memo

To: Natelle Dietrich, PSC; Brenda Wilbers, DNR
From: Tom Franks
Date: December 13, 2010
Copy: Fred Coito & Kristina Kelly, KEMA; Gwen Mizell, GSM Development
Subject: High Level Memo on Technical and Economic Potential

This memorandum contains a summary of the findings from the analysis of technical and economic savings potential of natural gas and electric energy efficiency efforts in Missouri. Technical potential is defined as the complete penetration of all measures analyzed in applications where they were deemed technically feasible from an engineering perspective. Economic potential is defined as the technical potential of those energy conservation measures that are cost-effective when compared to supply-side alternatives. The analysis of achievable potential, which has a wide range of definitions and naming conventions, will be the next phase for this project.

Missouri Statewide Potential Study
Technical and Economic Potential High Level Summary

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Snapshot Results

KEMA analyzed technical and economic potential under three different avoided costs scenarios. The base avoided cost scenario is based on the values approved by the PSC in letter dated November 16, 2010. Avoided costs for the low and high scenarios are 20% less and 50% more than the base scenario, respectively. Table 1 below summarizes both the findings and the differences between the avoided cost scenarios.

Table 1 - Avoided Cost Scenario Summary

Summary of Potential at Three Avoided Cost Scenarios					
		Techical Potential	Economic - High	Economic - Base	Economic - Low
Electric					
GWh	% of base consumption	40%	31%	29%	28%
	% of Economic - Base Avoided Cost		108%	100%	96%
MW	% of base consumption	41%	33%	31%	31%
	% of Economic - Base Avoided Cost		105%	100%	98%
Natural Gas					
	% of base consumption	38%	27%	22%	20%
	% of Economic - Base Avoided Cost		125%	100%	90%

Electric Energy-Efficiency Potential Results

In this section, we present the technical and economic potential results for all electric measures considered in the study.

Overall Technical and Economic Potential

Figure 1 presents our overall estimates of total technical and economic potential for electrical energy and peak-demand savings for Missouri. The values of both energy savings and peak-demand reductions are incorporated in the TRC test.

- **Energy Savings.** Technical potential is estimated at 38,012 GWh per year, and economic potential at 27,783 GWh per year by 2020 (about 40 and 29 percent of base 2020 usage, respectively).

- **Peak-Demand Savings.** Technical potential is estimated at 10,881 MW, and economic potential at 8,313 MW by 2020 (about 41 and 31 percent of base 2020 demand, respectively).

Note that the technical and economic potentials include the effect of CFLs, although federal lighting standards may preempt much of the CFL potential that might otherwise be achieved through programs. This is eventuality is accommodated in the analysis of achievable potential.

Figure 1-Estimated Electric Technical and Economic Potential, 2020

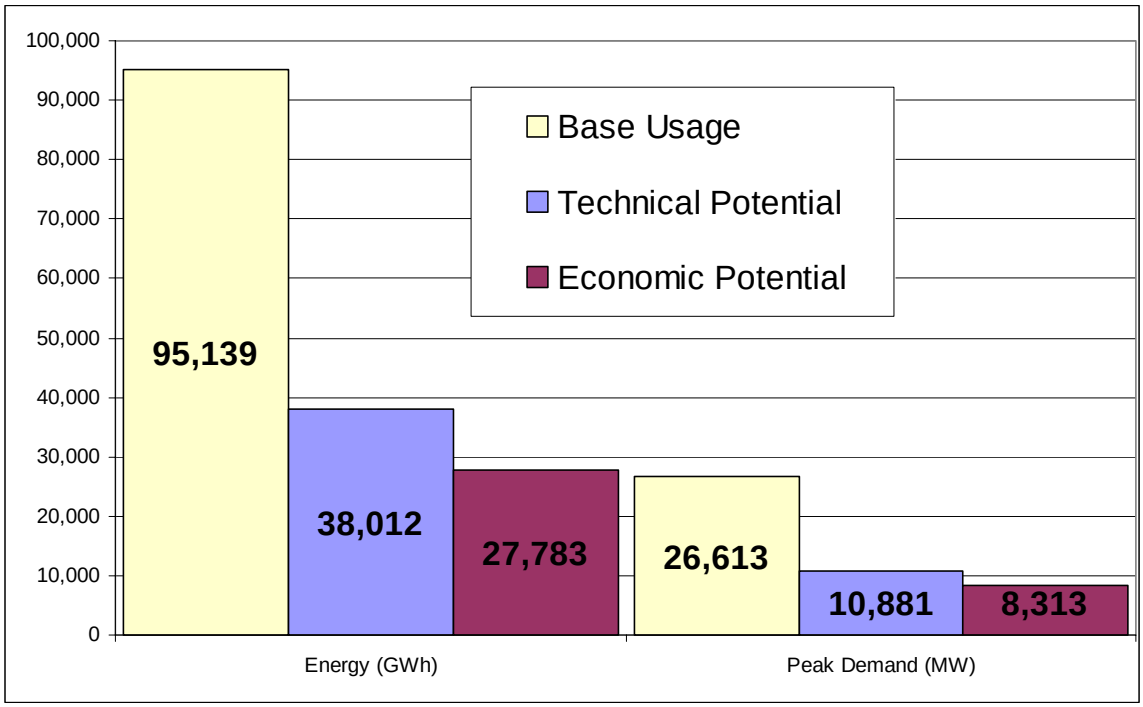


Table 2 - Estimated Electric Technical and Economic Potential, 2020

	Base	Technical	Economic
Energy Savings Potential (GWh)	95,138.89	38,011.95	27,783.00
Peak Demand Potential (MW)	26,613.45	10,880.97	8,313.26

Technical and Economic Potential Detail

In this subsection, we explore technical and economic potential in more detail, looking at potentials by sector and by end use.

Potentials by Sector

Figure 2 and Figure 3 show estimates of technical- and economic-energy and demand savings potential by sector.

As shown in Figure 5 and Figure 6, the commercial sector has a slightly higher energy savings potential in relation to base energy use than does the residential sector. The estimated savings fraction is lowest for the industrial sector at around 17 percent for technical and 14 percent for economic savings. In peak demand, residential is somewhat higher than commercial as a percent of base energy. Industrial is again significantly lower.

Figure 4 shows the same data in a different format. Figure 5 and Figure 6 show the same potentials as a percentage of 2020 base energy and base peak demand.

The residential sector provides the largest contribution to technical potential for energy savings and peak demand, accounting for 49 and 67 percent of these potentials, respectively. The commercial sector also contributes significantly to the energy technical potential (43 percent of the total), but contributes much less to the peak-demand technical potential (29 percent). In terms of economic energy potential, residential and commercial are almost equal at 45 percent of potential, with commercial contributing only slightly more. Commercial is again a less significant contributor to peak-demand potential, contributing 26 percent of economic peak-demand savings, compared to 70 percent for residential.

Figure 2
Technical and Economic Potential (2020)
Energy Savings by Sector—GWh per Year

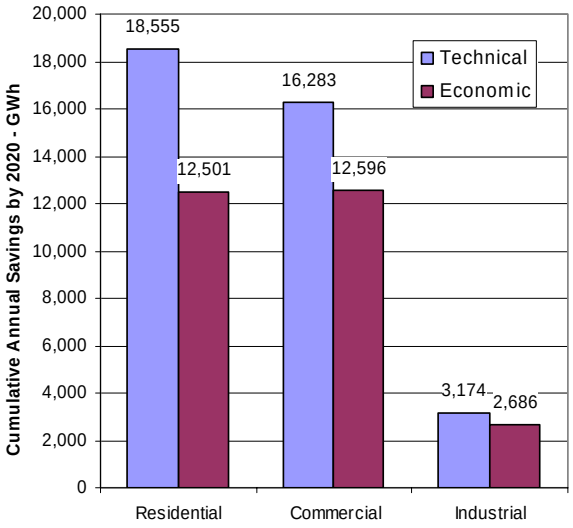


Figure 3
Technical and Economic Potential (2020)
Demand Savings by Sector—MW

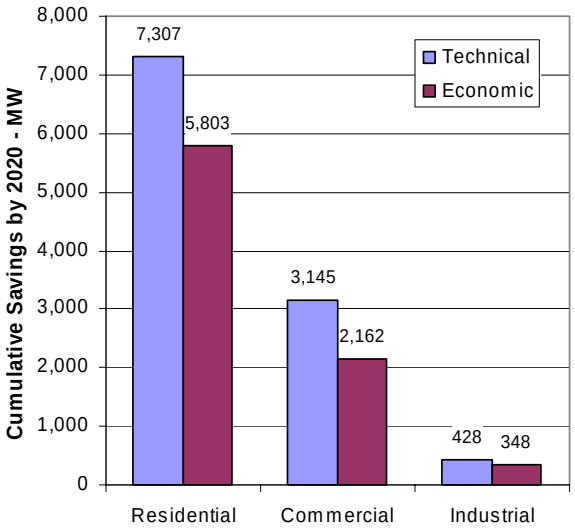


Table 3 - Technical and Economic Potential (2020) Energy and Demand Savings by Sector

	GWh			MW		
	Base GWh	Technical	Economic	Technical	Economic	Base MW
Residential	41,534	18,555	12,501	7,307	5,803	16,216
Commercial	35,019	16,283	12,596	3,145	2,162	7,572
Industrial	18,586	3,174	2,686	428	348	2,826
Total	95,139	38,012	27,783	10,881	8,313	26,613

As shown in Figure 5 and Figure 6, the commercial sector has a slightly higher energy savings potential in relation to base energy use than does the residential sector. The estimated savings fraction is lowest for the industrial sector at around 17 percent for technical and 14 percent for economic savings. In peak

demand, residential is somewhat higher than commercial as a percent of base energy. Industrial is again significantly lower.

Figure 4
Technical and Economic Potential (2020)
Energy and Peak-Demand Savings Shares by Sector—GWh per Year

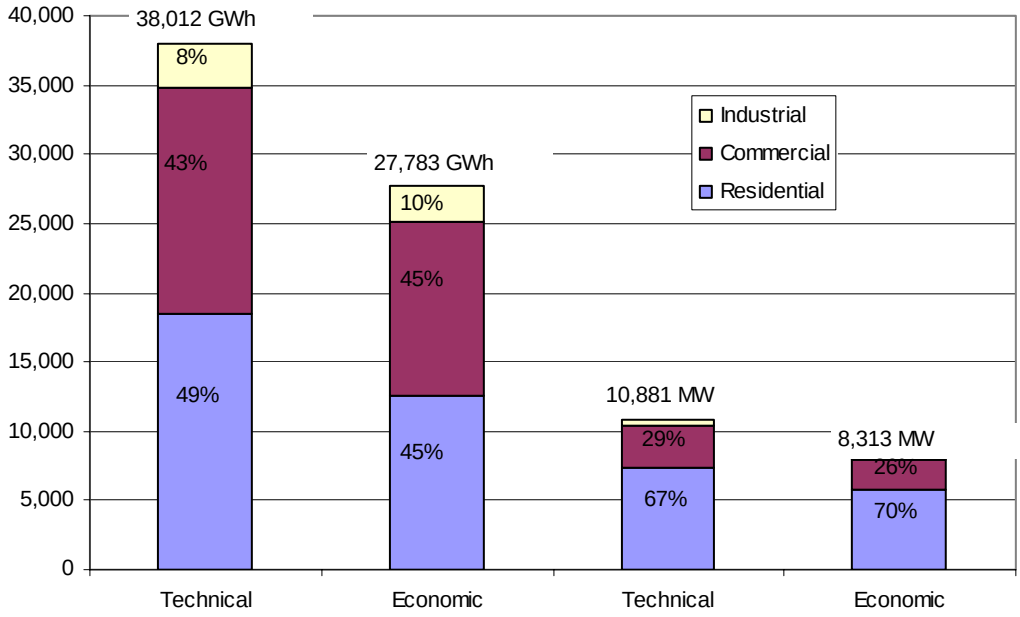


Figure 5
Technical and Economic Potential (2020)
Percentage of Base Energy Use

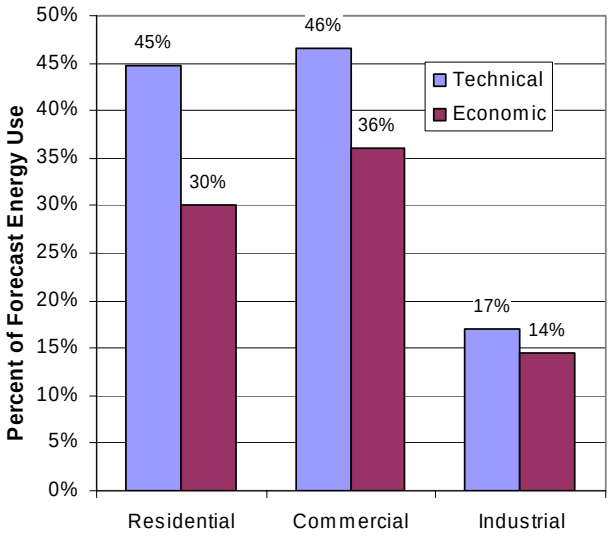


Figure 6
Technical and Economic Potential (2020)
Percentage of Base Peak Demand

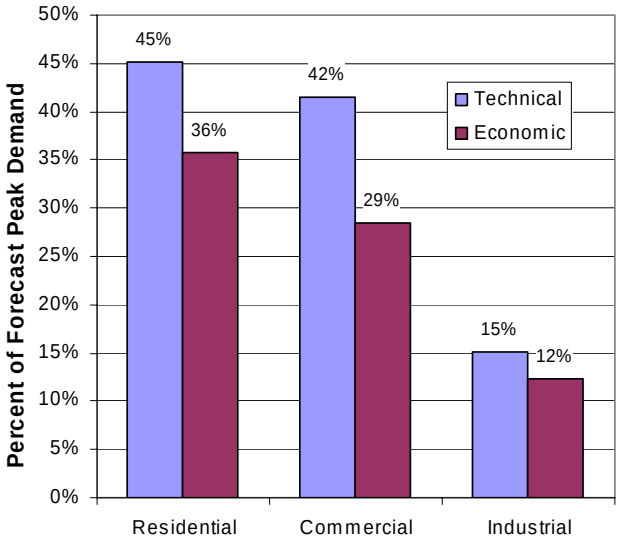


Table 4 - Technical and Economic Potential (2020)
Percentage of Base Energy Use and Base Peak Demand

Potentials by Building Type

	GWh		MW	
	Technical	Economic	Technical	Economic
Residential	45%	30%	45%	36%
Commercial	46%	36%	42%	29%
Industrial	17%	14%	15%	12%
Total	40%	29%	41%	31%

Figure 7 and Figure 8 show the potentials in the residential sector by building type. Single-family homes account for about 84 percent of the potential, and low-income homes account for about one-quarter of the potential.

Figure 7
Residential Energy-Savings Potential by Building Type (2020)

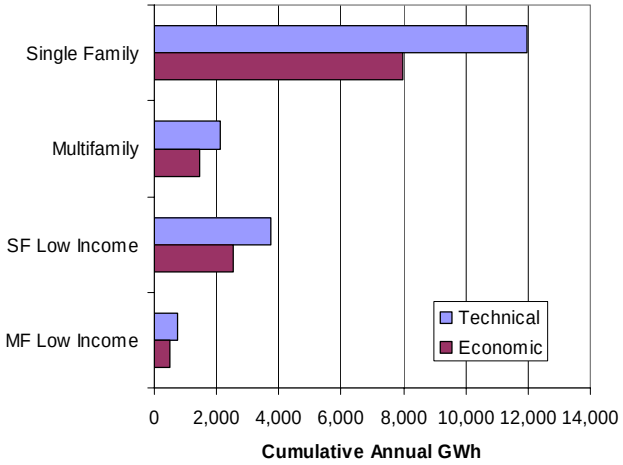


Figure 8
Residential Demand-Savings Potential by Building Type (2020)

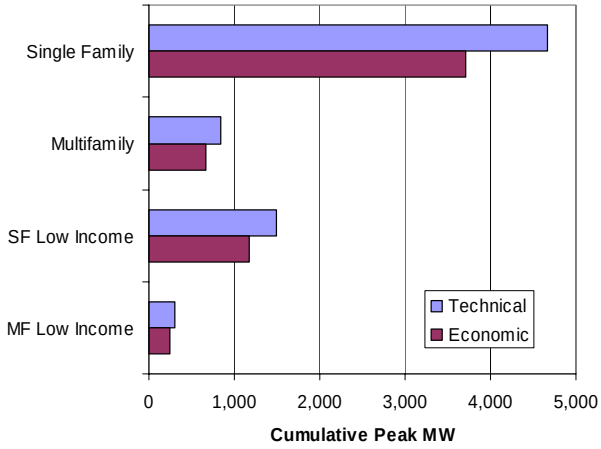


Table 5 - Residential Energy and Demand Savings Potential by Building Type (2020)

	GWh		MW	
	Technical	Economic	Technical	Economic
Single Family	11,960	7,982	4,666	3,704
Multifamily	2,134	1,455	838	673
SF Low Income	3,726	2,554	1,494	1,178
MF Low Income	735	510	309	249

Figure 9 and Figure 10 show the building-type breakdown of commercial potential. Offices account for about 44 percent of the economic energy potential, followed by health, miscellaneous commercial buildings and retail.

Figure 9
Commercial Economic Energy-Savings Potential by Building Type (2010)

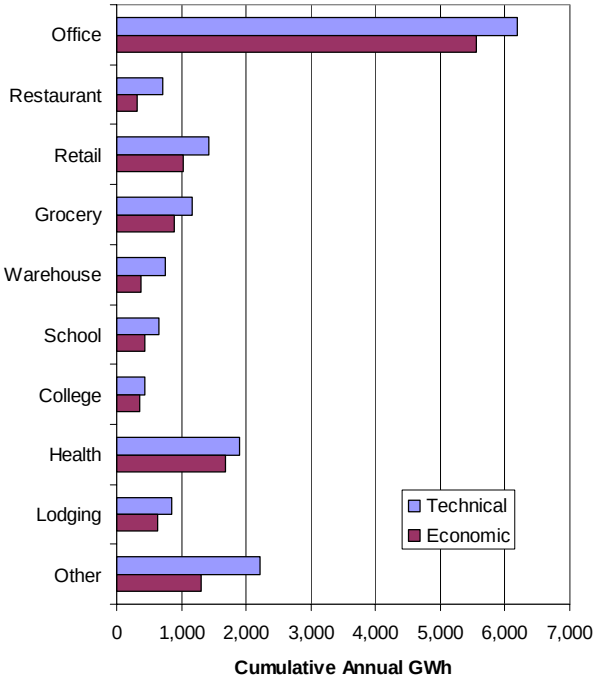


Figure 10
Commercial Economic Demand-Savings Potential by Building Type (2010)

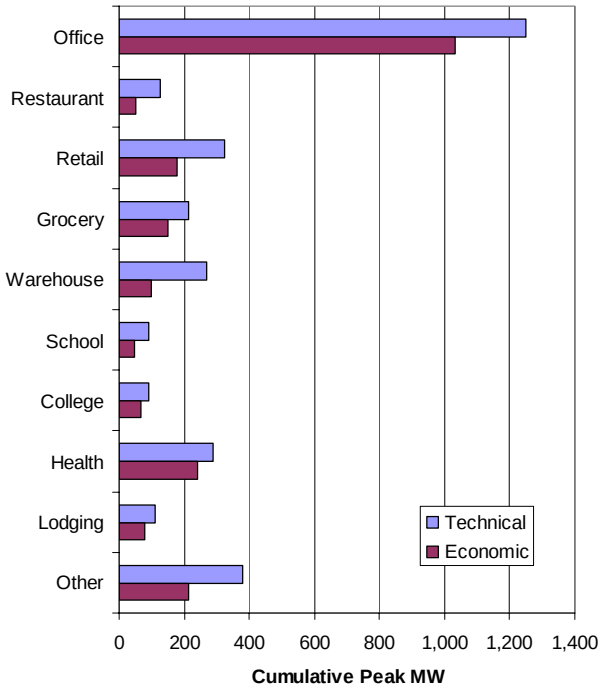


Table 6 – Commercial Energy and Demand Savings Potential by Building Type (2010)

	GWh		MW	
	Technical	Economic	Technical	Economic
Office	6,192	5,547	1,248	1,033
Restaurant	702	320	128	53
Retail	1,421	1,034	325	177
Grocery	1,166	897	213	150
Warehouse	747	370	268	97
School	644	436	89	48
College	445	358	91	67
Health	1,895	1,684	290	243
Lodging	849	640	112	80
Other	2,223	1,310	380	214

Figure 11 and Figure 12 show the business-type breakdown of industrial potential. Key industries in terms of economic potential include chemicals, paper, food processing, and primary metals.

Figure 11
Industrial Economic Energy-Savings Potential by Business Type (2020)

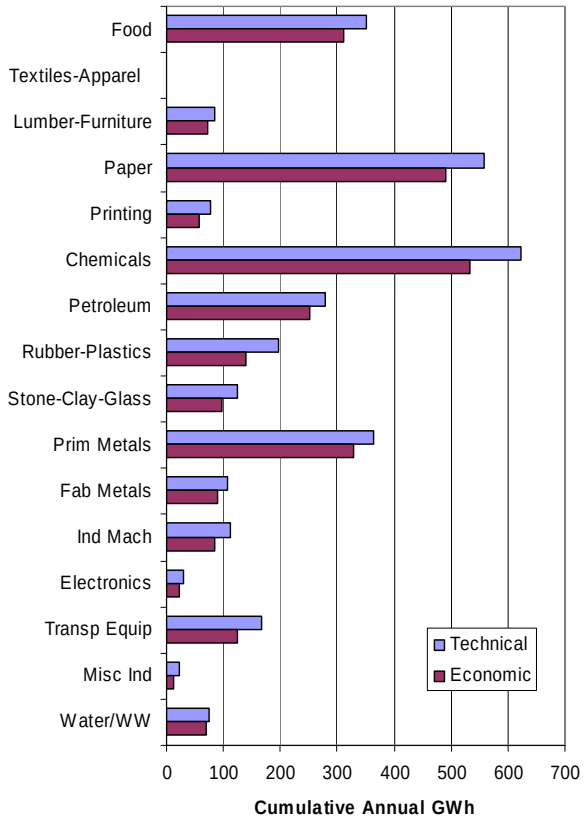


Figure 12
Industrial Economic Demand-Savings Potential by Business Type (2020)

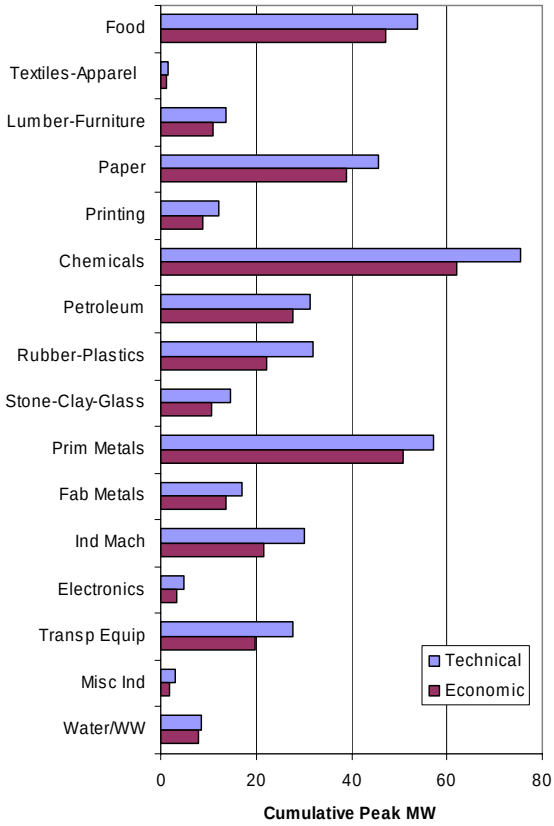


Table 7 – Industrial Energy and Demand Savings Potential by Building Type (2010)

	GWh		MW	
	Technical	Economic	Technical	Economic
Food	352	312	54	47
Textiles-Apparel	3	2	1	1
Lumber-Furniture	85	71	14	11
Paper	557	490	46	39
Printing	78	58	12	9
Chemicals	623	534	75	62
Petroleum	278	251	31	28
Rubber-Plastics	197	139	32	22
Stone-Clay-Glass	124	97	14	11
Prim Metals	364	329	57	51
Fab Metals	107	89	17	14
Ind Mach	111	83	30	22
Electronics	31	21	5	3
Transp Equip	166	125	28	20
Misc Ind	22	13	3	2
Water/WW	76	71	8	8

Potentials by End Use

Figure 13 and Figure 14 show the end-use breakdown of technical and economic potential in the residential sector. Figure 15 and Figure16 show the share each end use contributes to the economic potential for both energy and demand savings. Energy savings potential is split fairly evenly among the lighting and cooling end uses, followed by space heating and furnace fans. Water heating ranks high in technical, but not in economic energy potential. Cooling accounts for most of the peak-demand savings potential, since very little lighting is used on warm summer afternoons. Whole-building new construction measures also account for significant amounts of both energy and peak-demand potential.

Figure 13
Residential Technical and Economic Energy-Savings Potential by End Use (2020)

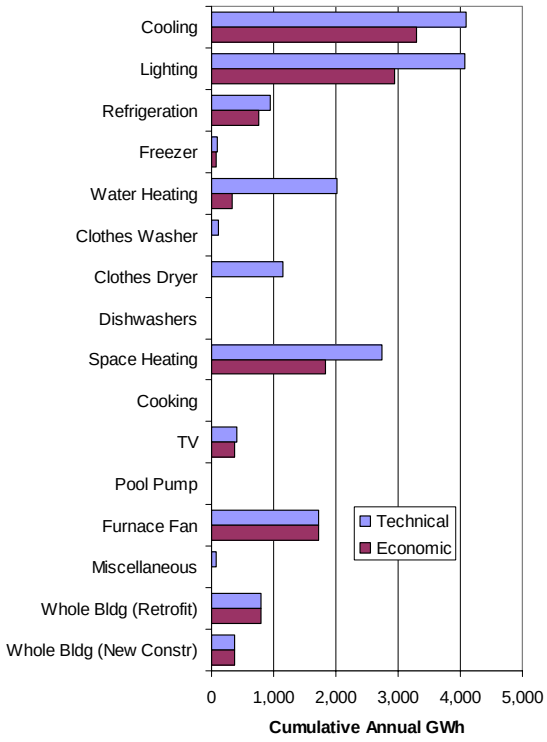


Figure 14
Residential Technical and Economic Demand-Savings Potential by End Use (2020)

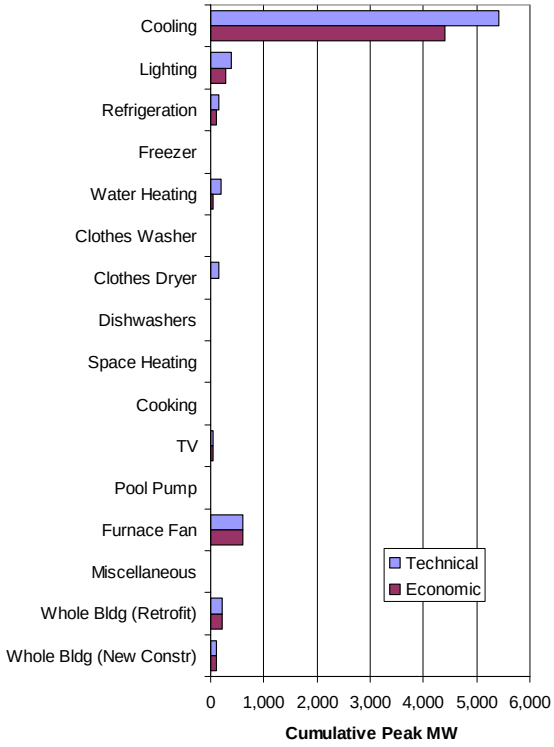


Figure 15
Residential Economic Energy-Savings Potential by End Use (2020)

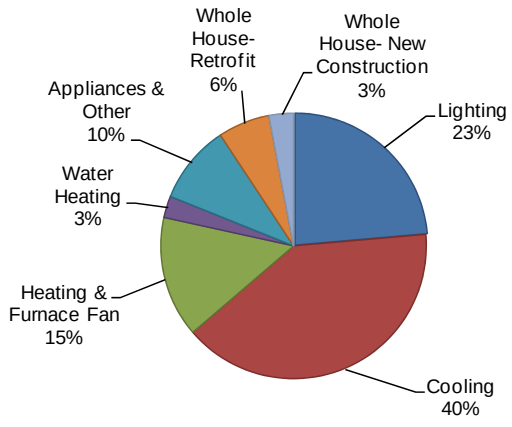


Figure 16
Residential Economic Demand-Savings Potential by End Use (2020)

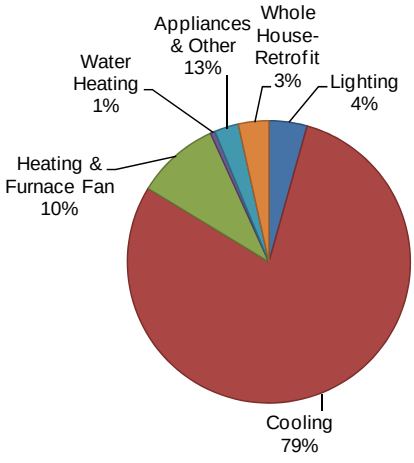


Table 8 - Residential Energy and Demand Savings Potential by End Use (2020)

	GWh		MW	
	Technical	Economic	Technical	Economic
Cooling	4,087	3,301	5,423	4,399
Lighting	4,076	2,951	380	275
Refrigeration	942	765	142	115
Freezer	86	70	13	11
Water Heating	2,009	329	201	34
Clothes Washer	106	0	15	0
Clothes Dryer	1,140	0	151	0
Dishwashers	0	0	0	0
Space Heating	2,742	1,839	0	0
Cooking	0	0	0	0
TV	406	370	52	48
Pool Pump	3	0	0	0
Furnace Fan	1,715	1,715	599	599
Miscellaneous	81	0	9	0
Whole Bldg (Retrofit)	789	789	220	220
Whole Bldg (New Constr	372	372	103	103

Figure 17 and Figure 8 show the end-use breakdown of commercial potential. Figure 19 and Figure 20 show the share each end use contributes to the economic potential for both energy and demand savings. Indoor lighting is the largest contributor to both energy and peak-demand economic-savings potential, followed by cooling, which is especially significant in peak-demand potential.

Figure 17
Commercial Technical and Economic Energy Savings Potential by End Use (2020)

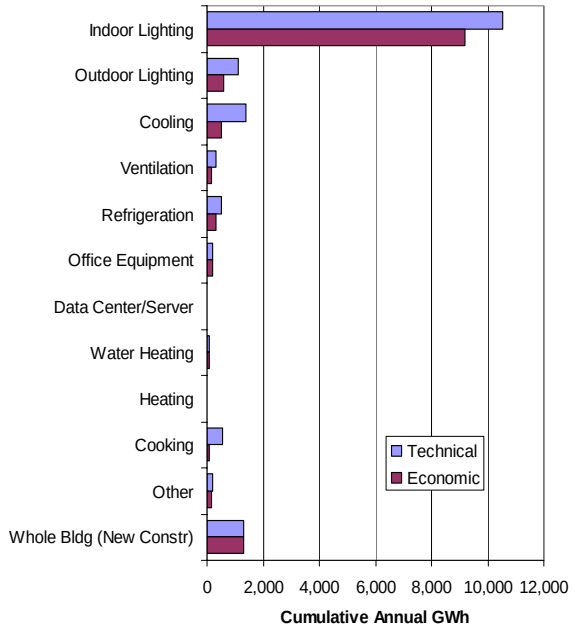


Figure 18
Commercial Technical and Economic Demand Savings Potential by End Use (2020)

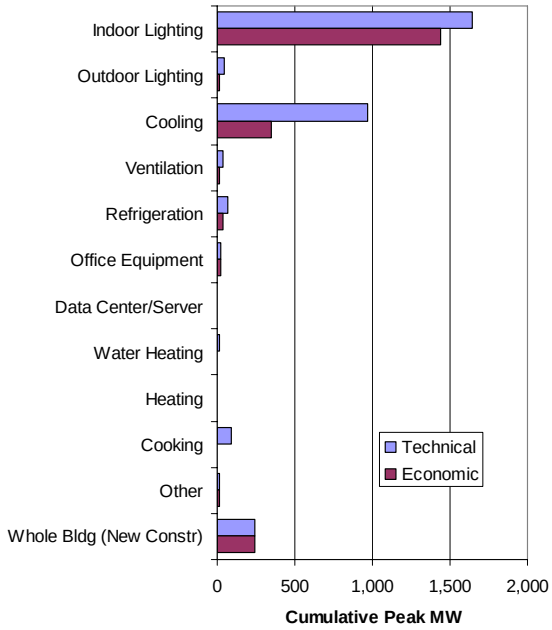


Figure 19
Commercial Economic Energy Savings Potential by End Use (2020)

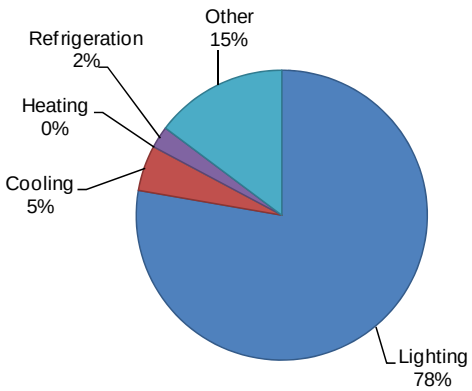


Figure 20
Commercial Economic Demand Savings Potential by End Use (2020)

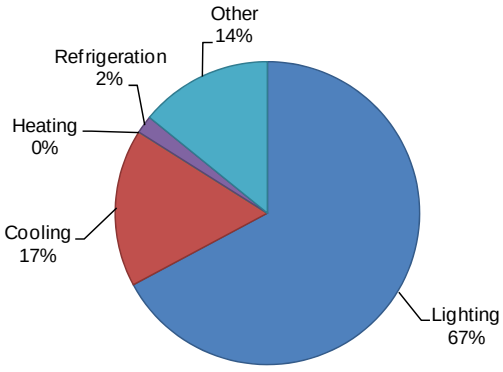


Table 9 - Commercial Energy and Demand Savings Potential by End Use (2014)

	GWh		MW	
	Technical	Economic	Technical	Economic
Indoor Lighting	10,548	9,181	1,643	1,437
Outdoor Lighting	1,119	609	42	16
Cooling	1,402	495	966	347
Ventilation	328	143	39	15
Refrigeration	510	306	65	41
Office Equipment	209	201	22	21
Data Center/Server	56	56	7	7
Water Heating	89	74	11	10
Heating	0	0	0	0
Cooking	550	67	92	11
Other	179	171	16	16
Whole Bldg (New Constr	1,292	1,292	241	241

Figure 21 and Figure 22 show the end-use breakdown of industrial potential. Figure 23 and Figure 24 show the share each end use contributes to the economic potential for both energy and demand savings. Pumping-system measures provide the largest source of economic potential, followed by fans, drives, and compressed air.

Figure 21
Industrial Technical and Economic Energy-Savings Potential by End Use (2020)

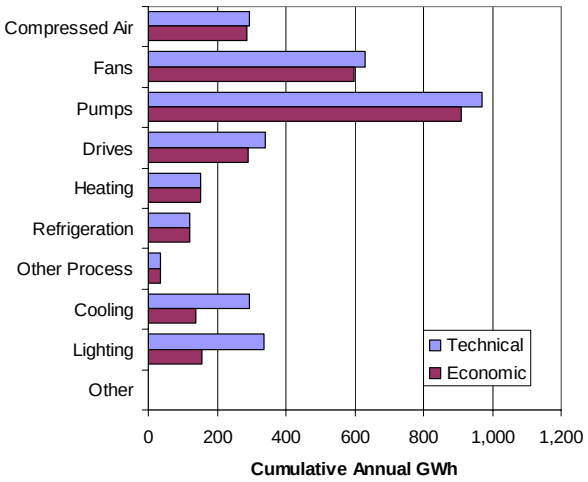


Figure 22
Industrial Technical and Economic Demand-Savings Potential by End Use (2020)

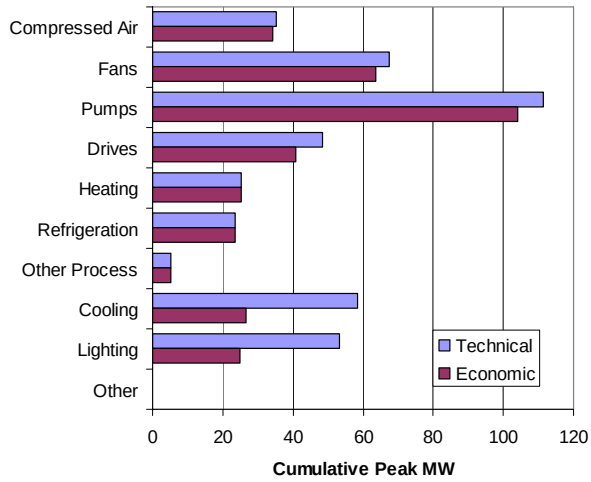


Figure 23
Industrial Economic Energy-Savings Potential by End Use (2020)

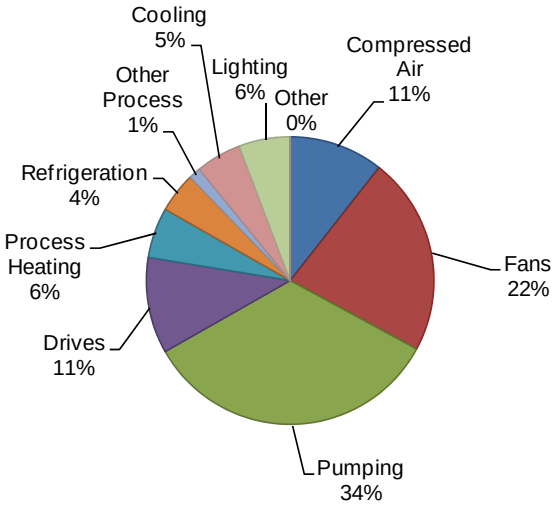


Figure 24
Industrial Economic Demand-Savings Potential by End Use (2020)

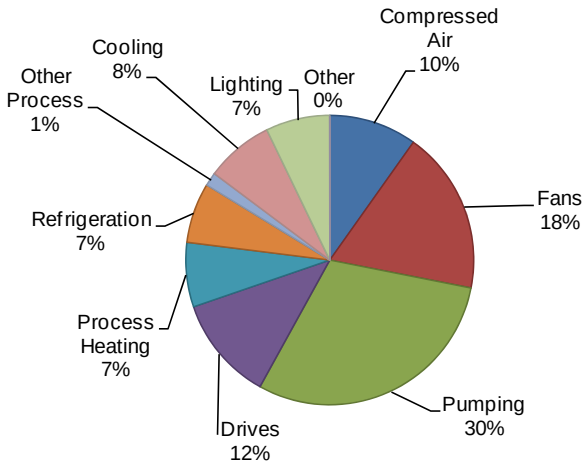


Table 10 - Industrial Energy and Demand Savings Potential by End Use (2020)

	GWh		MW	
	Technical	Economic	Technical	Economic
Compressed Air	295	285	35	34
Fans	629	599	67	64
Pumps	971	910	111	104
Drives	339	290	49	41
Heating	152	152	25	25
Refrigeration	122	122	23	23
Other Process	35	35	5	5
Cooling	294	138	58	26
Lighting	336	155	53	25
Other	0	0	0	0

Avoided Cost Scenarios

We examined two alternative avoided cost scenarios in addition to the base scenario. For the low avoided cost scenario, we reduced avoided costs by 20 percent in each year of the forecast. For the high scenario, we increased costs by 50 percent. Figure 25 shows technical and economic potential for the three scenarios (technical potential is the same for all three scenarios). In Table 18, we compare the three scenarios in terms of percent of sales, percent of technical, and relative to the economic potential of the base avoided cost scenario. The low avoided cost scenario results in economic savings that are 4 percent lower for energy and 2 percent lower for peak demand compared to the base avoided cost scenario. The

high avoided cost scenario results in savings that are 8 percent higher for energy and 5 percent higher for peak demand.

Figure 25
Estimated Electricity Technical and Economic Potential for Alternative Avoided Cost Scenarios, 2020

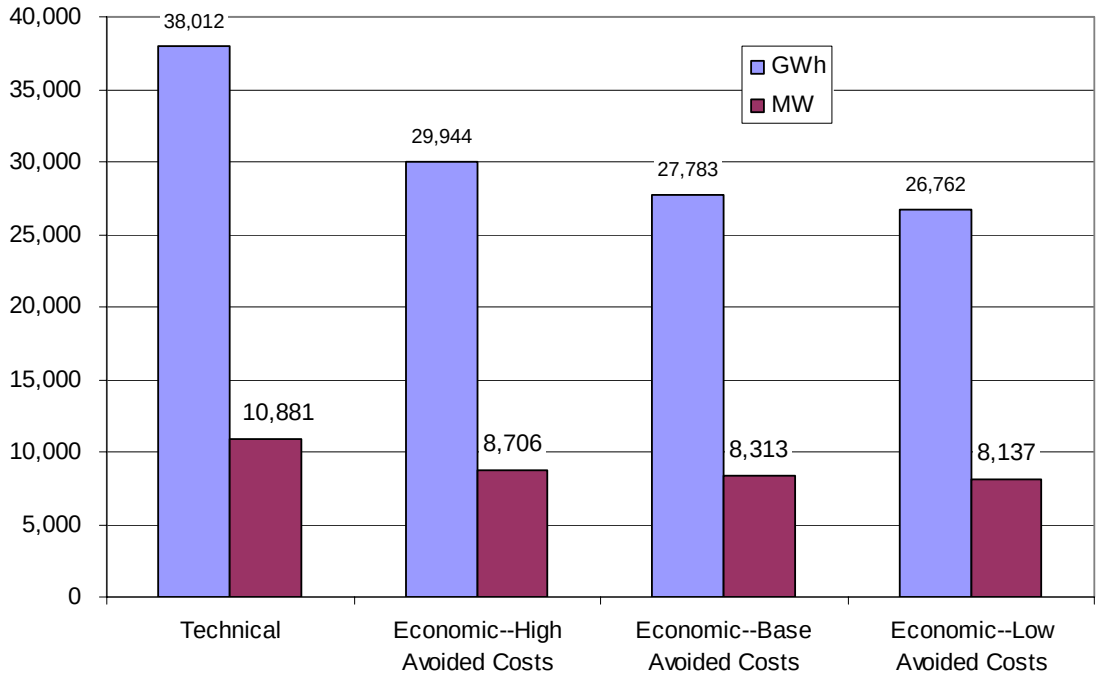


Table 17 - Estimated Electricity Technical and Economic Potential for Alternative Avoided Cost Scenarios, 2020

	Base	Technical	Economic--High Avoided Costs	Economic--Base Avoided Costs	Economic--Low Avoided Costs
Energy (GWh)	95,139	38,012	29,944	27,783	26,762
Peak Demand (MW)	26,613	10,881	8,706	8,313	8,137

Table 18 - Comparison of Estimated Electricity Technical and Economic Potential for Alternative Avoided Cost Scenarios, 2020

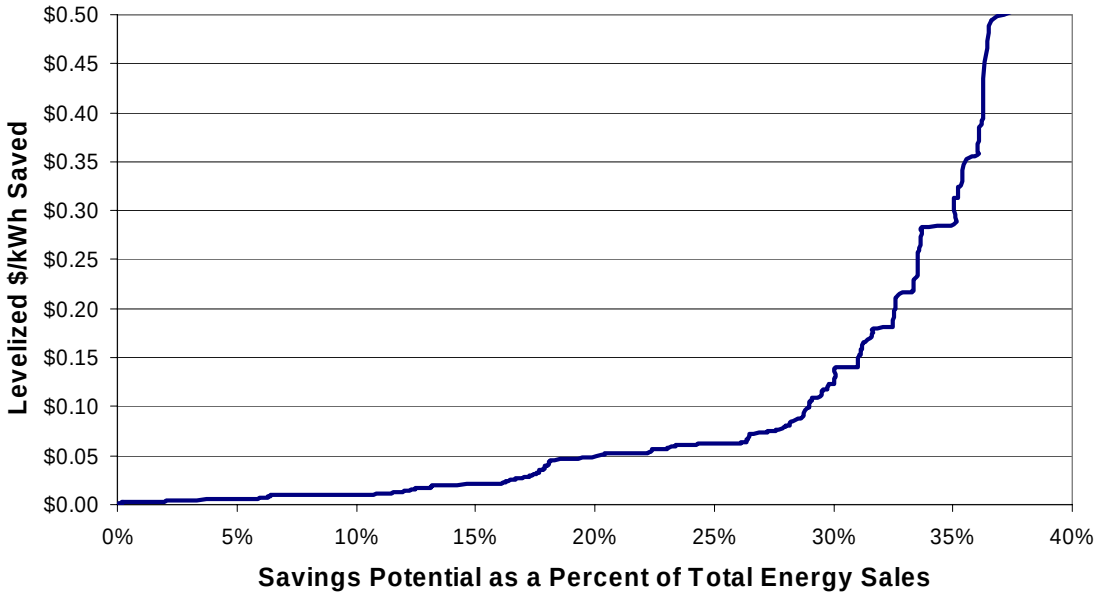
	Base	Technical	Economic--High Avoided Costs	Economic--Base Avoided Costs	Economic--Low Avoided Costs
Energy					
GWh	95,139	38,012	29,944	27,783	26,762
% of consumption		40%	31%	29%	28%
% of Technical			79%	73%	70%
% of Economic--Base Avoided Costs			108%	100%	96%
Peak Demand					
MW	26,613	10,881	8,706	8,313	8,137
% of consumption		41%	33%	31%	31%
% of Technical			80%	76%	75%
% of Economic--Base Avoided Costs			105%	100%	98%

Energy-Efficiency Supply Curves

A common way to illustrate the amount of energy savings per dollar spent is to construct an energy-efficiency supply curve. A supply curve typically is depicted on two axes: one captures the cost per unit of saved energy (e.g., levelized $/kWh saved), and the other shows energy savings at each level of cost. Measures are sorted on a least-cost basis, and total savings are calculated incrementally with respect to measures that precede them. The costs of the measures are levelized over the life of the savings achieved.

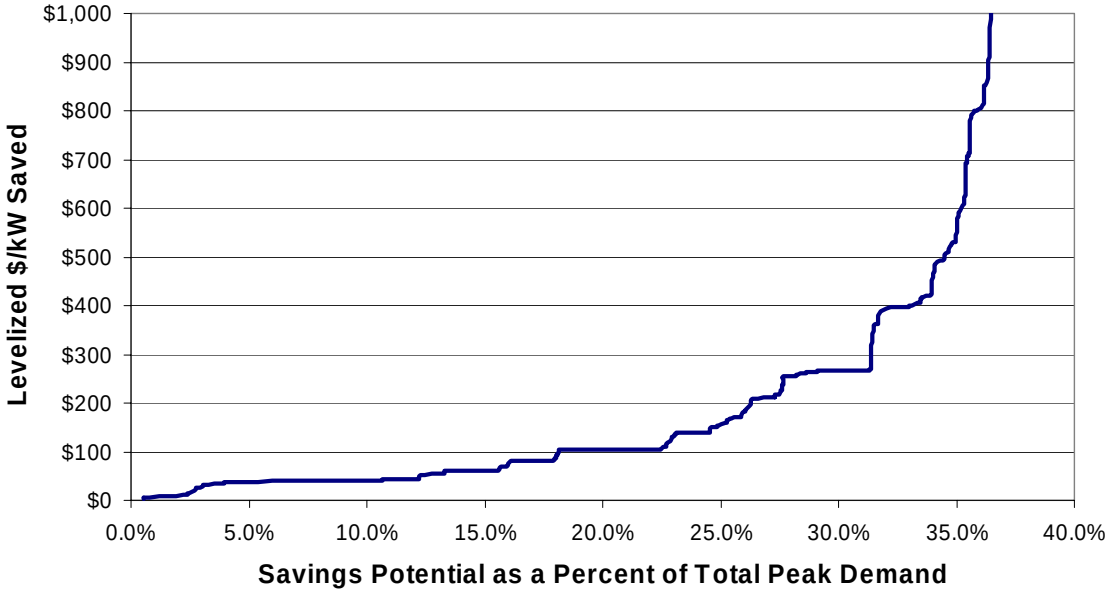
Figure 26 and Figure 27 present the supply curves constructed for this study for electric energy-efficiency and peak-demand efficiency, respectively. Each curve represents savings as a percentage of total energy or peak demand. These curves show that, across all sectors, energy savings of about 20 percent are available at under $0.05 per kWh, and peak demand savings of about 18 percent are available at under $100 per MW. Savings potentials and levelized costs for the individual measures that comprise the supply curves are provided in Appendix G.

Figure 26
Electric Energy Supply Curve*



*Levelized cost per kWh saved is calculated using a 7.9 percent nominal discount rate.

Figure 27
Peak-Demand Supply Curve*



*Levelized cost per kW saved is calculated using a 7.9 percent nominal discount rate.

Natural-Gas Energy-Efficiency Potential Results

Overall Technical and Economic Potential

Figure 28 presents the overall estimates of total technical and economic potential for natural gas energy savings for Missouri. Energy Savings. Technical potential is estimated at about 967 million therms per year and economic potential at 556 million therms per year by 2020 (about 38 and 22 percent of base 2020 usage, respectively).

Figure 158
Estimated Natural-Gas Technical and Economic Potential, 2020

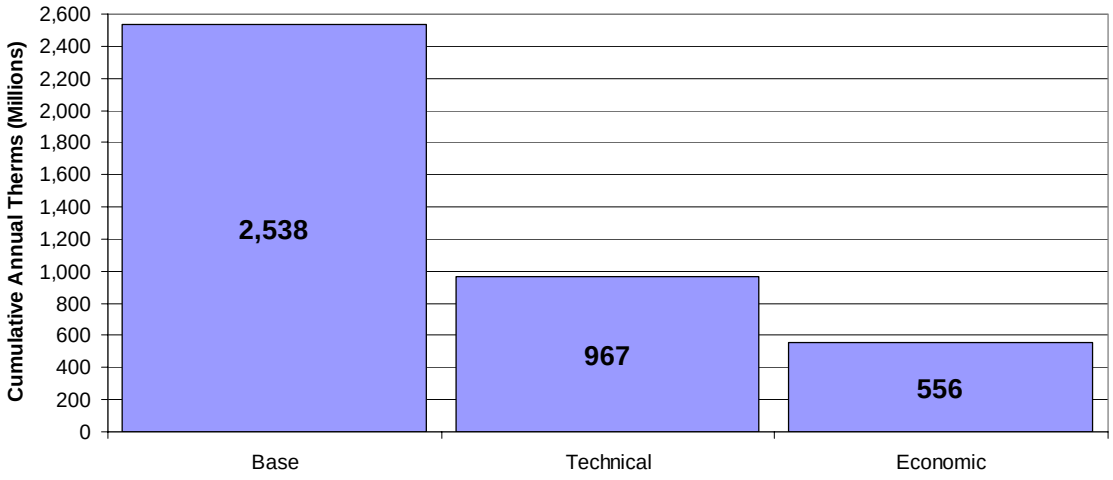


Table 19 - Estimated Natural-Gas Technical and Economic Potential, 2020

	Base	Technical	Economic--High Avoided Costs	Economic--Base Avoided Costs	Economic--Low Avoided Costs
Cumulative Annual Therms (Millions	2,538	967	695	556	502

Technical and Economic Potential Detail

In this subsection, we explore technical and economic potential in more detail, looking at potentials by sector and by end use.

Potentials by Sector

Figure 29 shows estimates of technical and economic energy-savings potential by sector. Figure 30 shows the same potentials as a percentage of 2020 base energy use.

The residential sector provides the largest contribution to both technical and economic potential for energy savings, accounting for about 62 percent of technical and 49 percent of economic savings. The

commercial sector contributes about 29 percent to the technical and 36 percent to economic potential, while the industrial sector contributes only 9 and 15 percent, respectively.

As shown in Figure 30, the residential sector has the highest technical savings potential in relation to base energy use, but when looking at economic potential, commercial has the highest savings in percentage terms.

Figure 29
Technical and Economic Potential (2020)
Energy Savings by Sector
Millions of Therms per Year

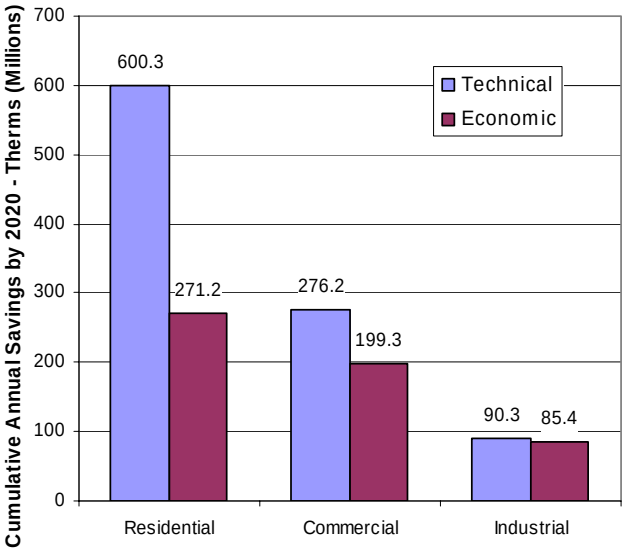


Figure 30
Technical and Economic Potential (2020)
Percentage of Base Energy Use

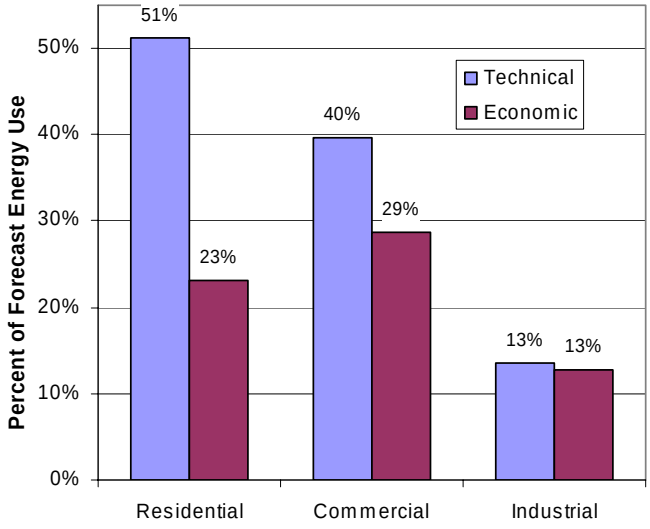


Table 20 - Technical and Economic Potential (2020) Energy Savings by Sector Millions of Therms per Year

	Base	Technical	Economic
Residential	1,170.96	600.29	271.25
Commercial	696.12	276.17	199.33
Industrial	670.98	90.32	85.36
Total	2,538.05	966.78	555.93

Potentials by Building Type

Figure 31 shows the technical and economic potentials in the residential sector by building type. Single-family homes account for more than 90% of the potential (including single-family low income), and low-income homes account for about 25 percent of the potential.

Figure 31
Residential Energy-Savings Potential by Building Type (2020)

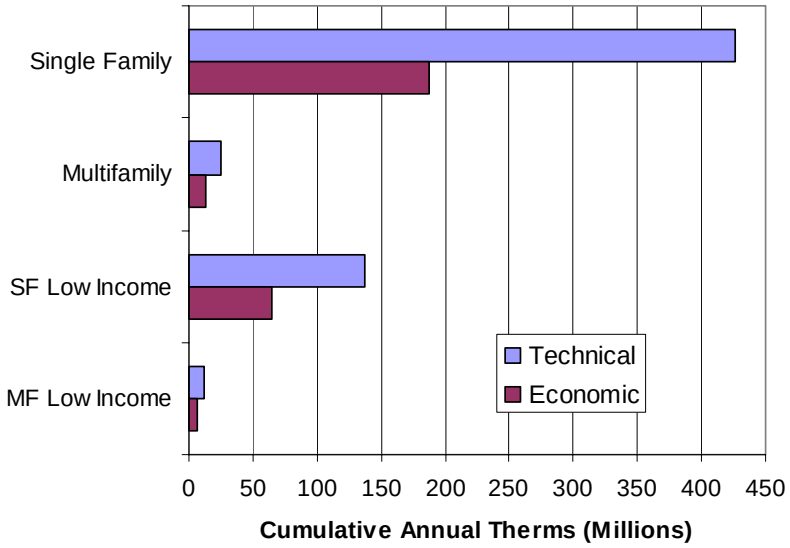


Table 21 - Residential Energy Savings Potential by Building Type (2020)

	Therms	
	Technical	Economic
Single Family	426,096,167	187,136,962
Multifamily	25,109,531	13,175,332
SF Low Income	137,469,316	64,399,564
MF Low Income	11,617,318	6,534,972

Figure 32 shows the building-type breakdown of commercial potential. Offices account for 37 percent of the economic potential, followed by other commercial buildings.

Figure 32
Commercial Energy-Savings Potential by Building Type (2020)

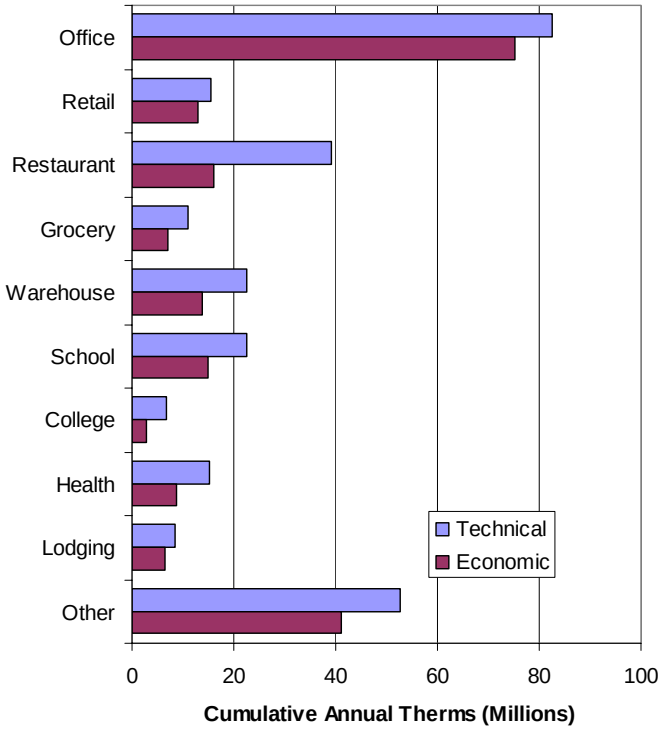


Table 2211 - Commercial Energy Savings Potential by Building Type (2020)

	Therms	
	Technical	Economic
Office	82,604,338	75,297,689
Retail	15,382,073	12,866,766
Restaurant	39,251,274	16,167,460
Grocery	10,938,285	7,164,716
Warehouse	22,565,772	13,862,211
School	22,473,118	14,963,946
College	6,672,555	2,864,189
Health	15,084,887	8,612,990
Lodging	8,390,880	6,479,808
Other	52,803,623	41,048,618

Figure 33 shows the business-type breakdown of industrial potential. Key industries in terms of economic potential include food, chemicals, petroleum, paper, and primary metals.

Figure 33
Industrial Energy-Savings Potential by Business Type (2020)

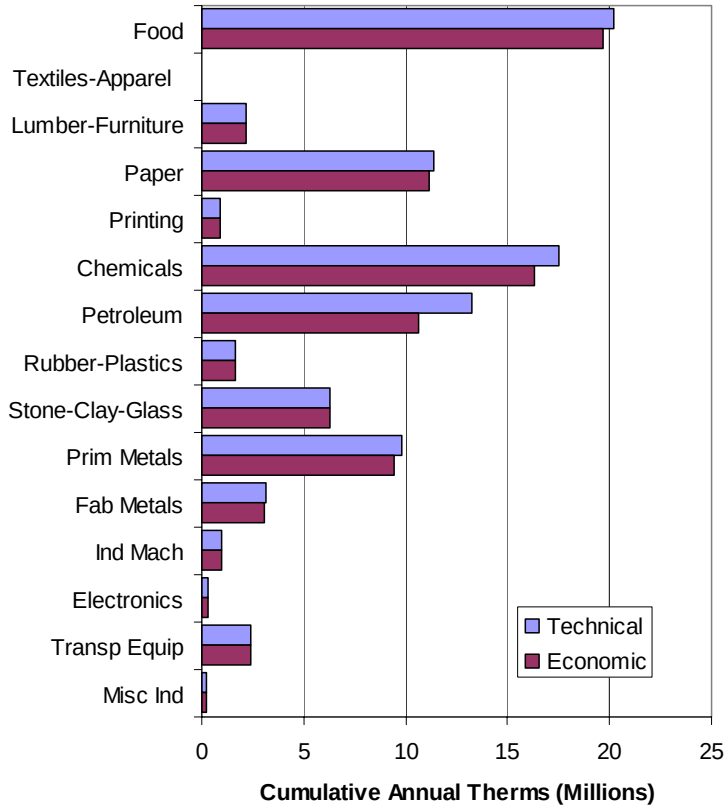


Table 23 - Industrial Energy Savings Potential by Business Type (2020)

	Therms	
	Technical	Economic
Food	20,192,532	19,697,513
Textiles-Apparel	99,102	99,102
Lumber-Furniture	2,149,925	2,149,925
Paper	11,359,707	11,118,343
Printing	872,820	872,820
Chemicals	17,517,072	16,312,732
Petroleum	13,237,737	10,592,307
Rubber-Plastics	1,682,313	1,682,313
Stone-Clay-Glass	6,312,824	6,312,824
Prim Metals	9,779,468	9,453,635
Fab Metals	3,146,013	3,091,804
Ind Mach	1,000,440	1,000,440
Electronics	332,085	332,085
Transp Equip	2,430,429	2,430,429
Misc Ind	210,031	210,031

Potentials by End Use

Figure 34 shows the end-use breakdown of technical and economic potential in the residential sector. Figure 35 shows the share each end use contributes to the economic energy savings potential. Energy-savings potential comes predominantly from space heating and water heating. The whole-building - new construction component also consists mainly of space-heating and water-heating measures. The whole-building – retrofit end use consists of a single behavioral conservation measure.

Figure 34
Residential Economic Energy-Savings Potential by End Use (2020)

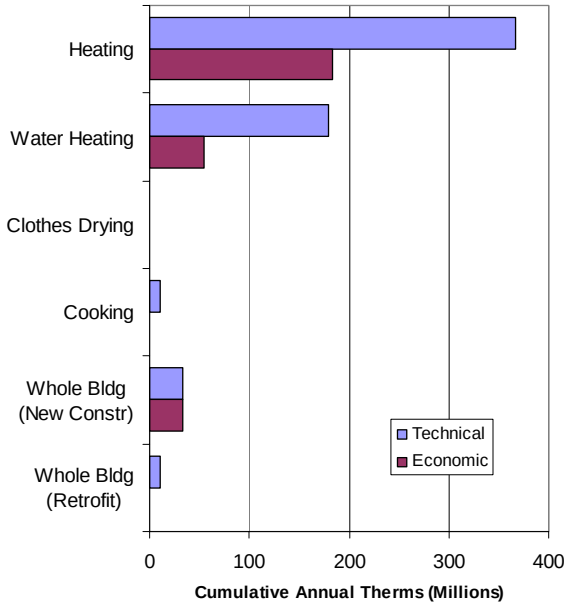


Figure 35
Residential Economic Energy-Savings Potential by End Use (2020)

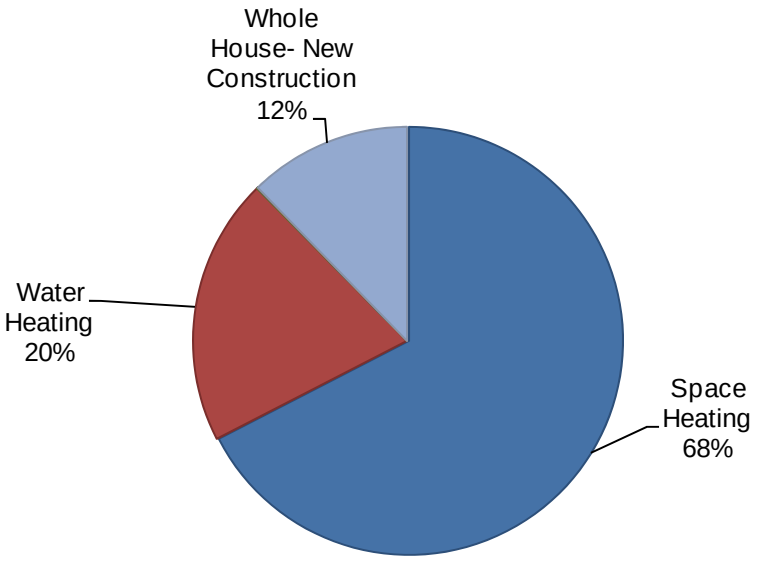


Table 24 - Residential Energy Savings Potential by End Use (2020)

	Therms	
	Technical	Economic
Heating	366,286,592	182,909,336
Water Heating	179,616,804	54,787,836
Clothes Drying	219,071	219,071
Cooking	10,852,431	0
Whole Bldg (New Constr)	33,330,587	33,330,587
Whole Bldg (Retrofit)	9,986,847	0

Figure 36 shows the end-use breakdown of commercial potential. Figure 37 shows the share each end use contributes to the economic energy savings potential. Space heating is the largest contributor to potentials, followed by water heating and cooking.

Figure 36
Commercial Economic Energy-Savings Potential by End Use (2020)

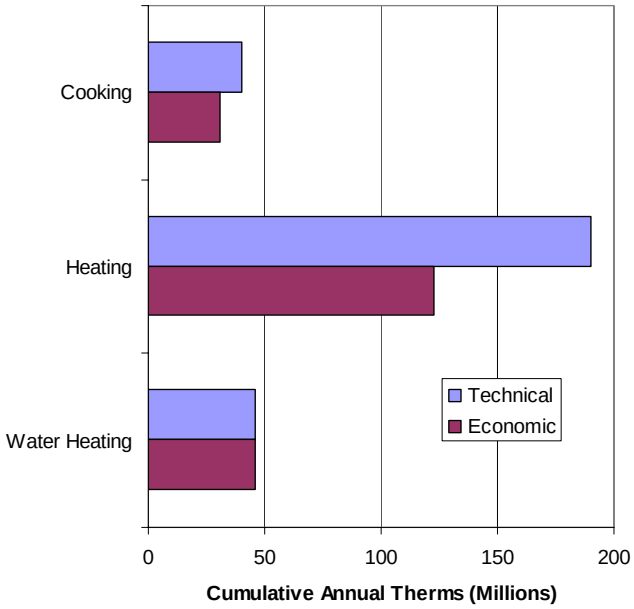


Figure 37
Commercial Economic Energy-Savings Potential by End Use (2020)

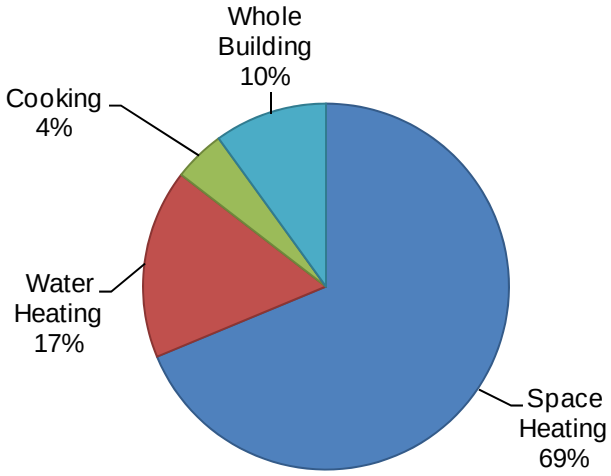


Table 25 - Commercial Energy Savings Potential by End Use (2020)

	Therms	
	Technical	Economic
Cooking	40,132,438	30,811,931
Heating	189,833,417	122,434,390
Water Heating	46,200,951	46,082,074

Figure 39 shows the end-use breakdown of industrial potential. Figure 40 shows the share each end use contributes to the economic energy savings potential. Both technical and economic potential savings are split fairly evenly between the boiler- and process-heating end uses, with boilers slightly ahead. HVAC contributes only a small share to the totals.

Figure 39
Industrial Economic Energy-Savings Potential by End Use (2020)

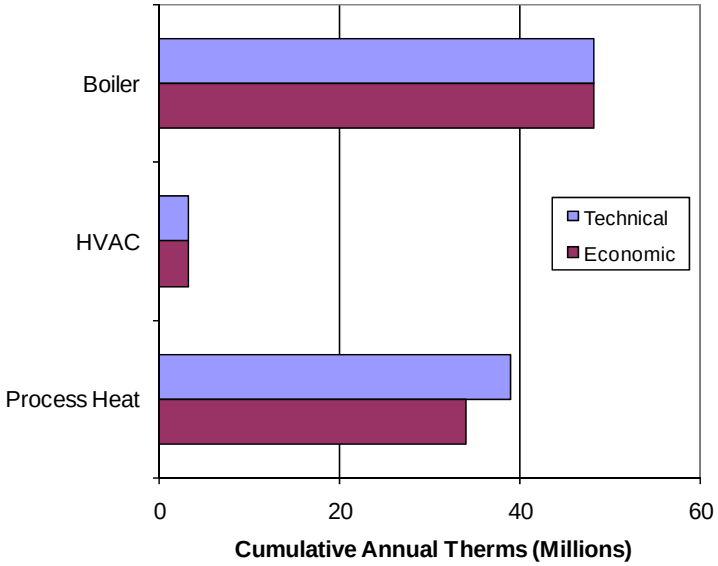


Figure 40
Industrial Economic Energy-Savings Potential by End Use (2020)

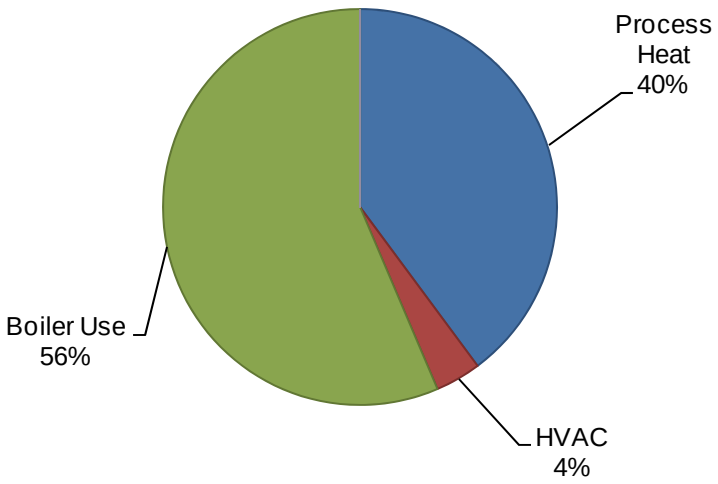


Table 26 - Industrial Energy Savings Potential by End Use (2020)

	Therms	
	Technical	Economic
Boiler	48,145,672	48,145,672
HVAC	3,187,754	3,187,754
Process Heat	38,989,070	34,022,876

Avoided Cost Scenarios

We examined two alternative avoided cost scenarios in addition to the base scenario. For the low avoided cost scenario, we reduced avoided costs by 20 percent in each year of the forecast. For the high scenario, we increased costs by 50 percent. Figure 41 shows technical and economic potential for the three scenarios (technical potential is the same for all three scenarios). In Table 30 we compare the three scenarios in terms of percent of sales, percent of technical, and relative to the economic potential of the base avoided cost scenario. The low avoided cost forecast results in economic savings that are 10 percent lower than the base avoided cost forecast, while the high avoided costs result in savings that are 25 percent higher.

Figure 41
Estimated Natural-Gas Technical and Economic Potential for Alternative Avoided Cost Scenarios, 2020

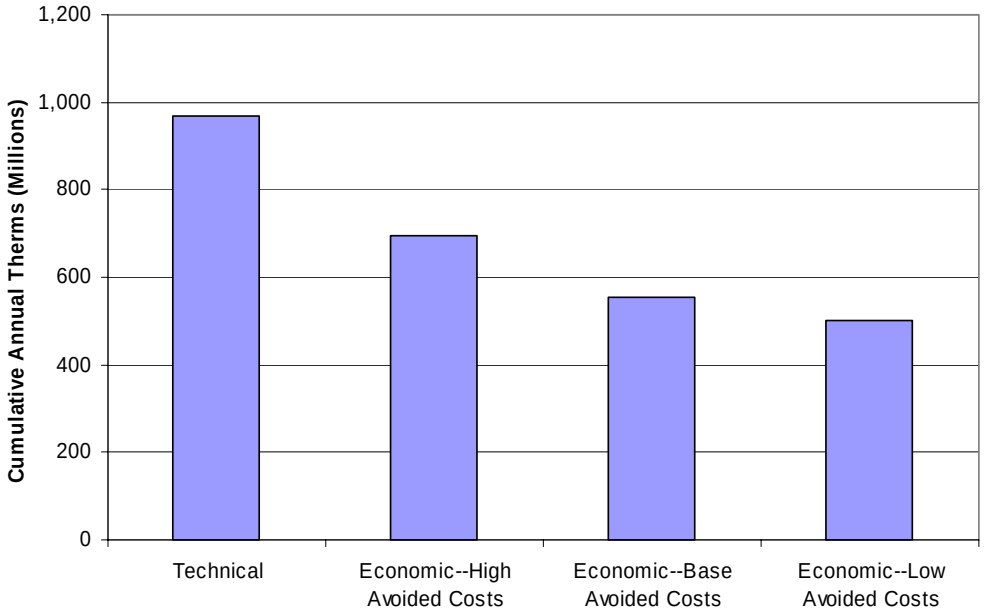


Table 30 - Comparison of Estimated Natural-Gas Technical and Economic Potential for Alternative Avoided Cost Scenarios, 2020

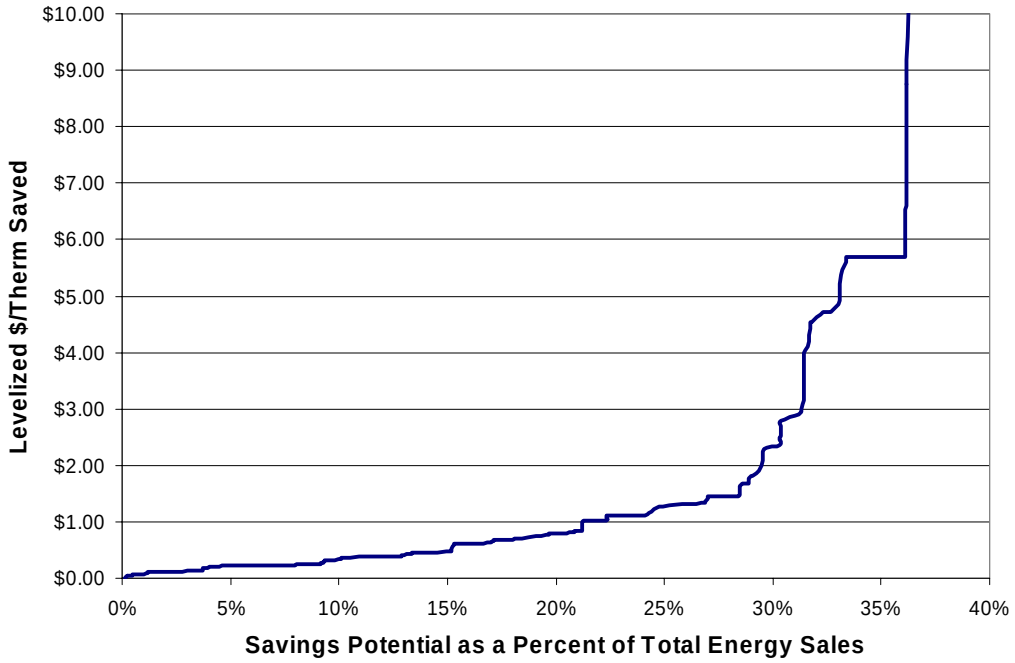
	Sales	Technical Potential	Economic--High Avoided Costs	Economic--Base Avoided Costs	Economic--Low Avoided Costs
Million Therms	2,538	967	695	556	502
% of consumption		38%	27%	22%	20%
% of Technical			72%	58%	52%
% of Economic--Base Avoided Costs			125%	100%	90%

Energy-Efficiency Supply Curves

Energy-efficiency supply curves for natural gas are constructed through the same process as those for electric efficiency. Only the units differ, for example costs per therm instead of cost per MWh.

Figure 42 presents the supply curve constructed for this study for natural gas. The curve represents savings as a percentage of total energy . It shows that, across all sectors, energy savings of more than 20 percent are available at under $1.00 per therm.

Figure 16 - Natural Gas Supply Curve



*Levelized cost per kWh saved is calculated using a 7.76 percent nominal discount rate.

Appendix - Top Twenty Energy Saving Measures by Sector and Fuel

Electric Energy

Residential Existing Top Twenty by Economic Potential (GWh)

Base	Measure Number	Measure Name	Building Type	Meausre TRC	Economic GWh
250	251	CFL (15-Watt integral ballast), 1.8 hr/day	Single Family	16.05	1841.92
180	182	Variable speed furnace fans (ROB)	Single Family	34.72	675.26
250	251	CFL (15-Watt integral ballast), 1.8 hr/day	SF Low Income	16.05	602.37
100	121	Infiltration Reduction	Single Family	4.51	559.92
970	971	Indirect Feedback	Single Family	12.62	531.42
220	221	Single Pane Windows to Double Pane with Gas	Single Family	8.06	433.89
340	341	Second Refrigerator Recycling	Single Family	29.75	415.48
180	181	Variable speed furnace fans (RET)	Single Family	1.58	409.83
100	107	Proper Refrigerant Charging and Air Flow	Single Family	6.21	363.13
100	101	15 SEER Split-System Air Conditioner	Single Family	1.99	352.50
220	233	Basement Insulation	Single Family	3.02	296.27
250	251	CFL (15-Watt integral ballast), 1.8 hr/day	Multifamily	16.05	268.23
100	108	Duct Repair	Single Family	2.22	224.93
180	182	Variable speed furnace fans (ROB)	SF Low Income	34.72	213.47
100	121	Infiltration Reduction	SF Low Income	6.41	200.80
130	131	15 SEER Split-System AC Early Replacement	Single Family	4.76	193.55
265	266	LEDs w/ Halogen Baseline	Single Family	1.34	191.25
180	182	Variable speed furnace fans (ROB)	Multifamily	34.72	167.05
970	971	Indirect Feedback	SF Low Income	11.76	161.89
300	301	HE Refrigerator - Energy Star	Single Family	1.14	140.18

Commercial Existing Top Twenty by Economic Potential (GWh)

Base	Measure Number	Measure Name	Measure TRC	Economic GWh
140	141	CFL Screw-in 18W	8.61	3388.44
150	151	CFL Hardwired, Modular 18W	3.75	2693.04
140	143	Screw-in LED--Base Incandescent	1.24	1287.79
150	153	Hardwired LED fixture--Base Incandescent	1.19	618.85
210	211	High Pressure Sodium 250W Lamp	1.83	280.33
210	214	Outdoor Lighting Controls (Photocell/Timeclock)	7.76	210.57
160	161	High Bay T5 - Base Std MH	8.86	185.03
800	801	Vending Misers (cooled machines only)	9.15	179.54
210	212	LED Outdoor Area Lighting	1.83	149.83
190	191	ROB 2L4' Premium T8, 1EB - Base 2L4'T8	5.77	141.39
190	192	Occupancy Sensor, 8L4' Fluorescent Fixtures - Base 2L4'T8	3.99	119.77
190	196	High Performance Lighting Remod/Renov - 25% Savings - Base 2L4'T8	5.14	113.14
130	132	RET 2 - 1L4' Premium T8, 1EB, Reflector OEM - Base 2L8'T12	1.63	111.85
180	181	ROB 4L4' Premium T8, 1EB - Base 4L4'T8	6.85	105.90
180	182	Occupancy Sensor, 4L4' Fluorescent Fixtures - Base 4L4'T8	3.11	101.95
520	538	Fiber Optic Display Lighting	8.86	101.02
400	402	Variable Speed Drive Control, 5 HP	1.23	91.52
180	185	High Performance Lighting Remod/Renov - 25% Savings - Base 4L4'T8	3.75	90.23
350	363	Ceiling/roof Insulation - DX	10.44	80.10
520	530	Demand Defrost Electric	10.98	69.09

Industrial Top Twenty by Economic Potential (GWh)

Base	Measure Number	Measure Name	Meausre TRC	Economic GWh
200	202	Fans - Controls	2.20	274.34
300	303	Pumps - System Optimization	3.16	247.34
300	302	Pumps - Controls	8.46	200.79
200	203	Fans - System Optimization	1.38	162.24
300	304	Pumps - Sizing	6.38	160.59
800	801	RET 2L4' Premium T8, 1EB	2.65	135.73
300	312	Pumps - ASD (100+ hp)	1.86	100.96
100	103	Compressed Air - System Optimization	7.51	100.29
500	552	Optimization Refrigeration	1.82	83.64
300	301	Pumps - O&M	12.84	80.80
500	505	Efficient electric melting	2.91	76.04
300	309	Pumps - ASD (6-100 hp)	8.19	70.75
400	418	Extruders/injection Moulding-multipump	2.10	53.65
100	101	Compressed Air-O&M	11.21	53.46
700	701	Centrifugal Chiller, 0.51 kW/ton, 500 tons	4.08	52.89
200	204	Fans- Improve components	6.09	52.77
100	109	Comp Air - ASD (6-100 hp)	7.81	41.08
400	415	Drives - Process Controls (batch + site)	1.17	39.83
500	551	Efficient Refrigeration - Operations	10.33	37.93
200	212	Fans - ASD (100+ hp)	1.95	37.10

Electric Demand

Residential Existing Top Twenty by Economic Potential (MW)

Base	Measure Number	Measure Name	Building Type	Meausre TRC	Economic MW
100	121	Infiltration Reduction	Single Family	4.51	746.88
100	107	Proper Refrigerant Charging and Air Flow	Single Family	6.21	484.38
100	101	15 SEER Split-System Air Conditioner	Single Family	1.99	470.21
100	108	Duct Repair	Single Family	2.22	300.03
100	121	Infiltration Reduction	SF Low Income	6.41	267.85
130	131	15 SEER Split-System AC Early Replacement	Single Family	4.76	258.18
180	182	Variable speed furnace fans (ROB)	Single Family	34.72	235.99
250	251	CFL (15-Watt integral ballast), 1.8 hr/day	Single Family	16.05	171.67
100	105	Whole House Fans	Single Family	2.61	171.48
100	111	Single Pane Windows to Double Pane with Gas	Single Family	1.94	168.86
100	101	15 SEER Split-System Air Conditioner	SF Low Income	2.01	164.04
100	121	Infiltration Reduction	Multifamily	13.72	149.34
970	971	Indirect Feedback	Single Family	12.62	147.83
180	181	Variable speed furnace fans (RET)	Single Family	1.58	143.23
100	108	Duct Repair	SF Low Income	2.32	102.93
170	171	Energy Star Dehumidifier (ROB)	Single Family	51.13	102.48
100	107	Proper Refrigerant Charging and Air Flow	SF Low Income	3.81	97.30
130	131	15 SEER Split-System AC Early Replacement	SF Low Income	4.76	84.11
180	182	Variable speed furnace fans (ROB)	SF Low Income	34.72	74.60
100	120	Self Install Weatherization	Single Family	22.52	69.58

Commercial Existing Top Twenty by Economic Potential (MW)

Base	Measure Number	Measure Name	Measure TRC	Economic MW
140	141	CFL Screw-in 18W	8.61	535.06
150	151	CFL Hardwired, Modular 18W	3.75	404.30
140	143	Screw-in LED--Base Incandescent	1.24	207.25
150	153	Hardwired LED fixture--Base Incandescent	1.19	96.17
350	363	Ceiling/roof Insulation - DX	10.44	70.05
350	362	Aerosol Duct Sealing - DX	6.94	53.12
350	357	Window Film (Standard)	1.17	49.54
350	353	DX Packaged System, EER=11.5, 10 tons	1.01	45.54
350	365	DX Coil Cleaning	3.83	39.38
300	303	EMS - Chiller	1.06	39.04
300	306	VSD for Chiller Pumps and Towers	2.14	27.85
160	161	High Bay T5 - Base Std MH	8.86	27.44
190	191	ROB 2L4' Premium T8, 1EB - Base 2L4'T8	5.77	21.74
190	192	Occupancy Sensor, 8L4' Fluorescent Fixtures - Base 2L4'T8	3.99	17.97
190	196	High Performance Lighting Remod/Renov - 25% Savings - Base 2L4'T8	5.14	17.49
800	801	Vending Misers (cooled machines only)	9.15	16.43
130	132	RET 2 - 1L4' Premium T8, 1EB, Reflector OEM - Base 2L8'T12	1.63	16.25
180	181	ROB 4L4' Premium T8, 1EB - Base 4L4'T8	6.85	15.71
180	182	Occupancy Sensor, 4L4' Fluorescent Fixtures - Base 4L4'T8	3.11	15.05
520	538	Fiber Optic Display Lighting	8.86	14.47

Industrial Top Twenty by Economic Potential (MW)

Base	Measure Number	Measure Name	Meausre TRC	Economic MW
200	202	Fans - Controls	2.20	36.53
300	303	Pumps - System Optimization	3.16	34.82
300	302	Pumps - Controls	8.46	27.27
300	304	Pumps - Sizing	6.38	21.61
800	801	RET 2L4' Premium T8, 1EB	2.65	21.42
500	552	Optimization Refrigeration	1.82	16.15
100	103	Compressed Air - System Optimization	7.51	15.55
500	505	Efficient electric melting	2.91	13.01
700	701	Centrifugal Chiller, 0.51 kW/ton, 500 tons	4.08	12.27
300	301	Pumps - O&M	12.84	11.37
200	203	Fans - System Optimization	1.38	10.79
400	418	Extruders/injection Moulding-multipump	2.10	8.87
100	101	Compressed Air-O&M	11.21	8.05
500	551	Efficient Refrigeration - Operations	10.33	7.32
200	204	Fans- Improve components	6.09	7.07
400	415	Drives - Process Controls (batch + site)	1.17	5.71
710	713	Window Film - DX	2.11	4.59
710	712	DX Packaged System, EER=10.9, 10 tons	1.06	4.48
100	102	Compressed Air - Controls	3.68	4.09
500	501	Bakery - Process	7.08	3.86

Natural Gas Energy

Residential Existing Top Twenty by Economic Potential (Dth)

Base	Measure Number	Measure Name	Building Type	Measure TRC	Economic DTh
100	126	Single Pane to Double Pane with Gas	Single Family	3.51	5,709,507
100	126	Single Pane to Double Pane with Gas	SF Low Income	4.37	2,049,224
400	408	Energy Star Water Heater (EF = .67)	Single Family	2.51	1,974,434
100	101	Basement insulation R-13 (Furnace)	Single Family	1.21	1,775,707
100	108	Comprehensive Shell Air Sealing - Inf. Reduction	Single Family	1.47	1,540,582
100	118	Furnace Diagnostic Testing, Repair and Maintenance	Single Family	1.37	1,400,960
100	113	ENERGY STAR Programmable Thermostat	Single Family	2.78	1,208,880
400	409	Faucent Aerators	Single Family	3.33	1,034,472
400	403	Drain Water Heat Recovery (GFX)	Single Family	1.22	708,923
100	101	Basement insulation R-13 (Furnace)	SF Low Income	1.49	634,946
100	121	Self Install Weatherization	Single Family	9.11	584,308
400	408	Energy Star Water Heater (EF = .67)	SF Low Income	2.19	564,401
100	108	Comprehensive Shell Air Sealing - Inf. Reduction	SF Low Income	1.38	473,561
100	118	Furnace Diagnostic Testing, Repair and Maintenance	SF Low Income	1.28	428,817
400	409	Faucent Aerators	SF Low Income	4.45	392,374
100	113	ENERGY STAR Programmable Thermostat	SF Low Income	2.74	390,205
400	411	Pipe Wrap	Single Family	5.67	384,983
100	126	Single Pane to Double Pane with Gas	Multifamily	18.35	383,525
400	401	Commercial Clotheswasher (MEF = 2.0)	Multifamily	42.72	237,697
100	126	Single Pane to Double Pane with Gas	MF Low Income	18.99	205,417

Commercial Existing Top Twenty by Economic Potential (DTh)

Base	Measure Number	Measure Name	Measure TRC	Economic DTh
200	216	Clock / Programmable Thermostat	1.89	3,645,090
400	403	Tankless Water Heater	6.77	3,316,832
200	228	High Efficiency (Power Burner/ Premium) Boiler 95% efficiency (in situ base=82%)	1.11	2,098,991
200	233	Demand controlled ventilation (DCV)	1.17	1,953,369
200	202	Insulation (ceiling)	4.02	1,187,165
500	503	Condensing Water Heater (gas, 95% thermal efficiency)	40.63	1,084,253
200	218	Installation of Energy Management Systems (EMS)	0.56	984,208
200	203	Insulation (wall)	1.62	774,723
200	231	Radiant heater	12.19	681,269
100	101	Energy Star Fryer	2.69	644,666
200	230	Condensing unit heaters	7.48	572,036
200	201	High Efficiency Windows (Multiple Glazed, Low Emissivity)	0.28	471,938
All WH	WH 02	Demand controlled circulating systems	38.41	441,726
200	229	Stack Heat Exchanger	3.13	301,616
110	111	Energy Star Steamer	2.52	242,861
200	235	Retrocommissioning	0.75	122,945
200	232	Hot water temperature reset	15.47	45,766
200	212	Boiler Tune-Up	2.42	32,341
130	131	High-Efficiency Griddle	0.22	31,250
All WH	WH 01	Hot Water Pipe Insulation	2.57	2,272

Industrial Top Twenty by Economic Potential (DTh)

Base	Measure Number	Measure Name	Measure TRC	Economic DTh
100	113	Thermally activated heat pump/chiller	3.64	1,210,871
100	108	Improved insulation	6.76	1,063,589
500	501	Process Controls & Management	4.12	915,482
500	503	Efficient burners	4.64	868,117
100	109	Steam trap maintenance	2.55	666,243
100	107	Load control	17.50	578,394
100	110	Automatic steam trap monitoring	8.27	340,894
100	102	Maintain boilers	92.32	295,099
500	504	Process integration	1.19	258,649
100	101	Improved process control	14.02	245,702
500	511	Fouling control	4.66	193,220
500	502	Heat Recovery	1.75	181,818
500	509	Thermal oxidizers	3.01	152,329
200	201	Improve ceiling insulation	2.21	136,735
500	513	Oxyfuel	2.58	136,351
500	508	Improved separation processes	3.28	125,856
100	106	Water treatment	4.55	122,068
500	510	Flare gas controls and recovery	4.77	117,690
100	103	Flue gas heat recovery/economizer	2.80	107,676
200	202	Install high efficiency (95%) condensing furnace/boiler	3.92	105,695