0029	



**Forecast 20 Commercial/Industrial Measure Characteristics**

Proj Meas	End Use	Measure Name	Mar-kets	Measure Description	Baseline Description	First Install Year	Last Install Year	Life (yr)	Units for KW / kWh / Cost Values	Baseline kW	Efficient kW	% Savings	Full Load Hours	Annual kWh Savings	Fossil Fuel Savings (MMBtu/yr)	Efficient Cost
79	Whole Building	Integrated building design - Tier II (ASHRAE 90.1-2004 baseline)	NC, Reno	Reflects comprehensive, optimized design of new buildings addressing all end-uses and interactions between them on a systems basis. Costs and savings estimates are based on meeting the basic requirements of the VT Core Performance New Construction Program as well as the "Enhanced Performance Strategies" as outlined in the program guidelines including, but not limited to, cool roofs, daylighting and controls, additional LPD reductions, plug loads/appliance efficiency, energy recovery, variable speed control, and additional commissioning strategies.	Incremental to Integrated Bldg Design Tier 1 (2004 baseline).	2008	2027	15.3	Average of representative building, per sq ft			5.0%			0.72	
80	Miscellaneous	High-efficiency commercial kitchen cooking/warming equipment	NC, Reno, Repl	High-efficiency commercial kitchen cooking/warming equipment (holding cabinet, steamer, convection oven, combination oven, deep fryer, griddle)	Standard efficiency kitchen equipment	2008	2027	12	Representative kitchen equipment			29.9%				
81	Miscellaneous	Data centers -IT	NC, Reno, Repl	Data Center energy savings for information technology (computer loads) at facilities or rooms used to house computer servers and data systems through the use of server virtualization.	Typical data center without server virtualization	2010	2027	5				47.9%				
81	Miscellaneous	Data centers -IT	Ret	Data Center energy savings for information technology (computer loads) at facilities or rooms used to house computer servers and data systems through the use of server virtualization.	Typical data center without server virtualization	2010	2027	5				47.9%				
82	Cooling	Data centers -Cooling	NC, Reno, Repl	Data Center reduced cooling loads associated with electric savings for computer loads.	Typical data center without server virtualization	2010	2027	5				47.9%				
82	Cooling	Data centers -Cooling	Ret	Data Center reduced cooling loads associated with electric savings for computer loads.	Typical data center without server virtualization	2010	2027	5				47.9%				



**FORECAST 20**  
Electricity Savings in Vermont from 20 Years of  
Continued End-Use Efficiency Investment

**Appendix 3**

**Commercial & Industrial Sector Analysis**

- b. Commercial & Industrial Measure Characteristics,  
by Applicability, Feasibility, and  
Percent of Retrofit Measures Not Completed

## APPLICABILITY

PM#	Measure Name	End Use	Office	Retail	Grocery	Warehouse	Education	Health	Lodging	Restaurant	Industrial	Streetlights	Other
1	Super T8 lamp/ballast (T12 baseline)	Indoor Lighting	62%	71%	20%	49%	78%	95%	56%	59%			53%
2	Super T8 lamp/ballast (T8 baseline)	Indoor Lighting	62%	71%	20%	49%	78%	95%	56%	59%			53%
3	Super T8 fixture (T12 baseline)	Indoor Lighting	62%	71%	20%	49%	78%	95%	56%	59%			53%
4	Super T8 fixture (T8 baseline)	Indoor Lighting	62%	71%	20%	49%	78%	95%	56%	59%			53%
6	HE fixtures/design Tier I (2004 baseline)	Indoor Lighting	81%	82%	22%	52%	84%	100%	100%	99%			58%
7	HE fixtures/design Tier II	Indoor Lighting	81%	82%	22%	52%	84%	100%	100%	99%			58%
8	HE fixtures/design Tier III	Indoor Lighting	81%	82%	22%	52%	84%	100%	100%	99%			58%
9	CFL fixture - interior 2008-11	Indoor Lighting	19%	11%	1%	1%	5%	4%	43%	40%			4%
10	CFL fixture - interior 2012-14	Indoor Lighting	19%	11%	1%	1%	5%	4%	43%	40%			4%
11	CFL spiral 2009-11	Indoor Lighting	19%	11%	1%	1%	5%	4%	43%	40%			4%
12	CFL spiral 2012-14	Indoor Lighting	19%	11%	1%	1%	5%	4%	43%	40%			4%
13	Fluor high-low bay fixture - interior	Indoor Lighting	17%	18%	78%	48%	16%	0%	0%	0%			42%
14	Occupancy on/off	Indoor Lighting	82%	82%	22%	52%	84%	100%	100%	100%			58%
15	Occupancy hi/low	Indoor Lighting	17%	18%	78%	48%	16%	0%	0%	0%			42%
16	Daylight dimming	Indoor Lighting	76%	88%	99%	98%	94%	93%	47%	60%			94%
17	Ceramic Metal Halide lighting	Indoor Lighting	3%	5%	3%	0%	3%	3%	3%	5%			3%
18	Interior LED	Indoor Lighting	19%	11%	1%	1%	5%	4%	43%	40%			4%
19	LED utility exterior street lighting	Outdoor Lighting	0%	0%	0%	0%	0%	0%	0%	0%		100%	0%
20	Pulse start MH v. Inc - ext	Outdoor Lighting	26%	3%	6%	6%	1%	20%	27%	55%			3%
21	CFL - exterior 2009-2011	Outdoor Lighting	26%	3%	6%	6%	1%	20%	27%	55%			3%
22	CFL - exterior 2012-2014	Outdoor Lighting	26%	3%	6%	6%	1%	20%	27%	55%			3%
23	LED exterior area lighting	Outdoor Lighting	90%	90%	90%	90%	90%	90%	90%	90%			90%
24	Improved ext lighting design	Outdoor Lighting	100%	100%	100%	100%	100%	100%	100%	100%			100%
25	High-eff AC CEE Tier I	Cooling	57%	63%	57%	57%	57%	56%	57%	57%			57%
26	High-eff AC CEE Tier II	Cooling	57%	63%	57%	57%	57%	56%	57%	57%			57%
27	Water src HP v. air src -Cool	Cooling	8%	0%	8%	8%	8%	23%	8%	8%			8%
28	Water src HP v. air src -Heat	Space Heating	6%	0%	6%	6%	6%	68%	6%	6%			6%
29	Ground source HP -Cool	Cooling	8%	0%	8%	8%	8%	23%	8%	8%			8%
30	Ground source HP -Heat	Space Heating	6%	0%	6%	6%	6%	68%	6%	6%			6%
31	HE Room AC	Cooling	23%	1%	23%	23%	23%	0%	23%	23%			23%
32	High-efficiency chillers Tier I	Cooling	20%	36%	20%	20%	20%	44%	20%	20%			20%
33	High-efficiency chillers Tier II	Cooling	20%	36%	20%	20%	20%	44%	20%	20%			20%
34	Opt unitary hvac dist/ctrl sys -Cool	Cooling	49%	63%	49%	49%	49%	33%	49%	49%			49%
35	Opt unitary hvac dist/ctrl sys -Heat	Space Heating	18%	18%	18%	18%	18%	18%	18%	18%			18%
36	Opt chiller dist/ctrl sys -Cool	Cooling	20%	36%	20%	20%	20%	44%	20%	20%			20%
37	EMS/Controls -Cool	Cooling	77%	99%	77%	77%	77%	100%	77%	77%			77%
38	EMS/Controls -Heat	Space Heating	95%	97%	98%	99%	96%	93%	83%	98%			97%
39	EMS/Controls -Vent	Ventilation	95%	97%	98%	99%	96%	93%	83%	98%			97%
40	Dual enthalpy economizer	Cooling	49%	63%	49%	49%	49%	33%	49%	49%			49%

## APPLICABILITY

PM#	Measure Name	End Use	Office	Retail	Grocery	Warehouse	Education	Health	Lodging	Restaurant	Industrial	Streetlights	Other
41	Demand controlled ventilation -Cool	Cooling	77%	99%	77%	77%	77%	100%	77%	77%			77%
42	Demand controlled ventilation -Vent	Ventilation	95%	97%	98%	99%	96%	93%	83%	98%			97%
43	HVAC tune-up -Cool	Cooling	94%	61%	98%	99%	84%	26%	66%	98%			97%
44	HVAC tune-up -Heat	Space Heating	94%	61%	98%	99%	84%	26%	66%	98%			97%
45	Duct sealing -Cool	Cooling	95%	97%	98%	99%	96%	93%	83%	98%			97%
46	Duct sealing -Vent	Ventilation	95%	97%	98%	99%	96%	93%	83%	98%			97%
47	HE stove hood -Cool	Cooling	0%	0%	0%	0%	100%	100%	100%	100%			0%
48	HE stove hood -Vent	Ventilation	0%	0%	0%	0%	100%	100%	100%	100%			0%
49	Premium efficiency motors	Ventilation	95%	92%	97%	93%	47%	87%	19%	73%			85%
50	Variable Frequency Drive (VFD)	Ventilation	32%	48%	87%	41%	4%	8%	0%	0%			23%
51	Water & sewer process	Miscellaneous	0%	0%	0%	0%	0%	0%	0%	0%			90%
52	HE tank-type electric water heater	Water Heating	100%	100%	100%	100%	100%	100%	100%	100%			100%
53	Water heat fuel switch	Water Heating	100%	100%	100%	100%	100%	100%	100%	100%			100%
54	Point of use water heat	Water Heating	61%	61%	61%	61%	61%	61%	61%	61%			61%
55	Booster water heat for dishwashing	Water Heating	100%	100%	100%	100%	100%	100%	100%	100%			100%
57	Electric DHW pipe insulation	Water Heating	100%	100%	100%	100%	100%	100%	100%	100%			100%
58	Electric water heater tank insulation	Water Heating	80%	80%	80%	80%	80%	80%	80%	80%			80%
60	HE clothes washer	Water Heating	0%	0%	0%	0%	2%	0%	2%	0%			0.6%
61	Vending miser	Refrigeration	16%	21%	3%	36%	25%	11%	7%	3%			11%
62	Energy Star vending machine	Refrigeration	16%	21%	3%	36%	25%	11%	7%	3%			11%
63	High-eff refrigeration	Refrigeration	33%	33%	33%	33%	33%	33%	33%	33%			33%
64	High-eff reach-in refrig, freezers	Refrigeration	17%	17%	17%	17%	17%	17%	17%	17%			17%
65	ESTAR Mini Refrigerator	Refrigeration	0%	0%	1%	0%	0%	35%	0%	0%			0%
66	HE residential-size refrigerator	Refrigeration	30%	52%	17%	45%	31%	21%	71%	36%			37%
67	High-efficiency small walk-in	Refrigeration	10%	8%	40%	0%	27%	29%	11%	32%			42%
68	HE Ice Makers	Refrigeration	32%	0%	6%	0%	2%	0%	6%	3%			0%
69	Walk-in refrig retrofit package	Refrigeration	10%	8%	40%	0%	27%	29%	11%	32%			42%
70	High-efficiency display coolers	Refrigeration	0%	0%	22%	0%	0%	0%	0%	0%			0%
71	Heat pump H2O heat from refrig -WH	Water Heating	100%	100%	100%	100%	100%	100%	100%	100%			100%
72	Heat pump H2O heat from refrig -Refrig	Refrigeration	5%	5%	5%	5%	5%	5%	5%	5%			5%
73	Industrial process	Industrial Process	0%	0%	0%	0%	0%	0%	0%	0%	100%		0%
74	Industrial lighting	Indoor Lighting	0%	0%	0%	0%	0%	0%	0%	0%	100%		0%
75	Industrial space cooling	Cooling	0%	0%	0%	0%	0%	0%	0%	0%	100%		0%
76	Retrocommissioning	Elec Total	66%	66%	66%	66%	66%	66%	66%	66%			66%
77	Commissioning	Elec Total	66%	66%	66%	66%	66%	66%	66%	66%			66%
78	Integrated bldg design - Tier I (2004 baseline)	Elec Total	93%	93%	93%	93%	93%	93%	93%	93%			93%
79	Integrated bldg design - Tier II (2004 baseline)	Elec Total	93%	93%	93%	93%	93%	93%	93%	93%			93%
80	HE Com kitchen equipment	Miscellaneous	1%	1%	5%	0%	5%	7%	15%	34%			5%
81	Data centers virtualization -IT	Miscellaneous	30%	5%	0%	0%	25%	20%	0%	0%			25%
82	Data centers virtualization -Cool	Cooling	30%	5%	0%	0%	25%	20%	0%	0%			25%









## **FORECAST 20**

Electricity Savings in Vermont from 20 Years of  
Continued End-Use Efficiency Investment

### **Appendix 3**

#### **Commercial & Industrial Sector Analysis**

c. Commercial & Industrial  
Measure Penetration Projections 2008 - 2027





**Commercial/Industrial Measures:  
Lost Opportunity Market Penetrations**

For program participants, as percent of applicable end-use energy

**Years 1-10 (2008-2017)**

PM#	Measure	End Use	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
43	HVAC tune-up -Cool	Cooling	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
44	HVAC tune-up -Heat	Space Heating	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
45	Duct sealing -Cool	Cooling	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
46	Duct sealing -Vent	Ventilation	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
47	HE stove hood -Cool	Cooling	3.00%	4.00%	5.00%	6.00%	7.00%	8.00%	9.00%	10.00%	11.00%	12.00%
48	HE stove hood -Vent	Ventilation	3.00%	4.00%	5.00%	6.00%	7.00%	8.00%	9.00%	10.00%	11.00%	12.00%
49	Premium efficiency motors	Ventilation	11.00%	11.00%	11.00%	11.00%	11.00%	11.00%	11.00%	10.00%	9.00%	8.00%
50	Variable Frequency Drive (VFD)	Ventilation	10.00%	11.00%	12.00%	13.00%	14.00%	15.00%	16.00%	17.00%	18.00%	19.00%
51	Water & sewer process	Miscellaneous	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%
52	HE tank-type electric water heater	Water Heating	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%
53	Water heat fuel switch	Water Heating	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
54	Point of use water heat	Water Heating	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
55	Booster water heat for dishwashing	Water Heating	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
57	Electric DHW pipe insulation	Water Heating	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
58	Electric water heater tank insulation	Water Heating	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
60	HE clothes washer	Water Heating	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%
61	Vending miser	Refrigeration	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
62	Energy Star vending machine	Refrigeration	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	4.00%	3.00%	2.00%	1.00%
63	High-eff refrigeration	Refrigeration	8.00%	10.00%	12.00%	14.00%	16.00%	18.00%	20.00%	22.00%	24.00%	26.00%
64	High-eff reach-in refrig, freezers	Refrigeration	6.40%	8.00%	9.60%	11.20%	12.80%	14.40%	16.00%	17.60%	19.20%	20.80%
65	ESTAR Mini Refrigerator	Refrigeration	5.00%	6.00%	7.00%	8.00%	9.00%	10.00%	10.00%	10.00%	10.00%	10.00%
66	HE residential-size refrigerator	Refrigeration	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%
67	High-efficiency small walk-in	Refrigeration	4.00%	5.00%	6.00%	7.00%	8.00%	9.00%	10.00%	10.00%	10.00%	10.00%
68	HE Ice Makers	Refrigeration	4.00%	5.00%	6.00%	7.00%	8.00%	9.00%	10.00%	10.00%	10.00%	10.00%
69	Walk-in refrig retrofit package	Refrigeration	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
70	High-efficiency display coolers	Refrigeration	8.00%	9.00%	10.00%	11.00%	12.00%	13.00%	14.00%	15.00%	15.00%	15.00%
71	Heat pump H2O heat from refrig -WH	Water Heating	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
72	Heat pump H2O heat from refrig -Refrig	Refrigeration	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
73	Industrial process	Industrial Process	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
74	Industrial lighting	Indoor Lighting	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
75	Industrial space cooling	Cooling	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
76	Retrocommissioning	Total	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
77	Commissioning	Total	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
78	Integrated bldg design - Tier I (2004 baseline)	Total	3.00%	4.00%	5.00%	6.00%	7.00%	8.00%	9.00%	10.00%	11.00%	12.00%
79	Integrated bldg design - Tier II (2004 baseline)	Total	0.75%	1.00%	1.25%	1.50%	1.75%	2.00%	2.25%	2.50%	2.75%	3.00%
80	HE Com kitchen equipment	Miscellaneous	1.00%	2.00%	4.00%	6.00%	10.00%	15.00%	20.00%	22.00%	22.00%	22.00%
81	Data centers virtualization -IT	Miscellaneous	0.00%	0.00%	5.00%	7.00%	9.00%	11.00%	13.00%	15.00%	17.00%	19.00%
82	Data centers virtualization -Cool	Cooling	0.00%	0.00%	5.00%	7.00%	9.00%	11.00%	13.00%	15.00%	17.00%	19.00%

**Commercial/Industrial Measures:  
Lost Opportunity Market Penetrations**

For program participants, as percent of applicable end-use energy

**Years 10-20 (2018-2027)**

PM#	Measure	End Use	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
43	HVAC tune-up -Cool	Cooling	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
44	HVAC tune-up -Heat	Space Heating	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
45	Duct sealing -Cool	Cooling	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
46	Duct sealing -Vent	Ventilation	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
47	HE stove hood -Cool	Cooling	13.00%	14.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%
48	HE stove hood -Vent	Ventilation	13.00%	14.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%
49	Premium efficiency motors	Ventilation	7.00%	6.00%	5.00%	4.00%	3.00%	2.00%	1.00%	0.00%	0.00%	0.00%
50	Variable Frequency Drive (VFD)	Ventilation	19.00%	19.00%	19.00%	19.00%	19.00%	19.00%	19.00%	19.00%	19.00%	19.00%
51	Water & sewer process	Miscellaneous	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%
52	HE tank-type electric water heater	Water Heating	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%
53	Water heat fuel switch	Water Heating	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
54	Point of use water heat	Water Heating	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
55	Booster water heat for dishwashing	Water Heating	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
57	Electric DHW pipe insulation	Water Heating	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
58	Electric water heater tank insulation	Water Heating	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
60	HE clothes washer	Water Heating	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%
61	Vending miser	Refrigeration	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
62	Energy Star vending machine	Refrigeration	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
63	High-eff refrigeration	Refrigeration	28.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
64	High-eff reach-in refrig, freezers	Refrigeration	22.40%	24.00%	24.00%	24.00%	24.00%	24.00%	24.00%	24.00%	24.00%	24.00%
65	ESTAR Mini Refrigerator	Refrigeration	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
66	HE residential-size refrigerator	Refrigeration	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%
67	High-efficiency small walk-in	Refrigeration	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
68	HE Ice Makers	Refrigeration	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
69	Walk-in refrig retrofit package	Refrigeration	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
70	High-efficiency display coolers	Refrigeration	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%
71	Heat pump H2O heat from refrig -WH	Water Heating	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
72	Heat pump H2O heat from refrig -Refrig	Refrigeration	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
73	Industrial process	Industrial Process	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
74	Industrial lighting	Indoor Lighting	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
75	Industrial space cooling	Cooling	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
76	Retrocommissioning	Total	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
77	Commissioning	Total	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
78	Integrated bldg design - Tier I (2004 baseline)	Total	13.00%	14.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%
79	Integrated bldg design - Tier II (2004 baseline)	Total	3.25%	3.50%	3.75%	3.75%	3.75%	3.75%	3.75%	3.75%	3.75%	3.75%
80	HE Com kitchen equipment	Miscellaneous	22.00%	22.00%	22.00%	22.00%	22.00%	22.00%	22.00%	22.00%	22.00%	22.00%
81	Data centers virtualization -IT	Miscellaneous	21.00%	21.00%	21.00%	21.00%	19.00%	17.00%	15.00%	13.00%	11.00%	9.00%
82	Data centers virtualization -Cool	Cooling	21.00%	21.00%	21.00%	21.00%	19.00%	17.00%	15.00%	13.00%	11.00%	9.00%





**Commercial/Industrial Measures:**

**Retrofit Market Penetrations**

For program participants, as percent of applicable end-use energy

PM#	Measure	End Use	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
43	HVAC tune-up -Cool	Cooling	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
44	HVAC tune-up -Heat	Space Heating	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
45	Duct sealing -Cool	Cooling	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%
46	Duct sealing -Vent	Ventilation	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%
47	HE stove hood -Cool	Cooling	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
48	HE stove hood -Vent	Ventilation	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
49	Premium efficiency motors	Ventilation	2.50%	2.50%	2.50%	2.30%	2.10%	1.90%	1.70%	1.50%	1.30%	1.10%
50	Variable Frequency Drive (VFD)	Ventilation	2.00%	2.20%	2.40%	2.60%	2.80%	3.00%	3.20%	3.40%	3.40%	3.40%
51	Water & sewer process	Miscellaneous	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
52	HE tank-type electric water heater	Water Heating	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
53	Water heat fuel switch	Water Heating	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%
54	Point of use water heat	Water Heating	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
55	Booster water heat for dishwashing	Water Heating	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
57	Electric DHW pipe insulation	Water Heating	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
58	Electric water heater tank insulation	Water Heating	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
60	HE clothes washer	Water Heating	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
61	Vending miser	Refrigeration	0.05%	0.05%	0.05%	0.05%	0.05%	0.04%	0.03%	0.02%	0.01%	0.00%
62	Energy Star vending machine	Refrigeration	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
63	High-eff refrigeration	Refrigeration	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
64	High-eff reach-in refrig, freezers	Refrigeration	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
65	ESTAR Mini Refrigerator	Refrigeration	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
66	HE residential-size refrigerator	Refrigeration	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
67	High-efficiency small walk-in	Refrigeration	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
68	HE Ice Makers	Refrigeration	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
69	Walk-in refrig retrofit package	Refrigeration	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.30%	2.10%	1.90%
70	High-efficiency display coolers	Refrigeration	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.30%	2.10%	1.90%
71	Heat pump H2O heat from refrig -WH	Water Heating	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
72	Heat pump H2O heat from refrig -Refrig	Refrigeration	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
73	Industrial process	Industrial Process	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
74	Industrial lighting	Indoor Lighting	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
75	Industrial space cooling	Cooling	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%
76	Retrocommissioning	Total	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
77	Commissioning	Total	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
78	Integrated bldg design - Tier I (2004 baseline)	Total	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
79	Integrated bldg design - Tier II (2004 baseline)	Total	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
80	HE Com kitchen equipment	Miscellaneous	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
81	Data centers virtualization -IT	Miscellaneous	0.00%	0.00%	0.30%	0.60%	0.90%	1.20%	1.50%	1.50%	1.50%	1.50%
82	Data centers virtualization -Cool	Cooling	0.00%	0.00%	0.30%	0.60%	0.90%	1.20%	1.50%	1.50%	1.50%	1.50%



**FORECAST 20**  
Electricity Savings in Vermont from 20 Years of  
Continued End-Use Efficiency Investment

**Appendix 3**

**Commercial & Industrial Sector Analysis**

- d. Commercial & Industrial Program Budget 2008 – 2027

Appendix - COM Program Budgets

Electric Utility Program Budgets

C&I Total	\$	16,918,133	\$	14,547,788	\$	15,767,787	\$	17,705,428	\$	16,012,773	\$	15,819,277	\$	15,361,532	\$	15,316,423	\$	15,162,772	\$	15,396,676	\$	15,282,683
5 Prgm #5: Commercial New Constructior		<u>2008</u>		<u>2009</u>		<u>2010</u>		<u>2011</u>		<u>2012</u>		<u>2013</u>		<u>2014</u>		<u>2015</u>		<u>2016</u>		<u>2017</u>		<u>2018</u>
Customer Incentives (calculated)	\$	279,317	\$	295,704	\$	347,424	\$	419,752	\$	435,794	\$	510,821	\$	562,908	\$	659,989	\$	784,795	\$	915,523	\$	1,120,799
Non-Incentives Costs	\$	340,766	\$	360,759	\$	423,857	\$	512,097	\$	531,669	\$	623,201	\$	686,748	\$	805,186	\$	957,450	\$	1,116,937	\$	1,435,744
<b>Total</b>	<b>\$</b>	<b>620,083</b>	<b>\$</b>	<b>656,463</b>	<b>\$</b>	<b>771,281</b>	<b>\$</b>	<b>931,849</b>	<b>\$</b>	<b>967,464</b>	<b>\$</b>	<b>1,134,022</b>	<b>\$</b>	<b>1,249,656</b>	<b>\$</b>	<b>1,465,174</b>	<b>\$</b>	<b>1,742,245</b>	<b>\$</b>	<b>2,032,460</b>	<b>\$</b>	<b>2,556,543</b>
Incentive % of Total		45%		45%		45%		45%		45%		45%		45%		45%		45%		45%		44%
Cumulative Total	\$	620,083	\$	1,276,546	\$	2,047,827	\$	2,979,677	\$	3,947,140	\$	5,081,162	\$	6,330,819	\$	7,795,993	\$	9,538,238	\$	11,570,698	\$	14,127,241
6 Prgm #6: Commercial Efficient Equipme		<u>2008</u>		<u>2009</u>		<u>2010</u>		<u>2011</u>		<u>2012</u>		<u>2013</u>		<u>2014</u>		<u>2015</u>		<u>2016</u>		<u>2017</u>		<u>2018</u>
Customer Incentives (calculated)	\$	545,799	\$	574,863	\$	679,203	\$	809,604	\$	838,893	\$	989,807	\$	1,090,282	\$	1,234,996	\$	1,423,612	\$	1,617,487	\$	1,929,885
Non-Incentives Costs	\$	611,294	\$	643,847	\$	760,708	\$	906,757	\$	939,560	\$	1,108,584	\$	1,221,116	\$	1,383,196	\$	1,594,445	\$	1,811,586	\$	2,269,545
<b>Total</b>	<b>\$</b>	<b>1,157,093</b>	<b>\$</b>	<b>1,218,710</b>	<b>\$</b>	<b>1,439,911</b>	<b>\$</b>	<b>1,716,361</b>	<b>\$</b>	<b>1,778,453</b>	<b>\$</b>	<b>2,098,391</b>	<b>\$</b>	<b>2,311,397</b>	<b>\$</b>	<b>2,618,192</b>	<b>\$</b>	<b>3,018,056</b>	<b>\$</b>	<b>3,429,073</b>	<b>\$</b>	<b>4,199,429</b>
Incentive % of Total		47%		47%		47%		47%		47%		47%		47%		47%		47%		47%		46%
Cumulative Total	\$	1,157,093	\$	2,375,803	\$	3,815,714	\$	5,532,075	\$	7,310,527	\$	9,408,919	\$	11,720,316	\$	14,338,508	\$	17,356,564	\$	20,785,637	\$	24,985,067
7 Prgm #7: Commercial Retrofit		<u>2008</u>		<u>2009</u>		<u>2010</u>		<u>2011</u>		<u>2012</u>		<u>2013</u>		<u>2014</u>		<u>2015</u>		<u>2016</u>		<u>2017</u>		<u>2018</u>
Customer Incentives (calculated)	\$	8,319,207	\$	6,962,975	\$	7,448,679	\$	8,273,196	\$	7,289,482	\$	6,915,859	\$	6,483,779	\$	6,172,009	\$	5,715,644	\$	5,458,870	\$	4,581,789
Non-Incentives Costs	\$	6,821,750	\$	5,709,640	\$	6,107,916	\$	6,784,021	\$	5,977,375	\$	5,671,005	\$	5,316,699	\$	5,061,047	\$	4,686,828	\$	4,476,273	\$	3,944,921
<b>Total</b>	<b>\$</b>	<b>15,140,957</b>	<b>\$</b>	<b>12,672,615</b>	<b>\$</b>	<b>13,556,595</b>	<b>\$</b>	<b>15,057,217</b>	<b>\$</b>	<b>13,266,857</b>	<b>\$</b>	<b>12,586,864</b>	<b>\$</b>	<b>11,800,478</b>	<b>\$</b>	<b>11,233,057</b>	<b>\$</b>	<b>10,402,471</b>	<b>\$</b>	<b>9,935,143</b>	<b>\$</b>	<b>8,526,710</b>
Incentive % of Total		55%		55%		55%		55%		55%		55%		55%		55%		55%		55%		54%
Cumulative Total	\$	15,140,957	\$	27,813,572	\$	41,370,167	\$	56,427,384	\$	69,694,241	\$	82,281,105	\$	94,081,583	\$	105,314,640	\$	115,717,111	\$	125,652,254	\$	134,178,964

Appendix - COM Program Budgets

lity Program Budgets

C&I Total \$ 14,875,049 \$ 15,012,852 \$ 15,297,234 \$ 15,392,848 \$ 15,395,864 \$ 15,403,057 \$ 15,535,739 \$ 15,544,289 \$ 15,551,202

	2019	2020	2021	2022	2023	2024	2025	2026	2027
Prgm #5: Commercial New Construction									
Customer Incentives (calculated)	\$ 1,283,529	\$ 1,406,635	\$ 1,504,252	\$ 1,567,472	\$ 1,601,399	\$ 1,636,994	\$ 1,672,546	\$ 1,680,035	\$ 1,687,337
Non-Incentives Costs	\$ 1,644,201	\$ 1,801,899	\$ 1,926,947	\$ 2,007,931	\$ 2,051,392	\$ 2,096,990	\$ 2,142,532	\$ 2,152,125	\$ 2,161,478
<b>Total</b>	<b>\$ 2,927,730</b>	<b>\$ 3,208,534</b>	<b>\$ 3,431,199</b>	<b>\$ 3,575,403</b>	<b>\$ 3,652,791</b>	<b>\$ 3,733,984</b>	<b>\$ 3,815,078</b>	<b>\$ 3,832,160</b>	<b>\$ 3,848,815</b>
Incentive % of Total	44%	44%	44%	44%	44%	44%	44%	44%	44%
Cumulative Total	\$ 17,054,970	\$ 20,263,504	\$ 23,694,703	\$ 27,270,106	\$ 30,922,897	\$ 34,656,880	\$ 38,471,958	\$ 42,304,119	\$ 46,152,934

	2019	2020	2021	2022	2023	2024	2025	2026	2027
Prgm #6: Commercial Efficient Equipme									
Customer Incentives (calculated)	\$ 2,156,378	\$ 2,309,178	\$ 2,419,644	\$ 2,478,917	\$ 2,507,656	\$ 2,539,710	\$ 2,573,126	\$ 2,579,521	\$ 2,585,600
Non-Incentives Costs	\$ 2,535,901	\$ 2,715,593	\$ 2,845,501	\$ 2,915,206	\$ 2,949,003	\$ 2,986,699	\$ 3,025,996	\$ 3,033,517	\$ 3,040,666
<b>Total</b>	<b>\$ 4,692,279</b>	<b>\$ 5,024,770</b>	<b>\$ 5,265,146</b>	<b>\$ 5,394,123</b>	<b>\$ 5,456,660</b>	<b>\$ 5,526,409</b>	<b>\$ 5,599,123</b>	<b>\$ 5,613,038</b>	<b>\$ 5,626,266</b>
Incentive % of Total	46%	46%	46%	46%	46%	46%	46%	46%	46%
Cumulative Total	\$ 29,677,345	\$ 34,702,116	\$ 39,967,261	\$ 45,361,384	\$ 50,818,043	\$ 56,344,453	\$ 61,943,575	\$ 67,556,613	\$ 73,182,879

	2019	2020	2021	2022	2023	2024	2025	2026	2027
Prgm #7: Commercial Retrofit									
Customer Incentives (calculated)	\$ 3,898,464	\$ 3,642,959	\$ 3,546,958	\$ 3,451,544	\$ 3,377,976	\$ 3,300,733	\$ 3,289,381	\$ 3,277,319	\$ 3,264,976
Non-Incentives Costs	\$ 3,356,577	\$ 3,136,588	\$ 3,053,931	\$ 2,971,779	\$ 2,908,438	\$ 2,841,931	\$ 2,832,157	\$ 2,821,772	\$ 2,811,144
<b>Total</b>	<b>\$ 7,255,041</b>	<b>\$ 6,779,547</b>	<b>\$ 6,600,889</b>	<b>\$ 6,423,323</b>	<b>\$ 6,286,414</b>	<b>\$ 6,142,664</b>	<b>\$ 6,121,538</b>	<b>\$ 6,099,091</b>	<b>\$ 6,076,121</b>
Incentive % of Total	54%	54%	54%	54%	54%	54%	54%	54%	54%
Cumulative Total	\$ 141,434,005	\$ 148,213,552	\$ 154,814,441	\$ 161,237,764	\$ 167,524,178	\$ 173,666,842	\$ 179,788,380	\$ 185,887,471	\$ 191,963,592