VERMONT ENERGY
INVESTMENT CORPORATION

Maximum Economically Achievable Electricity Savings from Unconstrained Investment in Energy Efficiency 2012 - 2031

Presented to the Vermont System Planning Committee
March 9, 2011

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Overview

DRP Context

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- VELCO unconstrained savings forecast constitutes a "boundary case" in the Public Service Board's DRP process

- It is the first of four efficiency resource plans to be developed, analyzed, and compared with the maximum achievable analysis

Additional Scenarios

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- Flat budget to acquire all economically achievable potential across 20 years
- Ramp up across 5 years to achieve 3% savings, relative to annual energy use
- Status quo budgets adjusted for inflation

History

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- PSB DRP process created after VELCO engaged VEIC to conduct the analysis for unconstrained potential
- Necessitated expansion of scope of work to include **updating costs and savings** estimates over time for **key efficiency technologies,** applicable across DRP scenario—**especially lighting**

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Approach

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Maximum Economically Achievable Efficiency Savings

Operating definition:

The maximum amount of cost-effective electricity savings that can be achieved, as quickly as possible, by deploying the most aggressive program strategies available in all major residential and business markets.

Guiding Principles

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IF

avoided costs are **constant or rising** in real terms, all else being equal,

AND

the **sooner and faster** maximum achievable **savings** are **achieved**,

THEN

the **greater** the resulting **net benefits.***

Maximum achievable penetration rates are the result of informed professional judgment about what's possible with the most aggressive intervention strategies in each market.

*This is automatically true, due to discounting

General Approach

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Same basic approach as analysis used in 2009 Forecast 20:

- Integration with VELCO 2010 Forecast
- Updated efficiency technology characterizations
- Two-stage analysis of measures / measure bundles
- Conceptual program design
- Market penetration rates

Integration with VELCO 2010 Forecast

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- Preliminary 2010 sales and peak demand forecast (Itron)
- VEIC worked closely with Itron to coordinate energy sales baseline energy intensities with savings analysis baselines
- This time Itron prepared a forecast adjusted for effects of continued EEU investments of $40 million annually throughout the period
- Along with an unadjusted forecast, without the effects of any continuation of Vermont DSM investment in efficiency

Development of 90 / 10 Scenario

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- Indicates expected summer peak demand savings under extreme weather conditions
- Assumes that the 90 / 10 DSM savings have the same **percentage increase** over the 50 / 50 DSM savings as the 90 / 10 forecast has over the 50 / 50 forecast

Updated Characterizations of Efficiency Technology

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- Re-assessed future changes in baseline
- Characterized additional measures (including solar residential hot water)

Two-stage Analysis of Measures / Measure Bundles

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- Assess the cost-effectiveness of efficiency measures or measure bundles
- Predict maximum penetration rates with most aggressive conceptual program designs specified for each market

Same approach as with original Forecast 20 and to be conducted in the analysis of other efficiency resource plans in the DRP process.

Avoided Costs Used in this Analysis

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Year	Winter On Peak Energy $/kWh	Winter Off Peak Energy $/kWh	Summer On-Peak $/kWh	Summer Off-Peak $/kWh	Summer Gener. Capacity $/kW-yr	T&D Capacity $/kW-yr
2012	0.0815	0.0628	0.0805	0.0582	39.60	181.51
2013	0.0818	0.0665	0.0827	0.0637	18.70	181.43
2014	0.0823	0.0675	0.0837	0.0639	18.71	181.34
2015	0.0823	0.0681	0.0854	0.0639	20.16	181.25
2016	0.0828	0.0693	0.0885	0.0651	21.64	181.14
2017	0.0843	0.0711	0.0900	0.0678	21.65	181.10
2018	0.0877	0.0728	0.0916	0.0700	23.12	180.99
2019	0.0882	0.0744	0.0939	0.0710	23.14	180.90
2020	0.0884	0.0746	0.0936	0.0710	24.60	180.79
2021	0.0871	0.0737	0.0920	0.0716	26.07	180.71
2022	0.0880	0.0756	0.0942	0.0727	27.55	180.61
2023	0.0908	0.0763	0.0979	0.0751	29.02	180.52
2024	0.0955	0.0778	0.1036	0.0796	30.50	180.43
2025	0.0971	0.0789	0.1058	0.0816	45.06	180.35
2026	0.0987	0.0801	0.1081	0.0836	59.65	180.25
2027	0.1003	0.0813	0.1105	0.0857	74.26	180.16
2028	0.1020	0.0825	0.1129	0.0878	88.89	180.06
2029	0.1037	0.0837	0.1153	0.0900	103.56	179.97
2030	0.1054	0.0850	0.1178	0.0922	116.78	179.88
2031	0.1072	0.0862	0.1204	0.0945	116.88	179.78
2032	0.1090	0.0875	0.1230	0.0968	116.98	179.69
2033	0.1108	0.0888	0.1257	0.0992	117.08	179.59
2034	0.1126	0.0901	0.1284	0.1017	117.18	179.50
2035	0.1145	0.0915	0.1312	0.1042	117.28	179.41
2036	0.1164	0.0928	0.1340	0.1068	117.38	179.31
2037	0.1183	0.0942	0.1370	0.1094	117.48	179.22
2038	0.1203	0.0956	0.1399	0.1121	117.59	179.11
2039	0.1223	0.0970	0.1430	0.1149	117.69	179.02
2040	0.1244	0.0985	0.1461	0.1177	117.69	178.92
2041	0.1264	0.0999	0.1493	0.1206	117.69	178.83

From *2009 Regional Analysis of Avoided Costs* (Synapse Energy Economics)

Expressed at same level as VELCO forecast

Conceptual Program Design

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- Program design incorporates **incentives covering 100% of installed or incremental costs**, depending on market.

> ***Example*:**
> **Incentives for large C&I customer retrofits**
>
> Program will "buy down" customer investment costs to 1 year, enabling customers to fund their contribution to efficiency investments out of operating budgets.

- **Exceptions** where experience suggests customers will adopt measures with less than 100% cost reimbursement

Market Penetration Rates

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Retrofit Markets

Annual pace and acceleration in market penetration is discretionary and constrained only by infrastructure readiness.

Lost Opportunity Markets

- **Replacements:** Pace depends on natural turnover of existing equipment stock
- **New Construction:** Pace depends on number of homes and business facilities

Residential Existing Homes

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Retrofit

- Piggyback on fossil heating retrofit program designed to retrofit the entire Vermont housing stock across 20 years
- Direct installation of all cost-effective electric efficiency measures
- Whole-house re-lighting
- Early replacement of appliances, AC
- Electric water heating conversion to solar or natural gas

Products

- Target all existing homes not reached through the retrofit programs
- Lighting

Commercial & Industrial Existing Facilities

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Retrofit

- Plan on achieving 80 – 90% participation among targeted eligible customers in as short a time as possible
- Ramp up from current levels within 3 years to a maximum sustainable rate to reach that target, backing down gradually throughout the rest of the 20-year horizon

Lost Opportunity

- Terminal market penetration rates approach 80 – 90% for all but infra-marginal (not most efficient) alternatives
- The EEU could ramp up to these maximum rates in 3 – 5 years

Improvements in Residential Efficiency Analysis (over 2009 Forecast 20)

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- Lighting
  - In F20, program savings for standard spiral CFLs ended in 2014 (after first phase of EISA regulations). Based on recent evaluations and negotiations with DPS, CFL (standard and specialty) assumed to continue (with the EISA compliant baseline shift) until 2019.
  - SSL lighting re-characterized
  - Recessed down light added
- Appliances
  - New CEE tiers added / adjusted

Improvements in Residential Efficiency Analysis (over 2009 Forecast 20)

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- Other additions
  - Air sealing and insulation measures for electric heat
  - Cooling savings from shell measures
  - Solar hot water as an efficiency measure
- Separated low-income from existing homes
- Matched RNC lighting and product assumptions to products program

Improvements in C&I Efficiency Analysis (over 2009 Forecast 20)

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- Lighting
  - New measures characterized for SSL for: down-lighting, screw-in, linear fluorescent replacement, refrigerated case light fixtures
  - Revised assumptions for LED costs and efficacy changes over time, based on revised Multi-Year Program Plan for SSL R&D (DOE EERE, March 2010)
  - New measures characterized for reduced-wattage T8 lamp and lamp / ballast

Example

Existing T12 lighting is replaced due to EISA phase-out of T12 lamps, and lower-wattage / lumen replacements are suitable, rather than straight T8 lamp / ballast replacements.

Improvements in C&I Efficiency Analysis
(over 2009 Forecast 20)

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- HVAC measure characterizations updated, future adjustments made for changing federal standards
- Due to advances in efficient technologies, new retrofit opportunities assumed to become available for more recently installed equipment,10 to 15 years out
- Assumed that measure costs would increase gradually over time (in real dollars), based on an expectation of a gradual increase in the cost of savings due to increasing baselines.

Additional Savings—Other Sources not Considered

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Other sources of cost-effective efficiency savings that were not considered in this analysis—or in Itron's forecast—that would increase maximum achievable efficiency savings:

- Accelerating the adoption of more efficient standards for buildings and equipment
- New, undiscovered, unidentified technologies emerging beyond 2020
- Changes in the load profiles of equipment and appliances with the introduction of real-time pricing and usage displays

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Results

The Big Picture: 2012 - 2031

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2,317 GWh / year

390 MW / year Summer Peak

390 MW / year Winter Peak

	Societal Test	Electric System Test
PV of Net Benefits ($M)	**$2,113**	**$1,318**
Benefit-Cost Ratio	**2.42**	**1.86**

Statewide Incremental Savings

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Incremental Annual MWh, Summer Peak MW and Winter Peak MW Savings

	RES MWh	RES Summer Peak MW	RES Winter Peak MW	C&I MWh	C&I Summer Peak MW	C&I Winter Peak MW	Total MWh	Total Summer Peak MW	Total Winter Peak MW
2012	67,118	9	14	134,746	29	20	201,864	38	34
2013	92,406	13	19	161,813	35	24	254,219	48	43
2014	111,245	15	22	173,400	38	26	284,645	53	48
2015	122,718	15	24	163,365	36	24	286,083	51	48
2016	147,846	19	29	152,099	33	23	299,946	52	52
2017	175,010	22	34	134,560	29	20	309,570	51	54
2018	188,624	24	37	125,874	28	19	314,498	52	56
2019	197,101	26	38	119,513	26	18	316,614	52	56
2020	106,320	11	18	109,519	24	16	215,839	35	34
2021	107,925	11	18	99,340	21	15	207,264	32	33
2022	109,672	11	19	93,711	20	14	203,383	31	33
2023	111,403	12	19	90,380	19	13	201,783	31	32
2024	111,834	11	19	84,940	18	13	196,774	29	32
2025	114,050	12	20	84,779	18	12	198,829	30	32
2026	115,705	12	20	83,766	18	12	199,470	30	32
2027	117,017	12	20	84,649	18	12	201,666	30	32
2028	118,791	12	21	86,931	19	13	205,722	31	34
2029	120,581	13	21	89,797	19	13	210,378	32	34
2030	122,351	13	21	92,902	20	14	215,253	33	35
2031	123,761	13	22	96,428	21	14	220,189	34	36

Statewide Cumulative Savings

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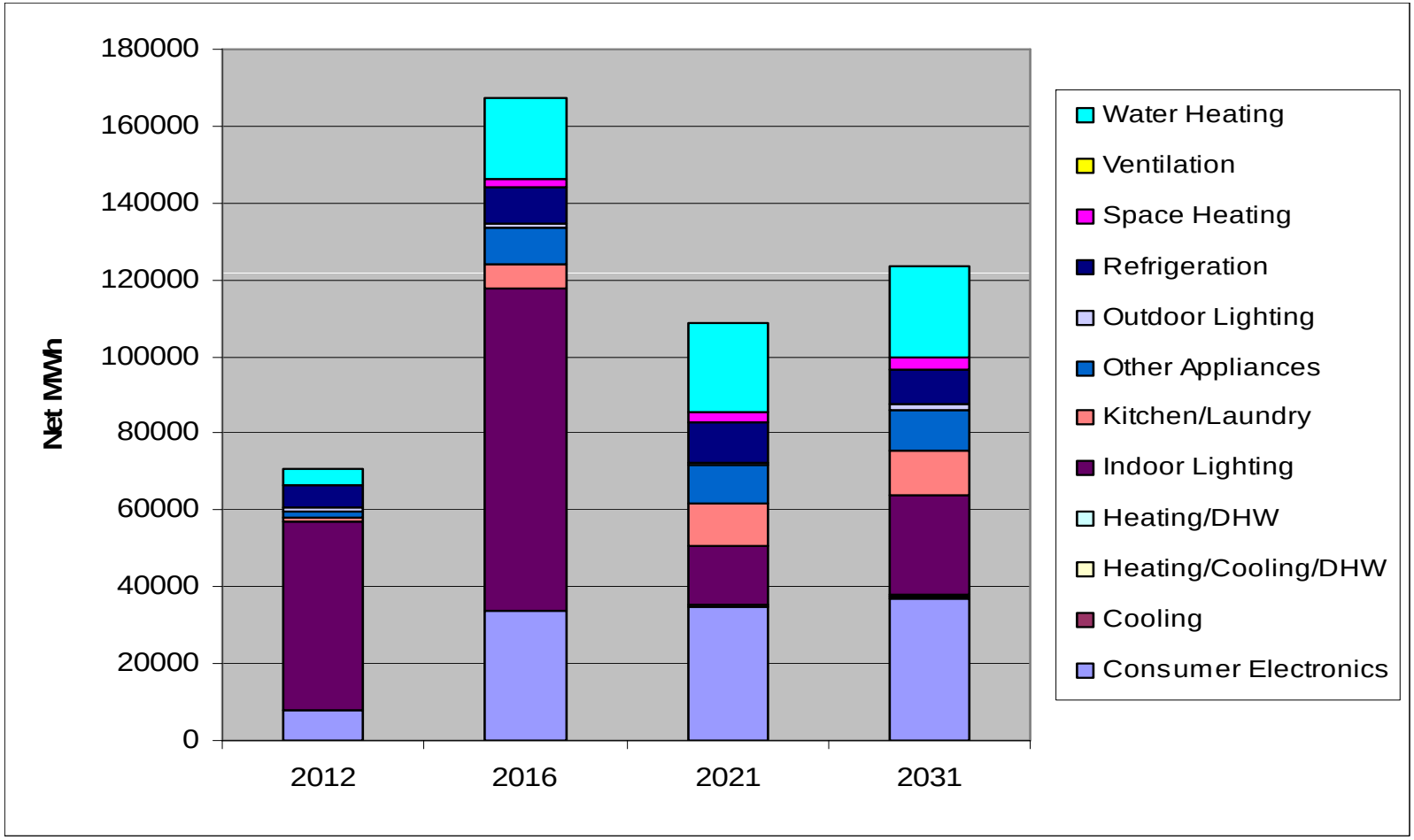
Cumulative Annual MWh, Summer Peak MW and Winter Peak MW Savings

	RES MWh	RES Summer Peak MW	RES Winter Peak MW	C&I MWh	C&I Summer Peak MW	C&I Winter Peak MW	Total MWh	Total Summer Peak MW	Total Winter Peak MW
2012	67,118	9	14	134,746	29	20	201,864	38	34
2013	148,564	21	31	296,558	64	44	445,123	85	75
2014	245,086	34	51	469,792	102	70	714,878	136	121
2015	353,706	48	73	629,117	137	94	982,823	185	167
2016	472,998	62	98	773,819	169	116	1,246,817	230	214
2017	606,790	77	126	895,699	196	134	1,502,489	272	261
2018	737,514	92	155	1,004,837	220	151	1,742,351	311	306
2019	860,535	107	182	1,105,478	241	166	1,966,013	349	348
2020	514,377	55	94	1,194,790	260	180	1,709,167	315	273
2021	570,822	59	106	1,273,915	277	192	1,844,737	336	297
2022	621,134	63	116	1,334,255	288	201	1,955,390	351	317
2023	675,186	68	127	1,391,872	299	211	2,067,058	368	338
2024	729,976	74	138	1,437,348	308	219	2,167,324	382	357
2025	783,761	80	148	1,476,383	315	226	2,260,145	396	374
2026	834,707	86	158	1,503,380	320	230	2,338,087	407	388
2027	883,984	92	167	1,467,893	314	225	2,351,876	405	392
2028	930,508	97	176	1,421,321	305	217	2,351,829	402	393
2029	973,597	101	185	1,371,793	296	208	2,345,390	397	393
2030	997,218	104	190	1,326,974	288	200	2,324,192	392	390
2031	1,020,453	107	196	1,296,307	283	194	2,316,759	390	390

Residential Incremental MWh Saved, by End Use



Residential Incremental MWh Saved, by End Use

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End Use	2012	2016	2021	2031
Consumer Electronics	7,812	33,555	34,833	37,107
Cooling	85	351	384	428
Heating/Cooling/DHW	28	52	76	137
Heating/DHW	36	56	72	99
Indoor Lighting	48,839	83,592	15,481	26,202
Kitchen/Laundry	1,025	6,404	10,910	11,562
Other Appliances	2,064	9,527	9,817	10,443
Outdoor Lighting	987	1,181	912	1,516
Refrigeration	5,425	9,310	10,331	9,099
Space Heating	394	2,131	2,695	2,951
Ventilation	25	89	136	120
Water Heating	361	1,600	22,278	24,098

Residential Cumulative MWh Saved, by End Use

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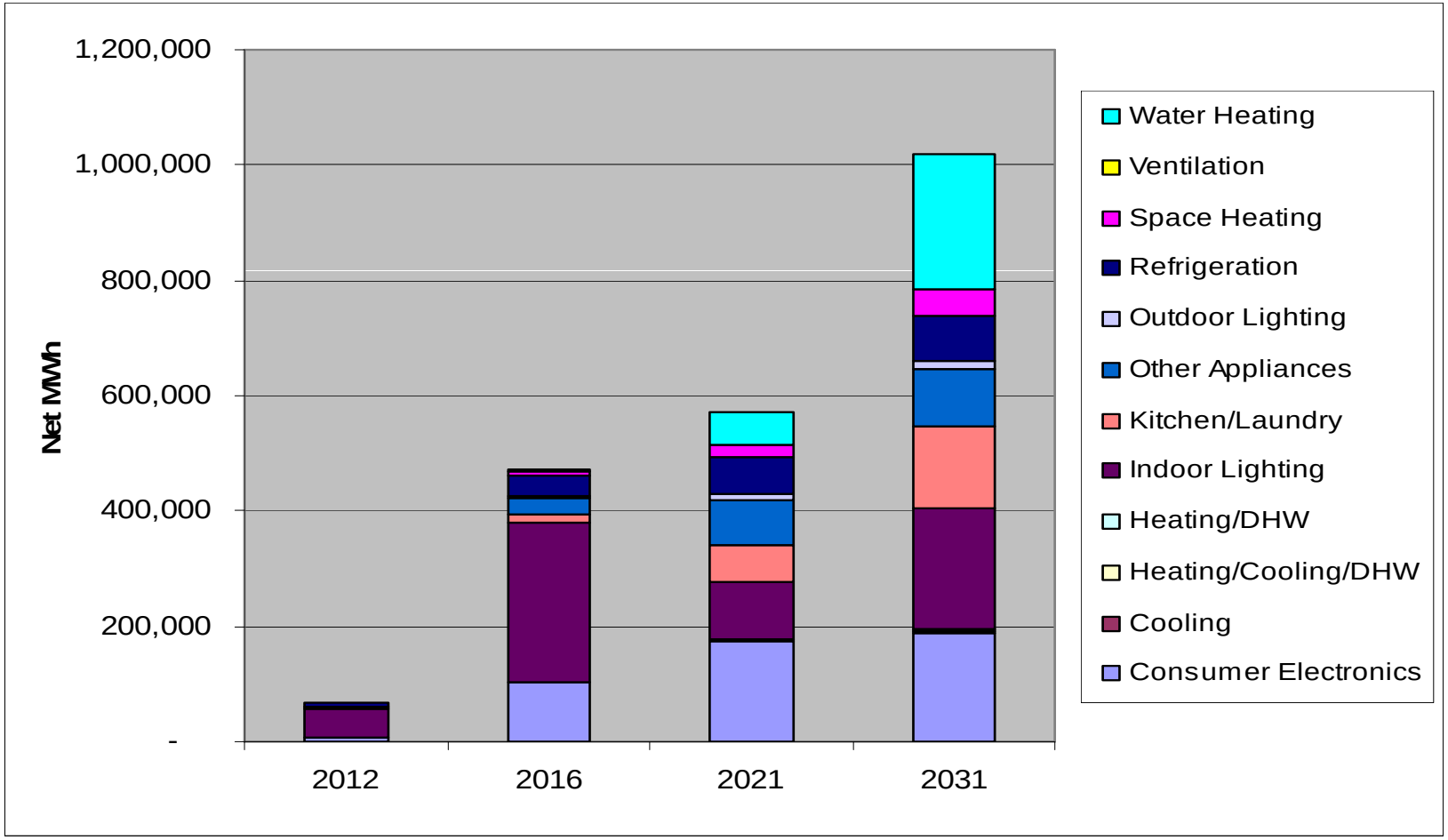

Residential Cumulative MWh Saved, by End Use

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End Use	2012	2016	2021	2031
Consumer Electronics	7,812	101,772	173,636	187,380
Cooling	85	1,079	2,936	5,352
Heating/Cooling/DHW	28	200	572	1,784
Heating/DHW	36	232	603	1,583
Indoor Lighting	48,839	275,644	98,537	208,909
Kitchen/Laundry	1,025	14,506	65,545	140,170
Other Appliances	2,064	28,866	77,365	101,939
Outdoor Lighting	987	5,221	11,124	12,402
Refrigeration	5,425	34,547	64,696	79,305
Space Heating	394	6,067	18,922	45,257
Ventilation	25	271	922	1,275
Water Heating	361	4,558	55,927	235,096

Residential Incremental Summer Peak MW Saved, by End Use

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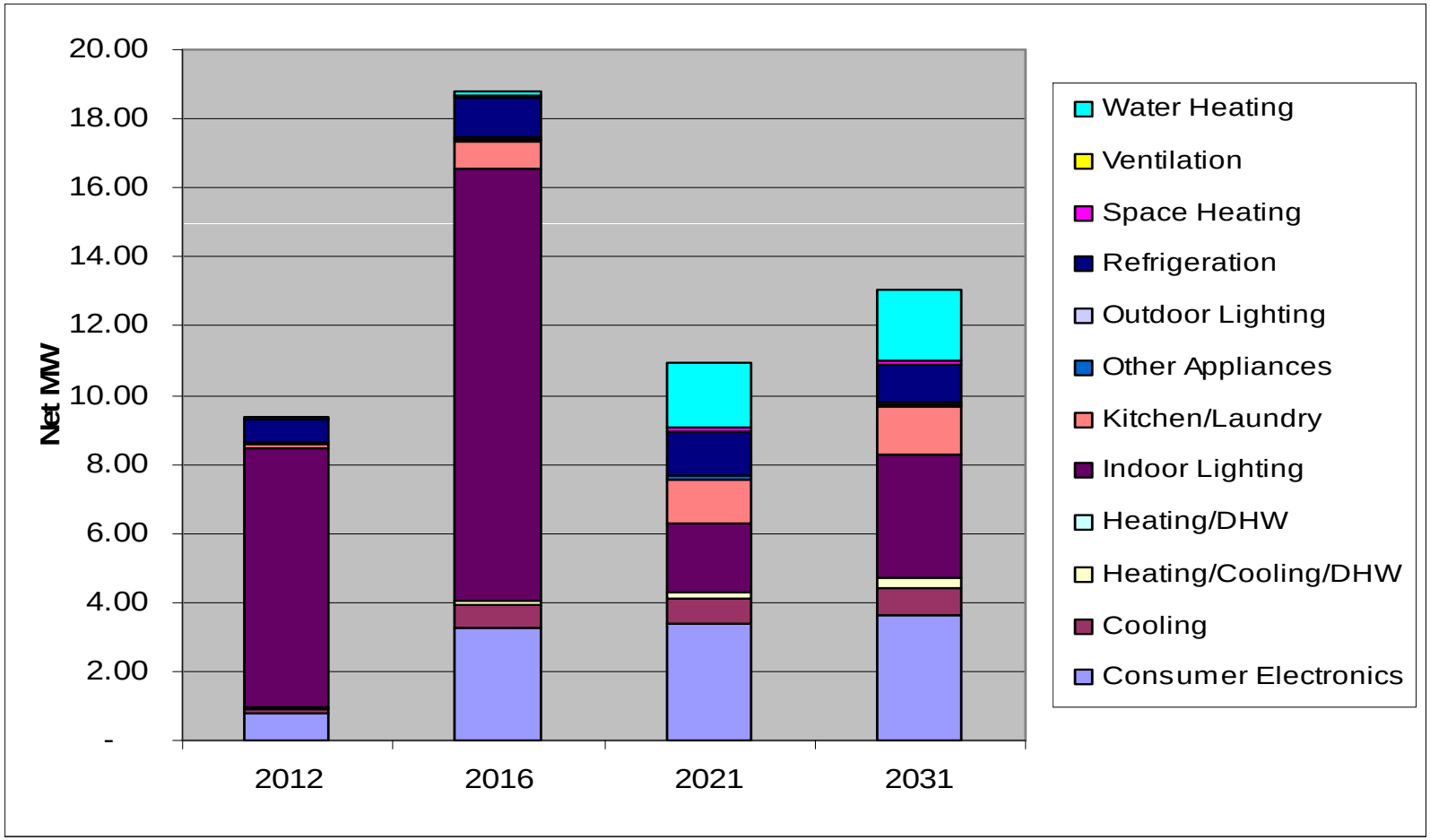

Residential Incremental Summer Peak MW Saved, by End Use

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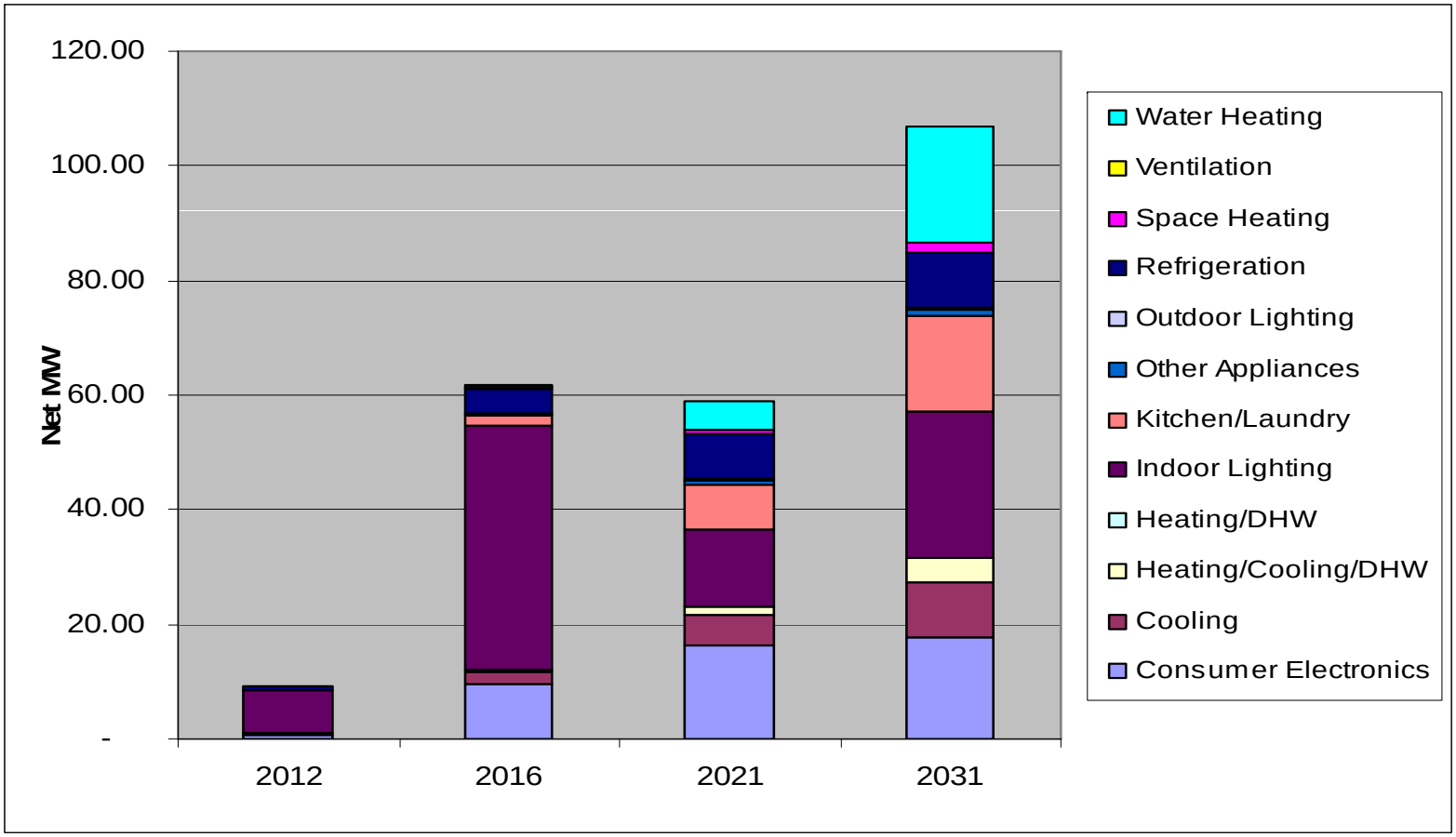
End Use	2012	2016	2021	2031
Consumer Electronics	0.76	3.28	3.40	3.61
Cooling	0.16	0.62	0.69	0.78
Heating/Cooling/DHW	0.06	0.12	0.17	0.31
Heating/DHW	-	-	-	-
Indoor Lighting	7.46	12.54	2.00	3.55
Kitchen/Laundry	0.13	0.77	1.31	1.39
Other Appliances	0.04	0.08	0.09	0.09
Outdoor Lighting	0.01	0.02	0.02	0.03
Refrigeration	0.67	1.15	1.28	1.13
Space Heating	0.01	0.06	0.08	0.10
Ventilation	0.00	0.01	0.02	0.01
Water Heating	0.03	0.14	1.89	2.04

Residential Cumulative Summer Peak MW Saved, by End Use



Residential Cumulative Summer Peak MW Saved, by End Use

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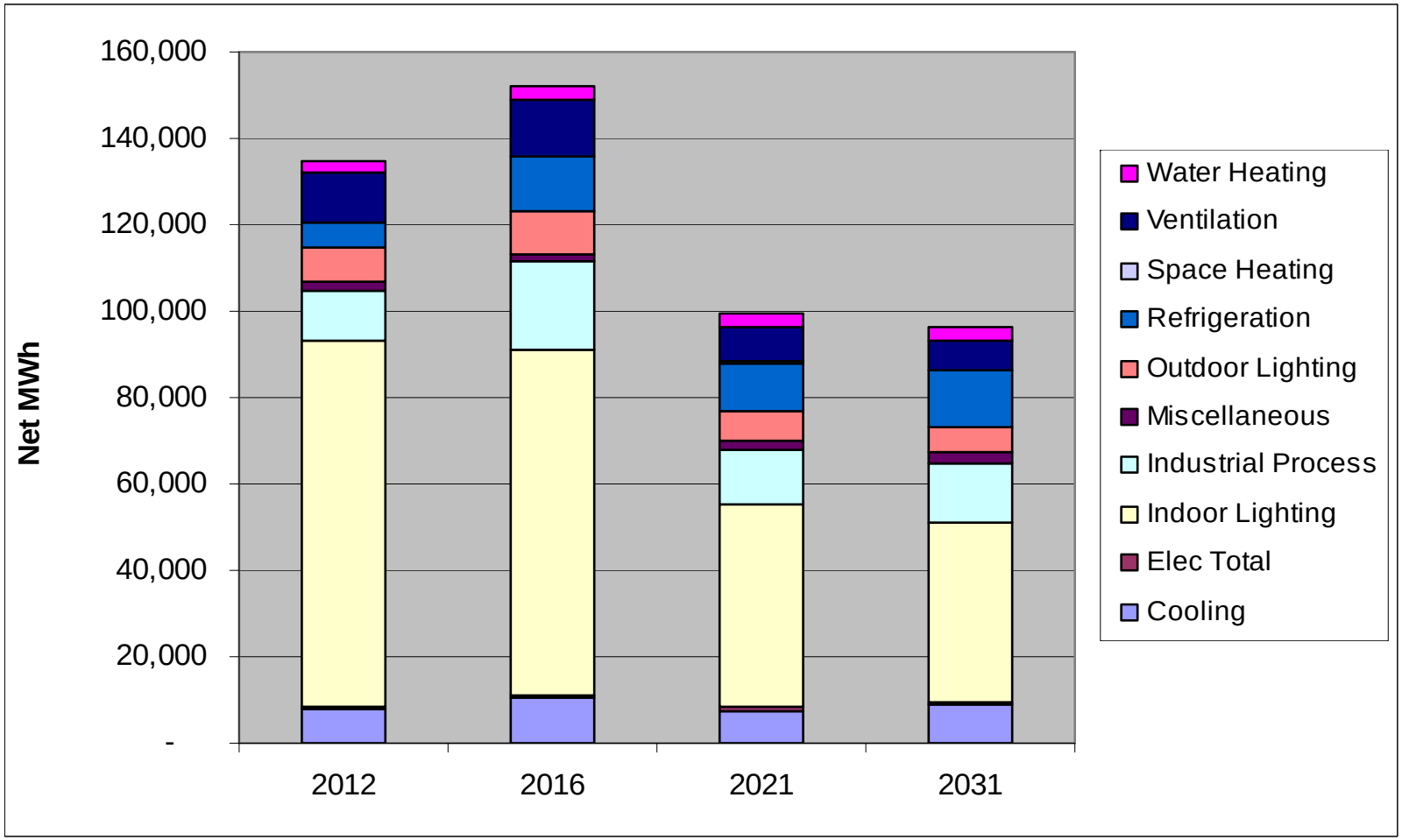
End Use	2012	2016	2021	2031
Consumer Electronics	0.76	9.69	16.49	17.75
Cooling	0.16	1.93	5.27	9.74
Heating/Cooling/DHW	0.06	0.46	1.31	4.10
Heating/DHW	-	-	-	-
Indoor Lighting	7.46	42.65	13.50	25.53
Kitchen/Laundry	0.13	1.79	7.90	16.86
Other Appliances	0.04	0.30	0.73	0.97
Outdoor Lighting	0.01	0.07	0.16	0.23
Refrigeration	0.67	4.28	8.02	9.83
Space Heating	0.01	0.16	0.54	1.46
Ventilation	0.00	0.03	0.11	0.15
Water Heating	0.03	0.40	4.83	20.10

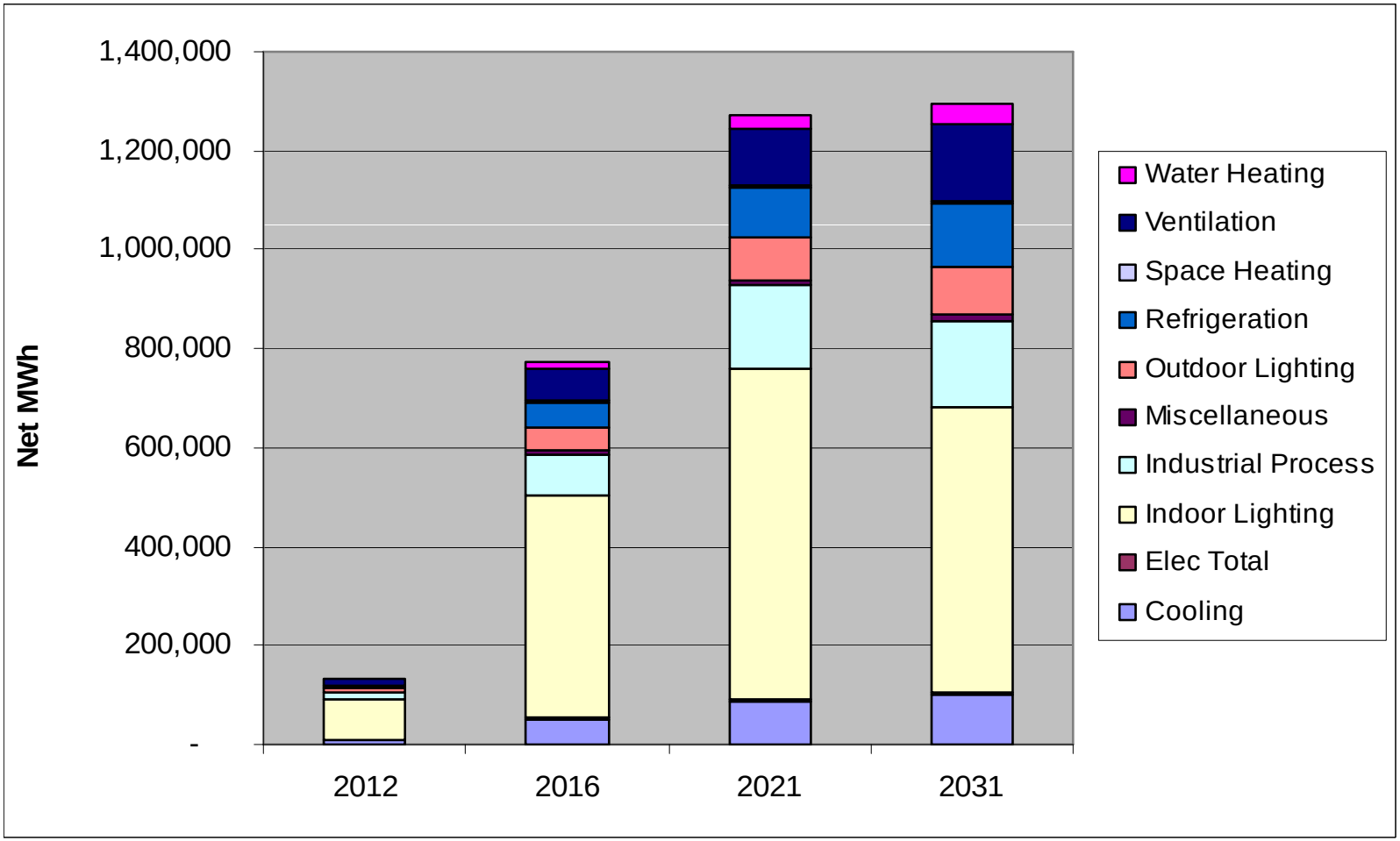
C&I Incremental MWh Saved, by End Use



C&I Incremental MWh Saved, by End Use

End Use	2012	2016	2021	2031
Cooling	8,148	10,475	7,553	8,769
Elec Total	445	711	666	650
Indoor Lighting	84,680	79,960	47,111	41,784
Industrial Process	11,718	20,391	12,645	13,411
Miscellaneous	1,623	1,808	1,890	2,550
Outdoor Lighting	8,056	10,032	6,890	5,983
Refrigeration	5,849	12,414	11,280	13,149
Space Heating	146	247	208	211
Ventilation	11,404	13,115	8,279	6,884
Water Heating	2,677	2,946	2,818	3,037

C&I Cumulative MWh Saved, by End Use



C&I Cumulative MWh Saved, by End Use

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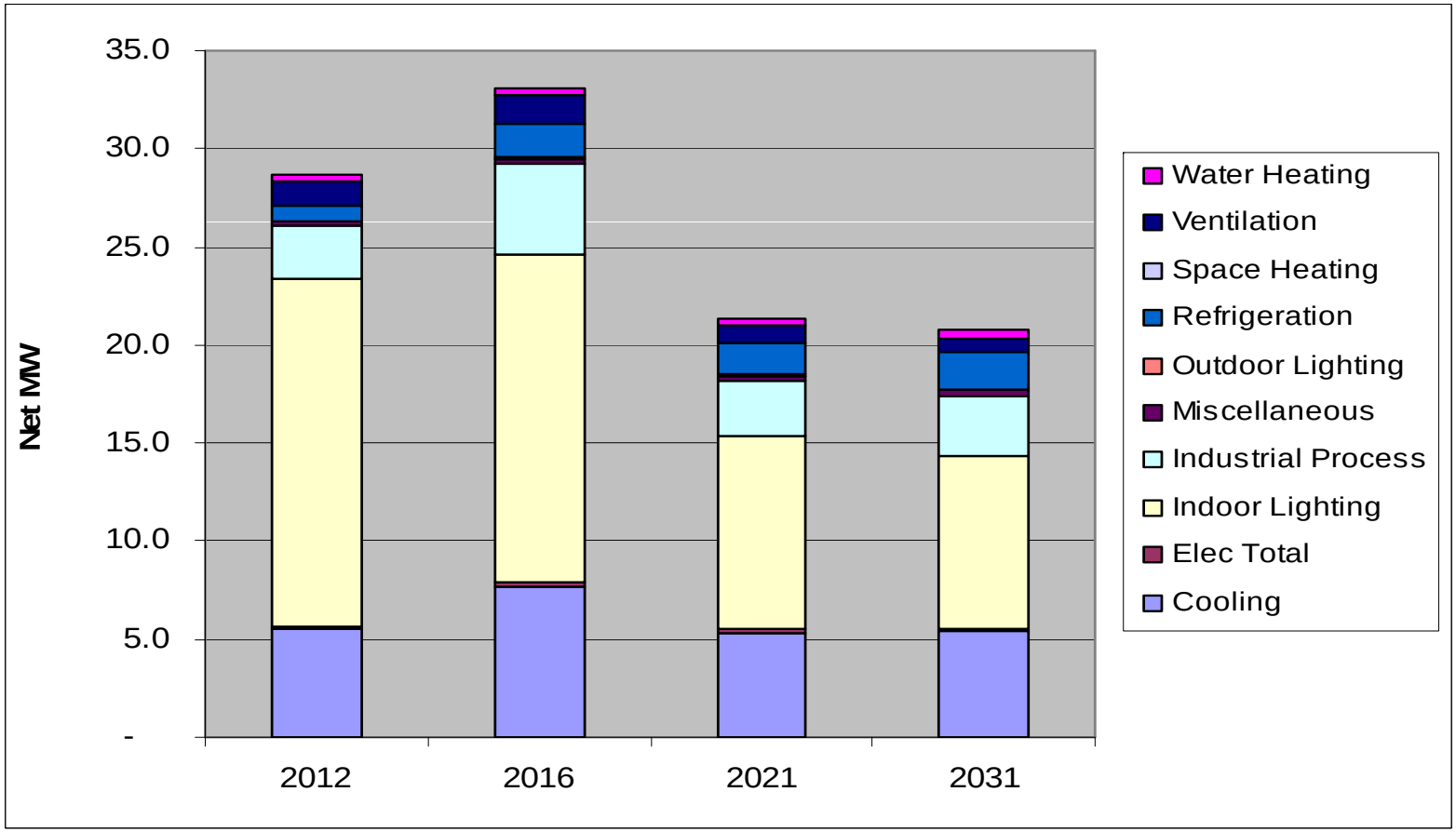
End Use	2012	2016	2021	2031
Cooling	8,148	52,523	84,707	98,398
Elec Total	445	3,019	5,087	5,161
Indoor Lighting	84,680	447,689	671,556	580,411
Industrial Process	11,718	83,480	166,913	172,230
Miscellaneous	1,623	9,797	10,709	14,430
Outdoor Lighting	8,056	45,790	84,669	92,813
Refrigeration	5,849	50,389	102,944	131,587
Space Heating	146	1,145	2,280	3,136
Ventilation	11,404	65,746	116,450	156,168
Water Heating	2,677	14,241	28,598	41,972

C&I Incremental Summer Peak MW Saved, by End Use



C&I Incremental Summer Peak MW Saved, by End Use

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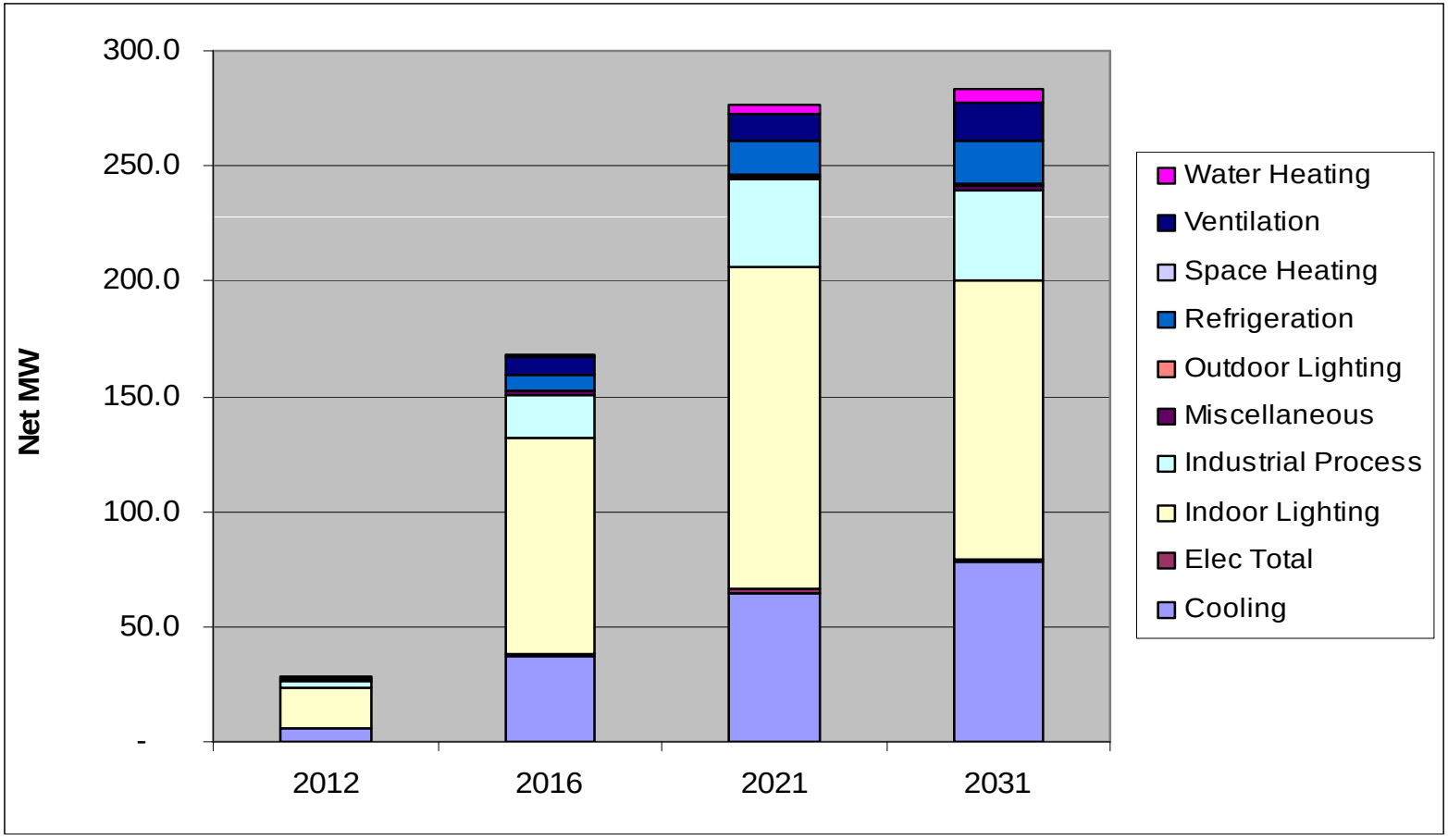
End Use	2012	2016	2021	2031
Cooling	5.5	7.7	5.3	5.4
Elec Total	0.1	0.2	0.2	0.2
Indoor Lighting	17.8	16.7	9.8	8.8
Industrial Process	2.7	4.7	2.9	3.1
Miscellaneous	0.2	0.2	0.2	0.3
Outdoor Lighting	0.1	0.1	0.1	0.0
Refrigeration	0.8	1.8	1.6	1.9
Space Heating	0.0	0.0	0.0	0.0
Ventilation	1.2	1.4	0.9	0.7
Water Heating	0.4	0.4	0.4	0.4

C&I Cumulative Summer Peak MW Saved, by End Use



C&I Cumulative Summer Peak MW Saved, by End Use

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End Use	2012	2016	2021	2031
Cooling	5.5	37.5	64.7	77.7
Elec Total	0.1	0.7	1.2	1.3
Indoor Lighting	17.8	93.6	139.9	120.9
Industrial Process	2.7	19.1	38.1	39.3
Miscellaneous	0.2	1.2	1.4	1.9
Outdoor Lighting	0.1	0.4	0.7	0.8
Refrigeration	0.8	7.2	14.7	18.9
Space Heating	0.0	0.0	0.0	0.0
Ventilation	1.2	6.9	12.1	16.5
Water Heating	0.4	1.9	3.8	5.6

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Benefit–Cost Analysis

Benefits 2012 – 2031

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Program	PV of Societal Benefits ($M)	PV of Electric Energy System Benefits ($M)
Residential		
Residential New Construction	$174	$24
Retail Products	$1,108	$851
Existing Homes	$218	$126
Low Income (SF and MF)	$18	$10
Sub-Total Residential	***$1,518***	***$1,012***
Commercial & Industrial		
C&I New Construction	$326	$280
C&I Efficient Equipment	$873	$796
C&I Retrofit	$881	$765
Sub-Total C&I	***$2,081***	***$1,841***
EVT Core Supporting Services	-	-
Portfolio of Programs	**$3,599**	**$2,852**

Costs 2012 – 2031

VERMONT ENERGY INVESTMENT CORPORATION

Program	PV of Societal Costs ($M)	PV of Electric Energy System Costs ($M)
Residential		
Residential New Construction	$64	$64
Retail Products	$208	$291
Existing Homes	$76	$118
Low Income (SF and MF)	$10	$17
Sub-Total Residential	***$359***	***$491***
Commercial & Industrial		
C&I New Construction	$145	$118
C&I Efficient Equipment	$322	$232
C&I Retrofit	$358	$391
Sub-Total C&I	***$825***	***$741***
EVT Core Supporting Services	$303	$303
Portfolio of Programs	**$1,487**	**$1,535**

Societal Net Benefits & Benefit-Cost Ratios

VERMONT ENERGY INVESTMENT CORPORATION

Program	PV of Net Benefits ($M)	Benefit-Cost Ratio
Residential		
Residential New Construction	$110	2.71
Retail Products	$900	5.33
Existing Homes	$142	2.86
Low Income (SF and MF)	$7	1.73
Sub-Total Residential	***$1,160***	***4.23***
Commercial & Industrial		
C&I New Construction	$181	2.25
C&I Efficient Equipment	$551	2.71
C&I Retrofit	$523	2.46
Sub-Total C&I	***$1,256***	***2.52***
EVT Core Supporting Services*	($303)	-
Portfolio of Programs	**$2,113**	**2.42**

* Because societal costs are negative, BCR is meaningless

Electric System Net Benefits & Benefit-Cost Ratios

VERMONT ENERGY INVESTMENT CORPORATION

Program	PV of Net Benefits ($M)	Benefit-Cost Ratio
Residential		
Residential New Construction	($40)	0.38
Retail Products	$560	2.92
Existing Homes	$9	1.07
Low Income (SF and MF)	($7)	0.58
Sub-Total Residential	***$521***	***2.06***
Commercial & Industrial		
C&I New Construction	$163	2.38
C&I Efficient Equipment	$563	3.42
C&I Retrofit	$374	1.96
Sub-Total C&I	***$1,099***	***2.48***
EVT Core Supporting Services*	($303)	-
Portfolio of Programs	**$1,318**	**1.86**

* Because societal costs are negative, BCR is meaningless

Budget Projections 2012 – 2021

VERMONT ENERGY INVESTMENT CORPORATION

Millions of 2011$		Core Supporting Services				Remaining Budget for C&I and RES Markets		
Year	Total Portfolio Budget	Admin/ Mgmt	Marketing, Outreach & Bus. Dev.	NRA Activities	Total Core Supporting Services	Total C&I and RES	C&I Sector Budget	RES Sector Budget
2012	$109.1	$3.2	$13.3	$4.9	$21.3	$87.8	$68.9	$18.8
2013	$137.2	$3.2	$16.7	$5.1	$24.9	$112.3	$85.4	$26.9
2014	$155.3	$3.2	$18.9	$5.2	$27.2	$128.1	$92.5	$35.6
2015	$164.9	$3.2	$20.0	$4.8	$28.0	$136.9	$88.6	$48.3
2016	$163.9	$3.2	$19.9	$5.1	$28.2	$135.7	$81.1	$54.6
2017	$164.3	$3.2	$20.0	$5.2	$28.4	$136.0	$71.3	$64.7
2018	$159.5	$3.2	$19.4	$5.1	$27.7	$131.9	$66.5	$65.3
2019	$152.3	$3.2	$18.5	$5.4	$27.1	$125.2	$63.4	$61.8
2020	$130.0	$3.2	$15.7	$5.5	$24.4	$105.6	$58.4	$47.3
2021	$126.3	$3.2	$15.4	$5.4	$23.9	$102.4	$54.6	$47.8

Budget Projections 2022 – 2031

VERMONT ENERGY INVESTMENT CORPORATION

Millions of 2011$		Core Supporting Services				Remaining Budget for C&I and RES Markets		
Year	Total Portfolio Budget	Admin/ Mgmt	Marketing, Outreach & Bus. Dev.	NRA Activities	Total Core Supporting Services	Total C&I and RES	C&I Sector Budget	RES Sector Budget
2022	$125.5	$3.2	$15.3	$5.8	$24.2	$101.4	$52.2	$49.2
2023	$125.9	$3.2	$15.3	$5.9	$24.3	$101.5	$50.9	$50.7
2024	$119.6	$3.2	$14.5	$5.7	$23.4	$96.2	$46.0	$50.1
2025	$122.2	$3.2	$14.9	$6.1	$24.1	$98.1	$47.0	$51.0
2026	$123.8	$3.2	$15.0	$6.2	$24.4	$99.4	$47.4	$52.0
2027	$123.6	$3.2	$15.0	$6.1	$24.3	$99.4	$48.7	$50.7
2028	$127.2	$3.2	$15.5	$6.5	$25.1	$102.1	$50.3	$51.8
2029	$130.8	$3.2	$15.9	$6.6	$25.6	$105.1	$52.1	$53.0
2030	$132.3	$3.2	$16.1	$6.4	$25.7	$106.6	$54.2	$52.4
2031	$136.5	$3.2	$16.6	$6.8	$26.6	$109.9	$56.4	$53.5

VERMONT ENERGY
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Revisions to Analysis Presented on December 20, 2010

F20 Unconstrained Analysis REVISIONS

VERMONT ENERGY INVESTMENT CORPORATION

- VEIC accidentally retained the 2007 avoided costs used in the 2009 Forecast 20 analysis in the unconstrained savings forecast presented on December 20.
- The updated avoided costs approved by the Board in December 2009—and used by Efficiency Vermont in 2010 for program implementation—are substantially lower than the 2007 values mistakenly used in the original unconstrained analysis.
- VEIC has revised the unconstrained analysis using the 2009 avoided costs.

F20 Unconstrained Analysis REVISIONS

VERMONT ENERGY INVESTMENT CORPORATION

Reductions are especially significant in avoided generation capacity costs.

VEIC corrected this error by re-screening all efficiency measures.

- Most measures are still cost-effective at lower avoided costs.
- Others either are no longer cost-effective throughout the analysis period or they become cost-effective in later years.

VEIC also applied the revised real discount rate of 5.6%, recommended by the DPS (changed from 5.7%).

F20 Unconstrained Analysis REVISIONS

VERMONT ENERGY INVESTMENT CORPORATION

VEIC adjusted measure penetrations accordingly by

- removing measures no longer cost-effective, or
- postponing and lowering market penetration rates for measures that become cost-effective in later years.

VEIC re-screened all programs and entire portfolio for cost-effectiveness, and calculated new electricity savings.

Effects of lower avoided costs on measure cost-effectiveness and electricity savings are significant, particularly in the residential sector.

Annual Avoided Costs—Energy and Capacity

VERMONT ENERGY INVESTMENT CORPORATION

Difference between 2009 and 2007

Year	Winter On Peak Energy $/kWh	Winter Off Peak Energy $/kWh	Summer On-Peak $/kWh	Summer Off-Peak $/kWh	Summer Gener. Capacity $/kW-yr	T&D Capacity $/kW-yr
2012	(0.0130)	(0.0060)	(0.0179)	(0.0085)	(89.56)	(0.84)
2013	(0.0087)	0.0023	(0.0147)	(0.0000)	(110.46)	(0.84)
2014	(0.0102)	0.0028	(0.0133)	(0.0002)	(110.45)	(0.84)
2015	(0.0087)	0.0037	(0.0125)	(0.0007)	(108.99)	(0.84)
2016	(0.0097)	0.0027	(0.0118)	(0.0028)	(107.52)	(0.84)
2017	(0.0129)	0.0017	(0.0126)	0.0004	(107.50)	(0.84)
2018	(0.0065)	0.0047	(0.0100)	0.0010	(106.04)	(0.84)
2019	(0.0051)	0.0082	(0.0093)	0.0027	(106.02)	(0.84)
2020	(0.0080)	0.0052	(0.0124)	0.0018	(104.55)	(0.84)
2021	(0.0120)	0.0038	(0.0172)	0.0033	(103.08)	(0.84)
2022	(0.0131)	0.0046	(0.0167)	0.0023	(101.61)	(0.84)
2023	(0.0118)	0.0042	(0.0147)	0.0037	(100.14)	(0.84)
2024	(0.0086)	0.0047	(0.0106)	0.0072	(98.66)	(0.84)
2025	(0.0085)	0.0048	(0.0100)	0.0081	(84.10)	(0.84)
2026	(0.0084)	0.0049	(0.0094)	0.0091	(69.51)	(0.84)
2027	(0.0083)	0.0050	(0.0087)	0.0100	(54.90)	(0.84)
2028	(0.0082)	0.0051	(0.0081)	0.0111	(40.26)	(0.84)
2029	(0.0081)	0.0052	(0.0074)	0.0121	(25.60)	(0.84)
2030	(0.0080)	0.0053	(0.0066)	0.0132	(12.38)	(0.84)
2031	(0.0079)	0.0054	(0.0059)	0.0144	(12.28)	(0.84)
2032	(0.0078)	0.0055	(0.0051)	0.0155	(12.18)	(0.83)
2033	(0.0077)	0.0056	(0.0043)	0.0167	(12.08)	(0.83)
2034	(0.0076)	0.0057	(0.0034)	0.0180	(11.98)	(0.83)
2035	(0.0074)	0.0059	(0.0026)	0.0193	(11.87)	(0.83)
2036	(0.0073)	0.0060	(0.0017)	0.0207	(11.77)	(0.83)
2037	(0.0072)	0.0061	(0.0007)	0.0220	(11.67)	(0.83)
2038	(0.0070)	0.0062	0.0003	0.0235	(11.57)	(0.83)
2039	(0.0068)	0.0063	0.0013	0.0250	(11.47)	(0.83)
2040	(0.0067)	0.0065	0.0023	0.0265	(11.47)	(0.83)
2041	(0.0046)	0.0079	0.0055	0.0294	(11.47)	(0.83)

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Major Drivers of Long-term Changes in Opportunities

Codes & Standards: Short Term

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- DOE reviewing ASHRAE 90.1-2004
- ASHRAE 90.1-2007 available now
- Vermont standards (9 V.S.A § 2791) include:
  - Metal halide lamp fixtures
  - State regulated incandescent reflector lamps
  - Residential furnaces and residential boilers

Codes & Standards: Long Term

VERMONT ENERGY INVESTMENT CORPORATION

- DOE seeking 1 – 2% annual efficiency improvement (20 – 40% change by 2028)
- Potential adoption of regional standards
- Changes in impact from:
  - New and / or expanded standards and service
  - Better enforcement of codes
  - Expanded codes

Savings Due to Codes & Standards

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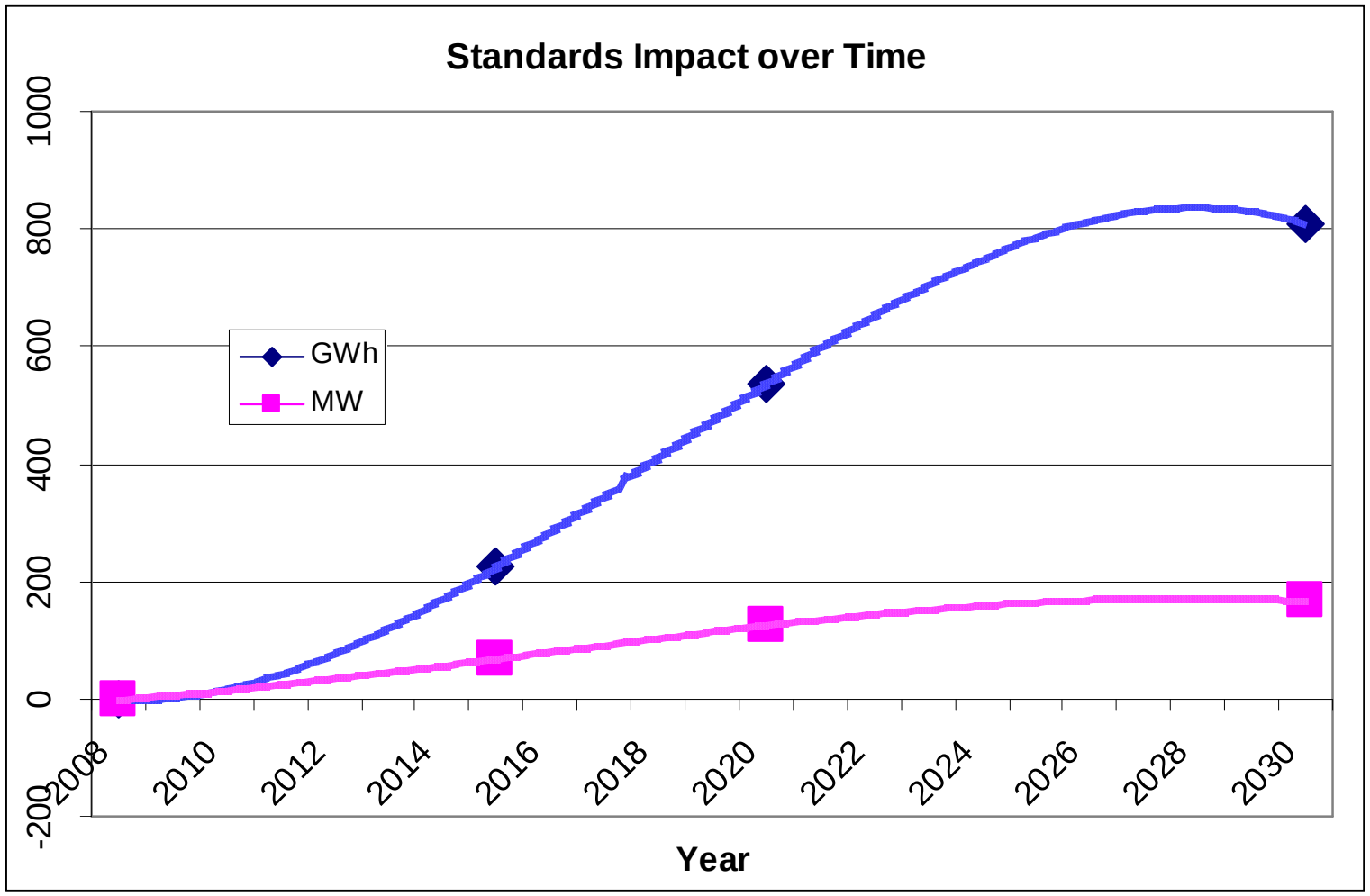

Decline of Savings from Compact Fluorescent Lamps

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2012 – 2020

- First tier of new federal lighting standard
- Incentives for specialty CFLs only (dimmers, three-way, etc.)

After 2020

- Second tier of federal lighting standards
- CFLs are baseline

Rise of Solid-state Lighting

VERMONT ENERGY INVESTMENT CORPORATION

- LEDs and Organic LEDs
- "New Frontier"
  - Highly efficient (eclipsing current technology)
  - Extremely long life
- Barriers exist, but are constantly shifting
  - Cost (high but falling)
  - Compatibility (new screw-in lamps coming to market)

Rebatable CFLs vs. SSL

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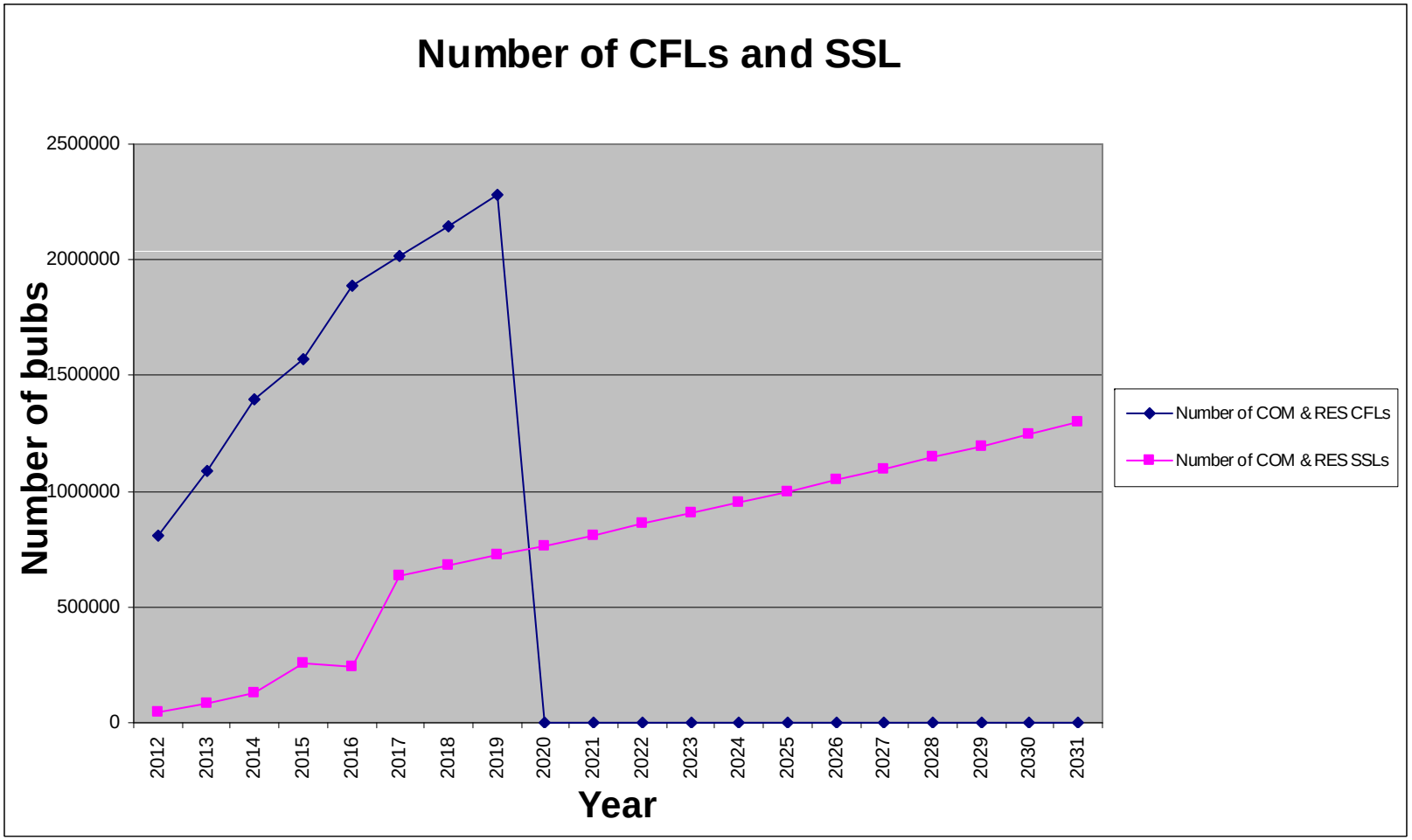
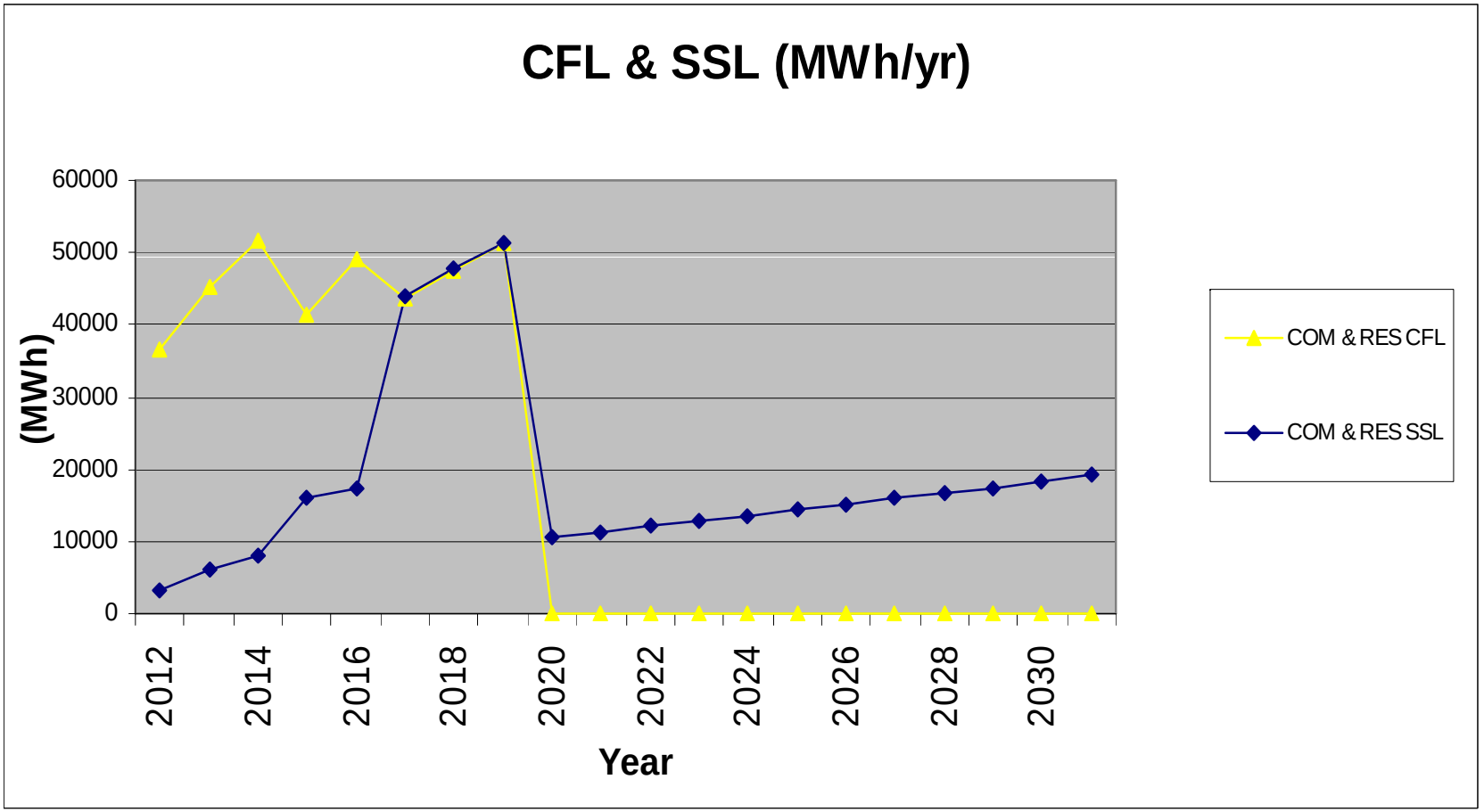


Savings from CFLs vs. SSL

VERMONT ENERGY INVESTMENT CORPORATION



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Issues

Baseline Household Lighting Energy Use, After 2020

VERMONT ENERGY INVESTMENT CORPORATION

Inconsistency persists between post-2020 baseline household lighting energy use intensities:

- Steep drop in lighting efficiency savings forecast because CFLs become baseline
- Itron EUIs continue gradual decline implying continued prevalence of incandescent

Baseline Household Lighting Energy Use, After 2020

VERMONT ENERGY INVESTMENT CORPORATION

Two options:

- VEIC develops an adjustment to be applied to post-2020 sales forecast when applying unconstrained residential maximum achievable savings
- Itron departs from EIA projections and builds discontinuity into its post-2020 sales peak demand forecasts

Avoided Costs Matter

VERMONT ENERGY INVESTMENT CORPORATION

The inadvertent use of the 2007 avoided costs forced an early analysis of the sensitivity of efficiency measure cost-effectiveness to changes in avoided costs

Lower avoided energy, and especially capacity costs:

- Rendered some measures cost-ineffective throughout the forecast period
- Delayed the point at which some measures become cost-effective
- Ultimately lowered the amount of cost-effectively achievable savings over the next 20 years, especially in the residential sector.