



Kansas Energy Council EE Potential Study Draft Results

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Agenda

- Project objectives and scope of work
- Energy Efficiency (EE) benchmarking results
- Baseline market profiles
- EE measure characterization results
- High level EE measure benefit-cost analysis results
- EE potential results

Project Objectives, from RFP

- Assess technical, economic, and achievable EE potential in Kansas
 - Residential, commercial, and industrial market sectors.
 - Twenty year forecasts desired.
 - End use level estimates desired, not specific program level estimates.

Meeting Objectives

- Present draft project results.
- Answer questions and address concerns.

Summary of Summit Blue's DSM Potential Estimation Approach

- Summit Blue uses four key sets of inputs for its DSM Resource Assessment Model to estimate DSM potentials:
 1. Baseline market profiles, such as the percentages of customers with each type of end use equipment.
 2. DSM measure characteristics, such as the energy and demand savings for each type of DSM measure.
 3. The benefit-cost results for each measure.
 4. The actual recent (2005-2006) results of best practice Midwest DSM programs and portfolios. These are used to calibrate the model to produce realistic results.

EE Benchmarking Results

- Collected 2006 EE program results and baseline sales information from 24 organizations across North America (22 for electricity DSM, 6 for natural gas DSM) with a focus on the Midwest (11-electricity, 6-natural gas).
- Data sources were primarily utilities' annual DSM regulatory reports to state PUCs, as well as EIA 861 information on baseline sales and peak demands.
- Normalized EE program results using baseline sales data to determine the percentages of baseline sales and peak demands conserved through EE programs.
- Also calculated costs of conserved energy and demand on a first year basis.
- Analysis results were used to set EE potential and program cost benchmarks.

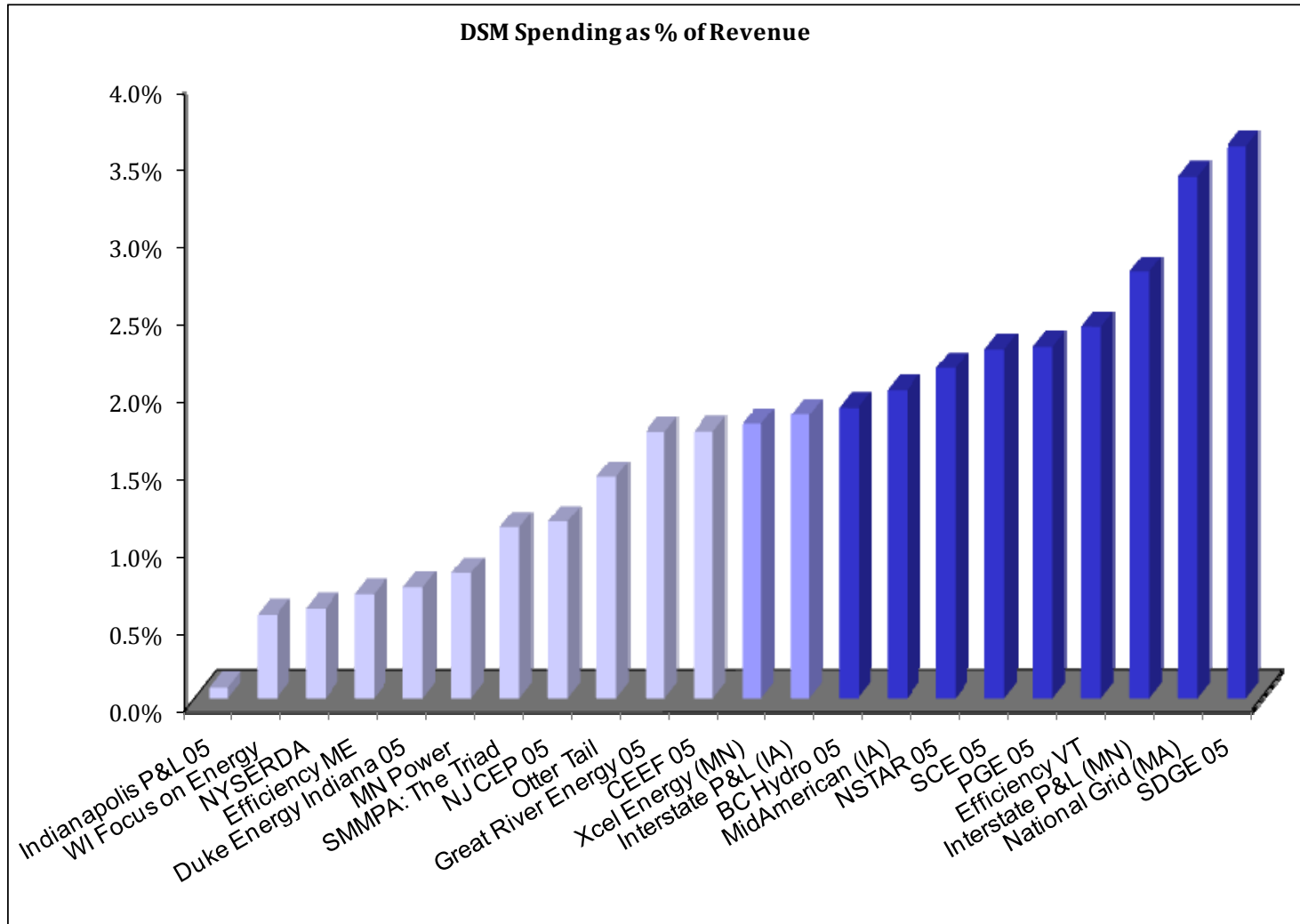
Organizations Benchmarked

Utility/Agency	State	Electricity	Natural Gas	Utility/Agency	State	Electricity	Natural Gas
Midwest				Northeast			
Aquila	IA		X	CT EE Fund	CT	X	
CenterPoint Energy	MN		X	Efficiency ME	ME	X	
Duke Energy	IN	X		Efficiency VT	VT	X	
Great River Energy	MN	X		National Grid	MA	X	
Indianapolis P&L	IN	X		NJ Clean Energy	NJ	X	
Interstate P&L	IA	X	X	NYSERDA	NY	X	
Interstate P&L	MN	X	X	NSTAR	MA	X	
MidAmerican Energy	IA	X	X	West			
MN Power	MN	X		PG&E	CA	X	
Otter Tail Power	MN	X		SDG&E	CA	X	
Southern MN Municipal Power: The Triad	MN	X		SCE	CA	X	
WI Focus on Energy	WI	X		Canada			
Xcel Energy	MN	X	X	BC Hydro and Power Authority	BC	X	

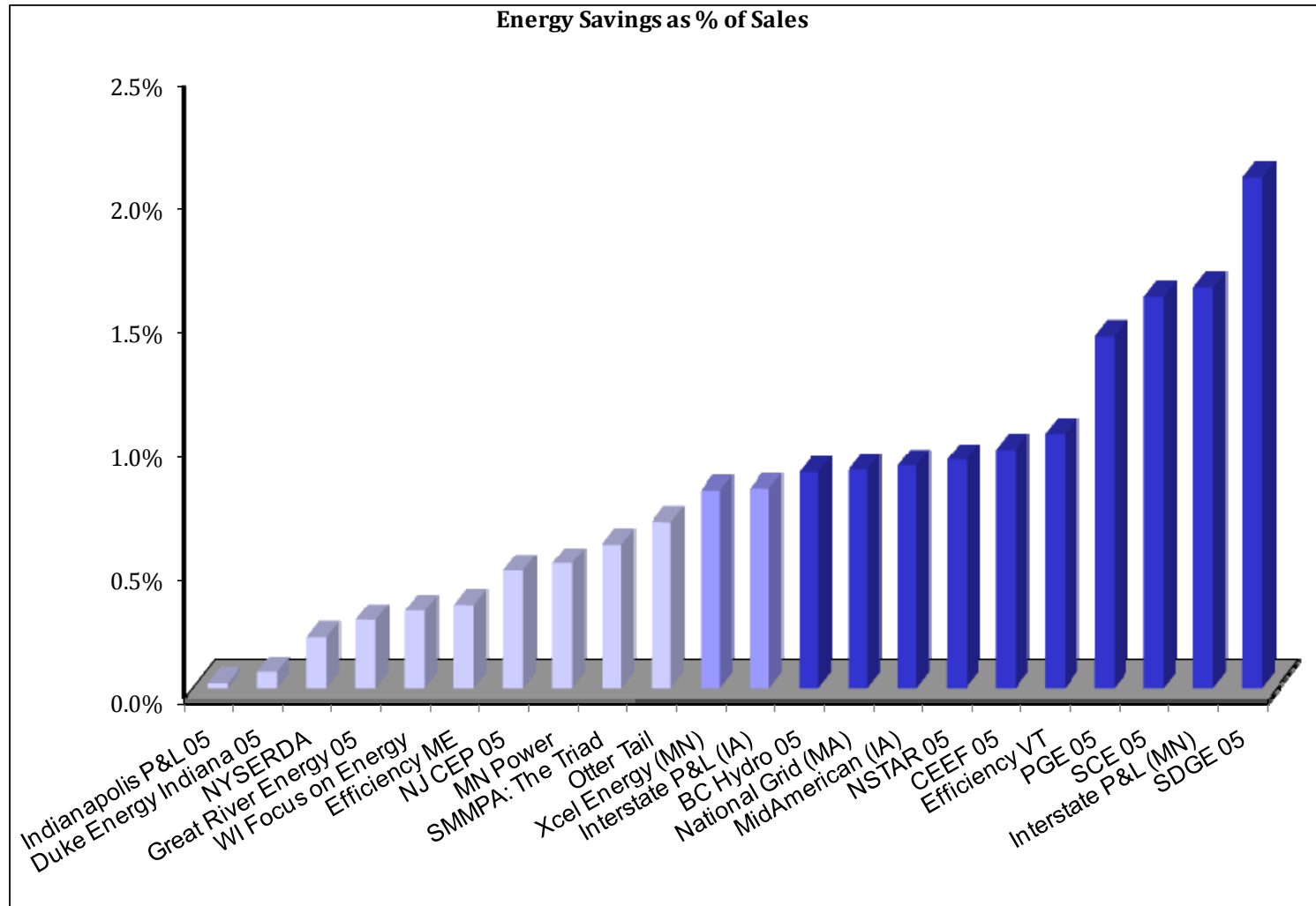
EE Benchmarking Context

- EE legislative and regulatory requirements and regulatory treatment have significant influences on overall EE program results. Some examples below.
- In Minnesota, electric utilities currently must spend 1.5%-2% of their revenues on EE/DR. Gas utilities must spend 0.5% of revenues on DSM. Program cost recovery is guaranteed, and performance-based EE/DR financial incentives can be up to 30% of program costs.
- Indiana grants EE/DR cost recovery, but it sets no requirements, nor does it offer any financial incentives. Indiana is the only jurisdiction reviewed that focuses C&I EE programs on small businesses.
- Illinois requires the state's electric IOUs to save increasing percentages of baseline sales, reaching 2% in 2015, but with a 2% rate cap.

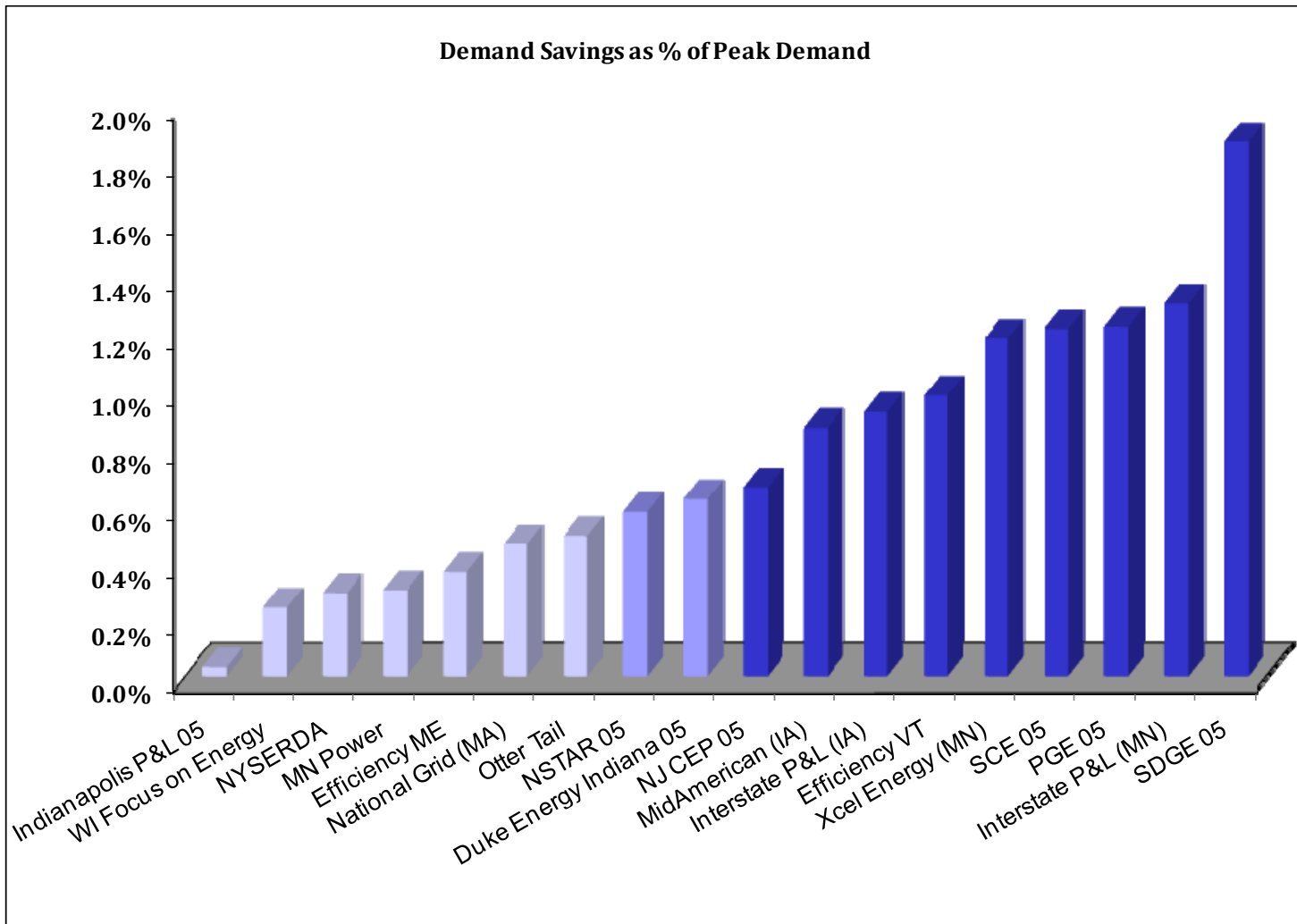
EE Spending, Percent of Revenue



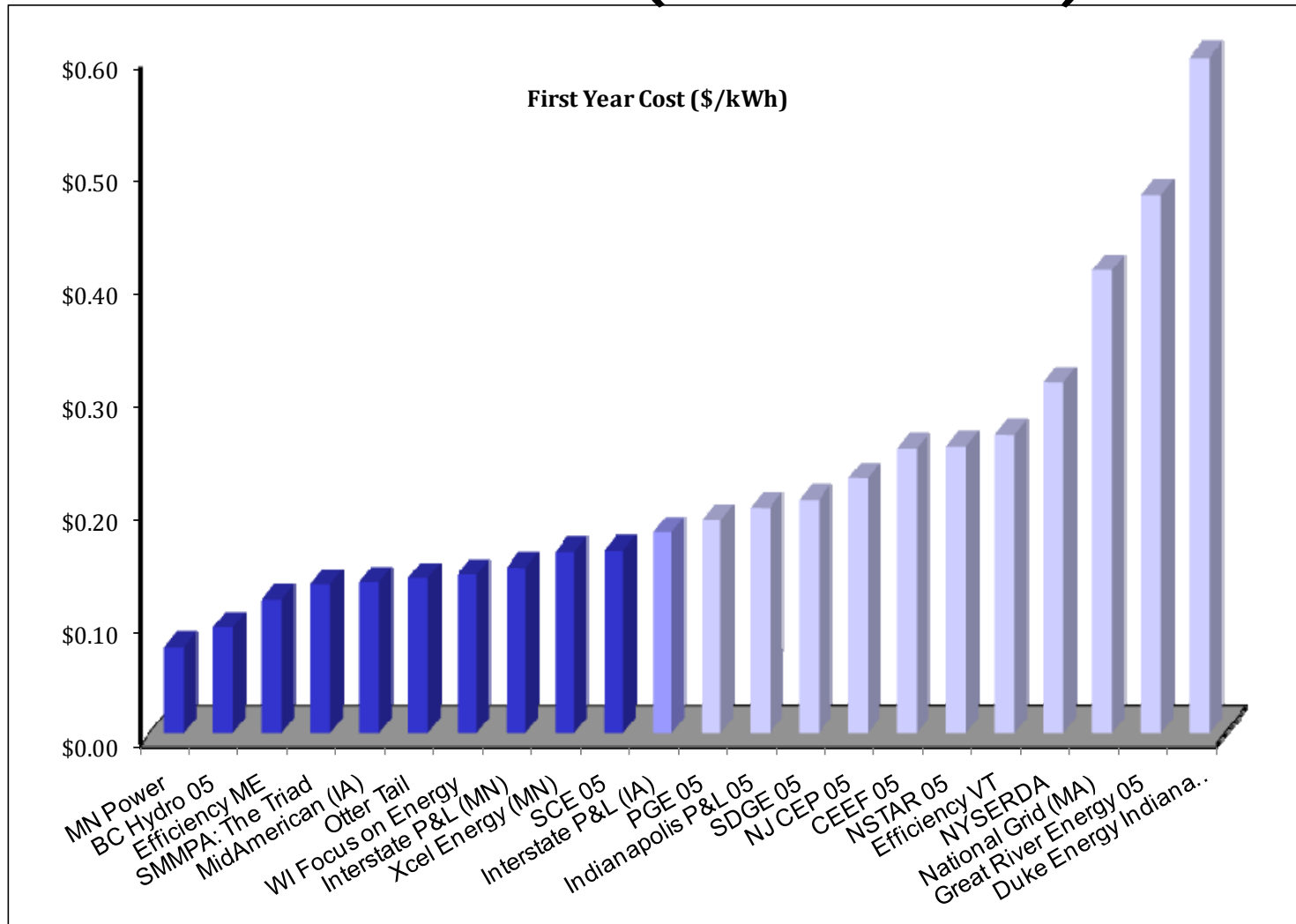
EE Energy Savings, Percent of Sales



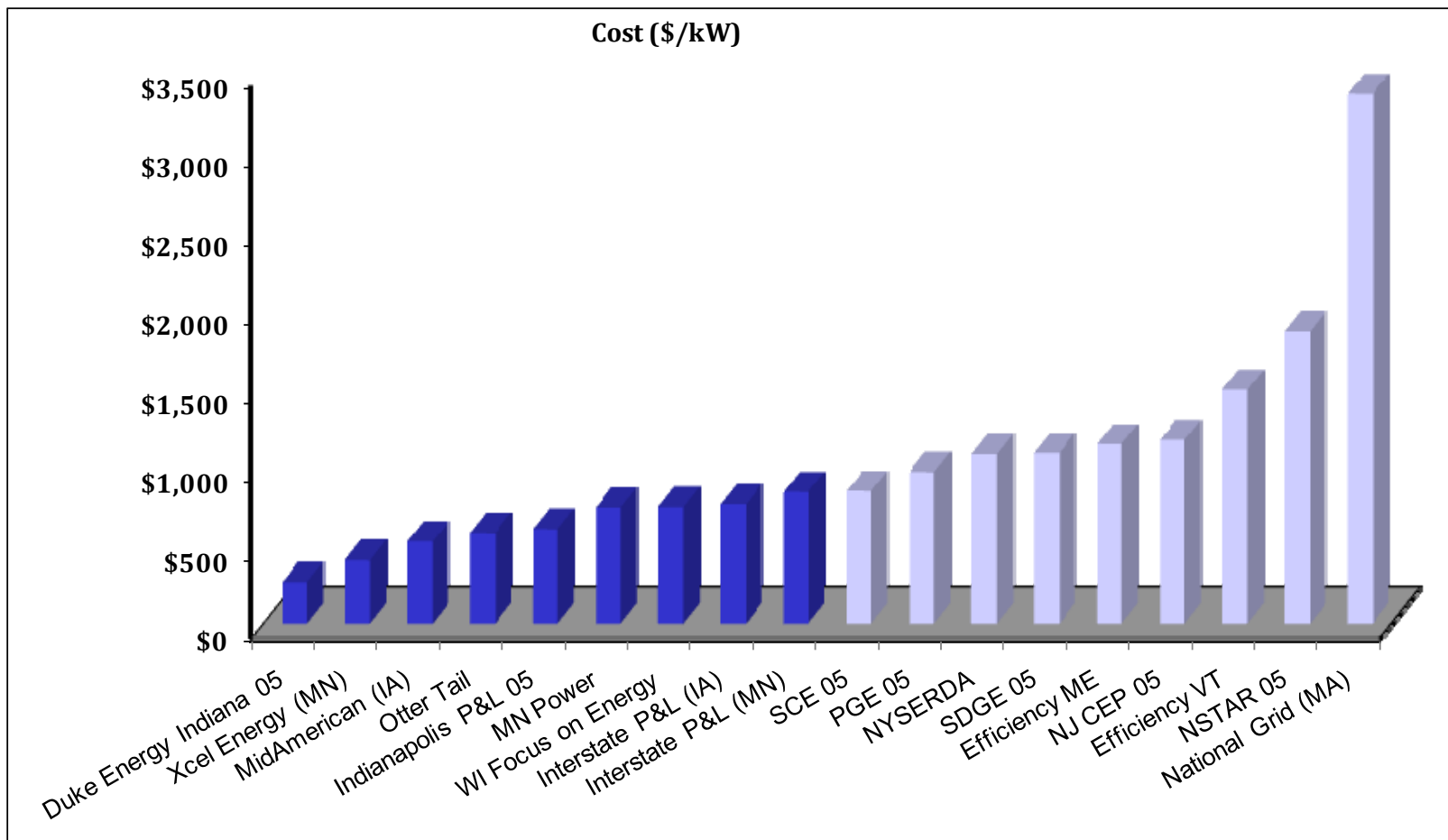
EE Peak Demand Savings, Percent



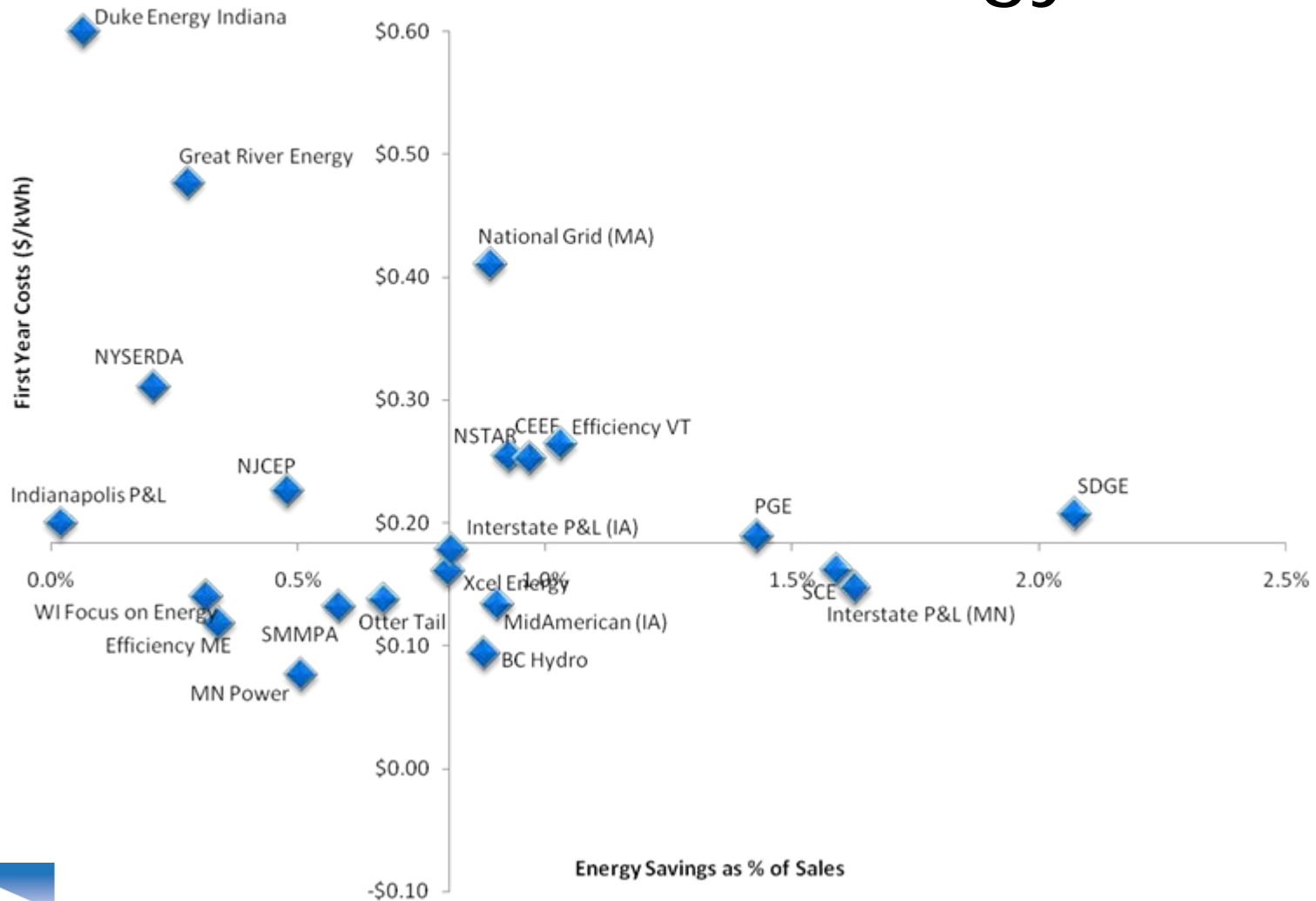
Costs of Conserved Energy, Cents/kWh (First Year)



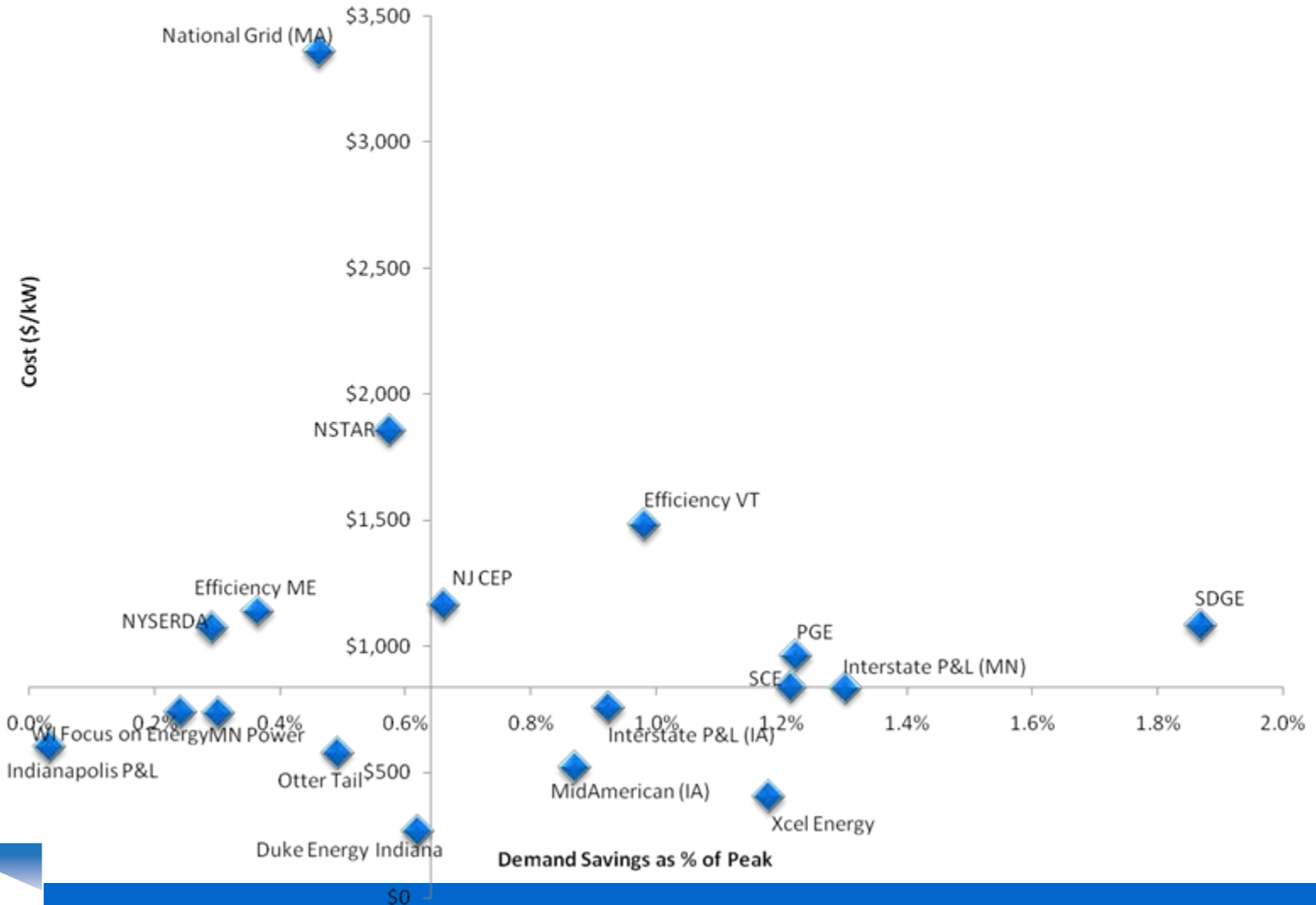
Cost of Conserved Peak Demand, \$/kW



Plot of Conserved Energy and Costs of Conserved Energy

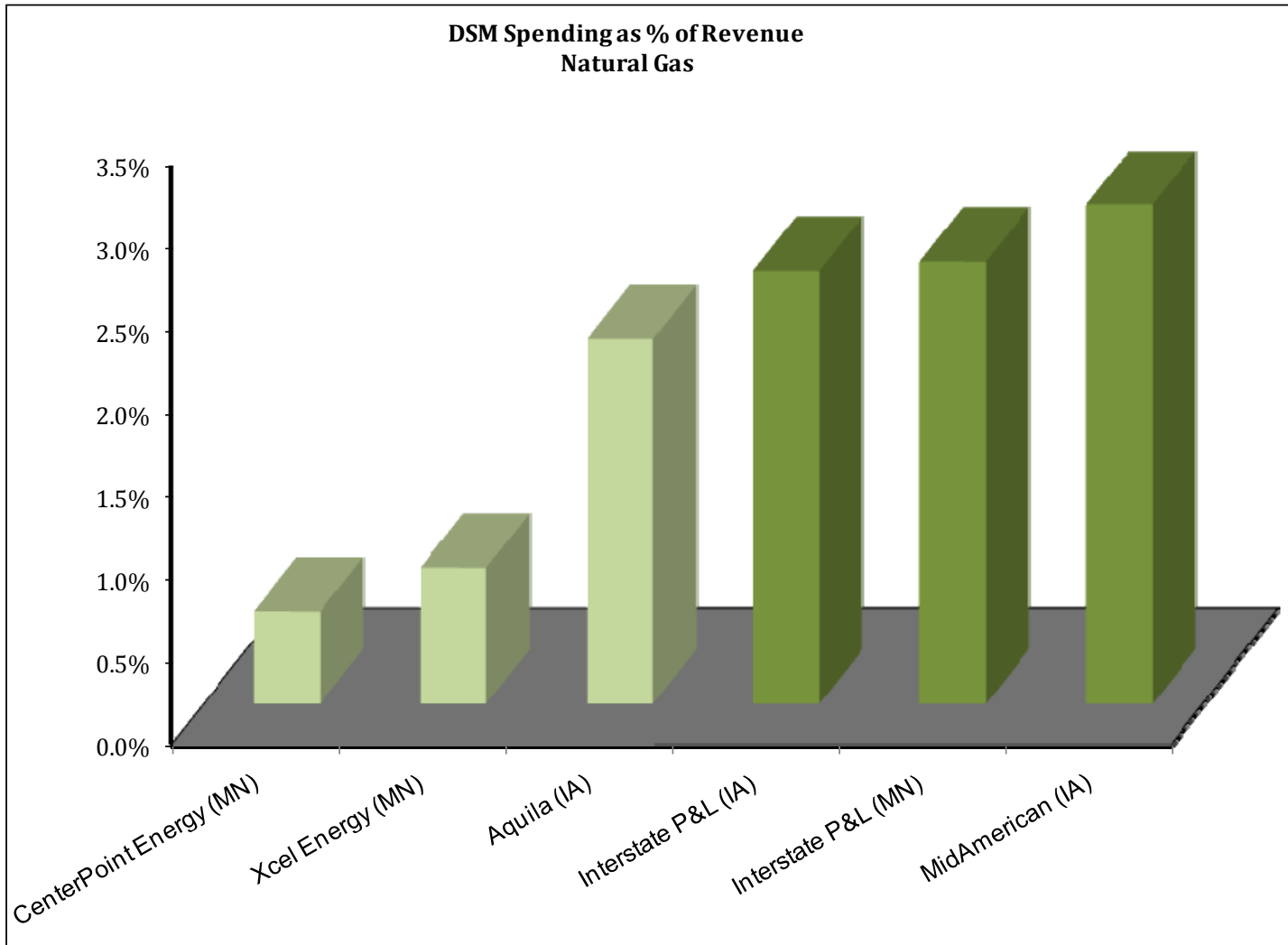


Plot of Peak Demand Reductions and Costs of Conserved Demand

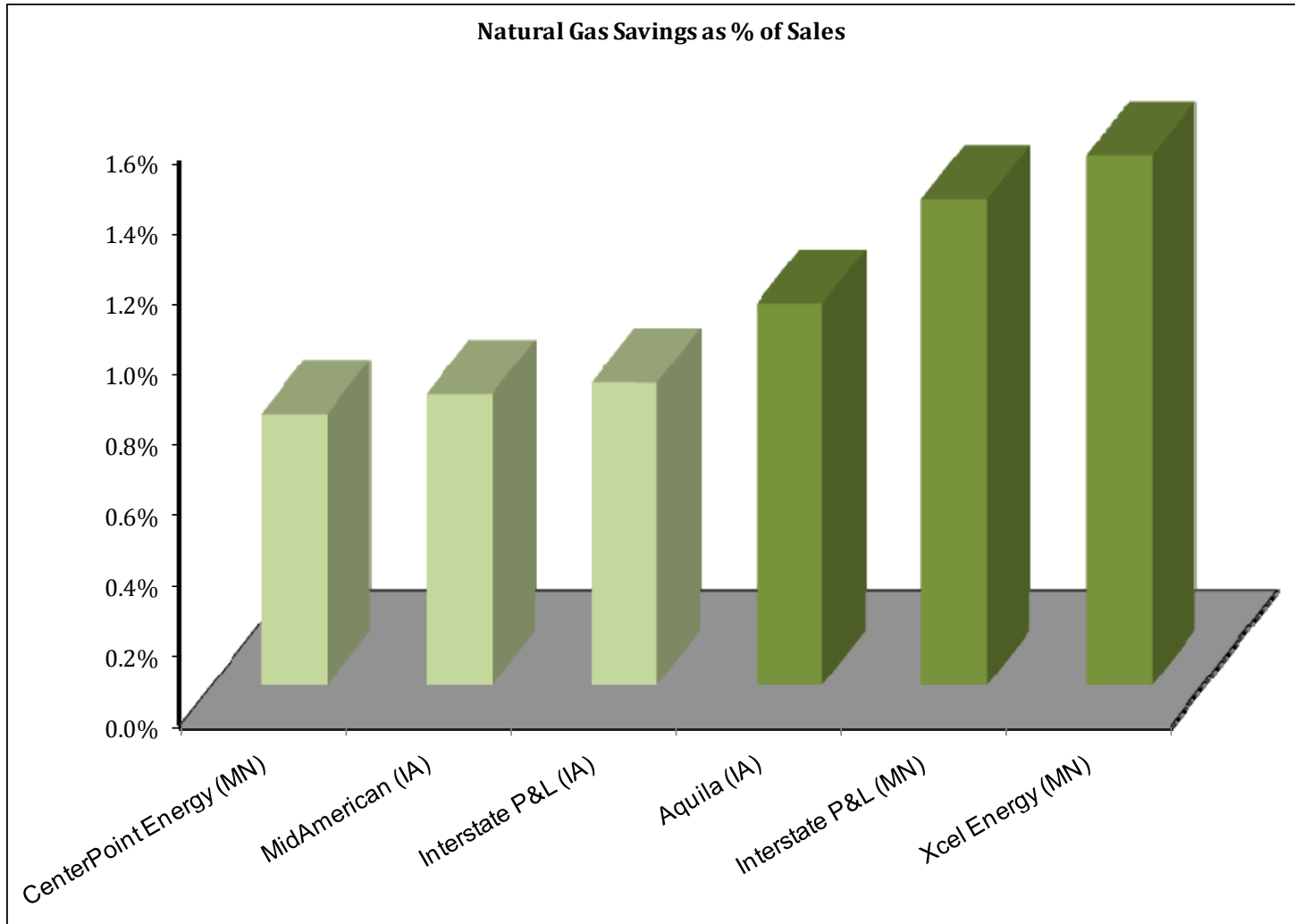


Natural Gas

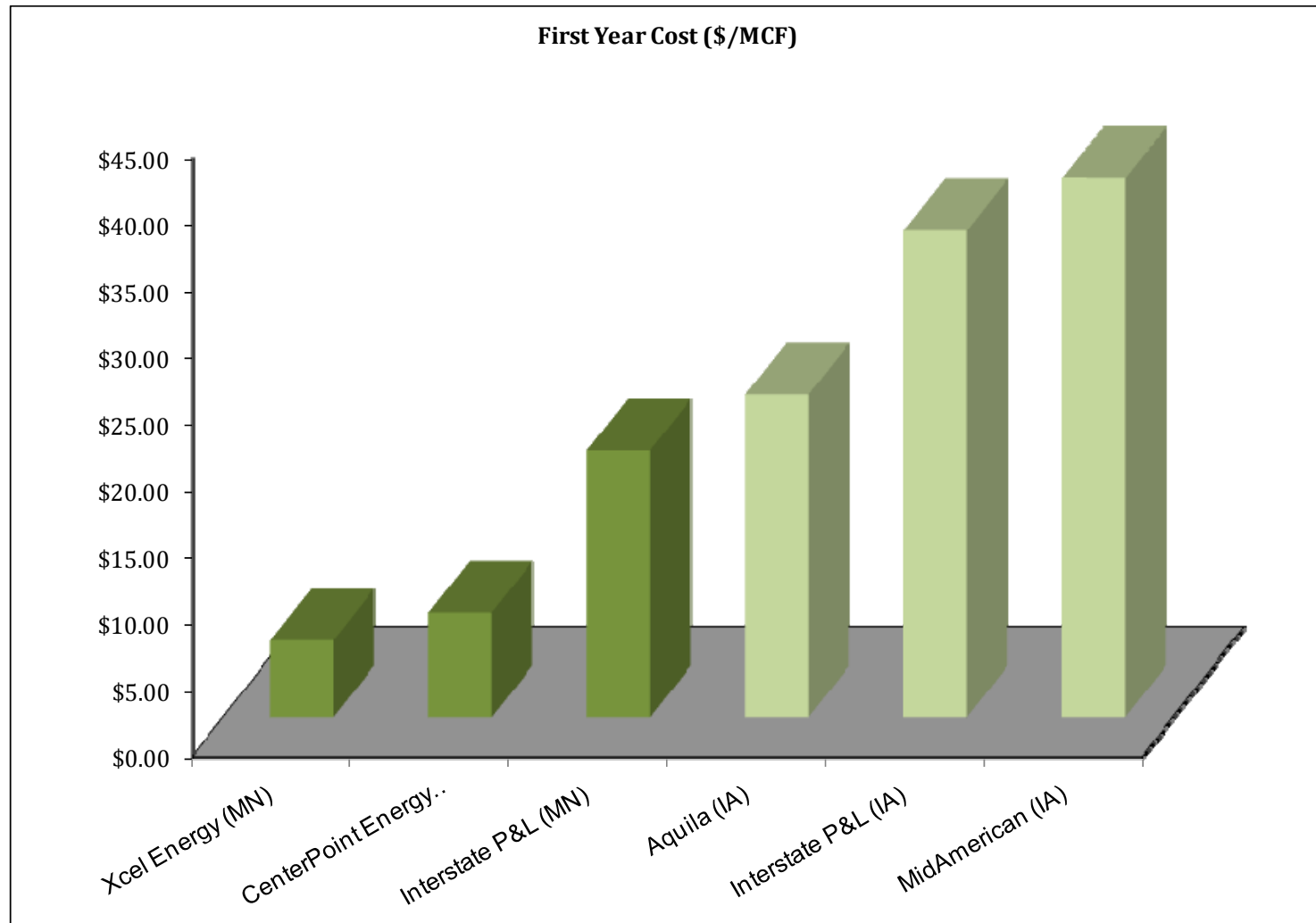
DSM Spending, Percent of Revenue



Natural Gas Savings, Percent of Sales



Costs of Conserved Natural Gas, \$/MCF (First Year)



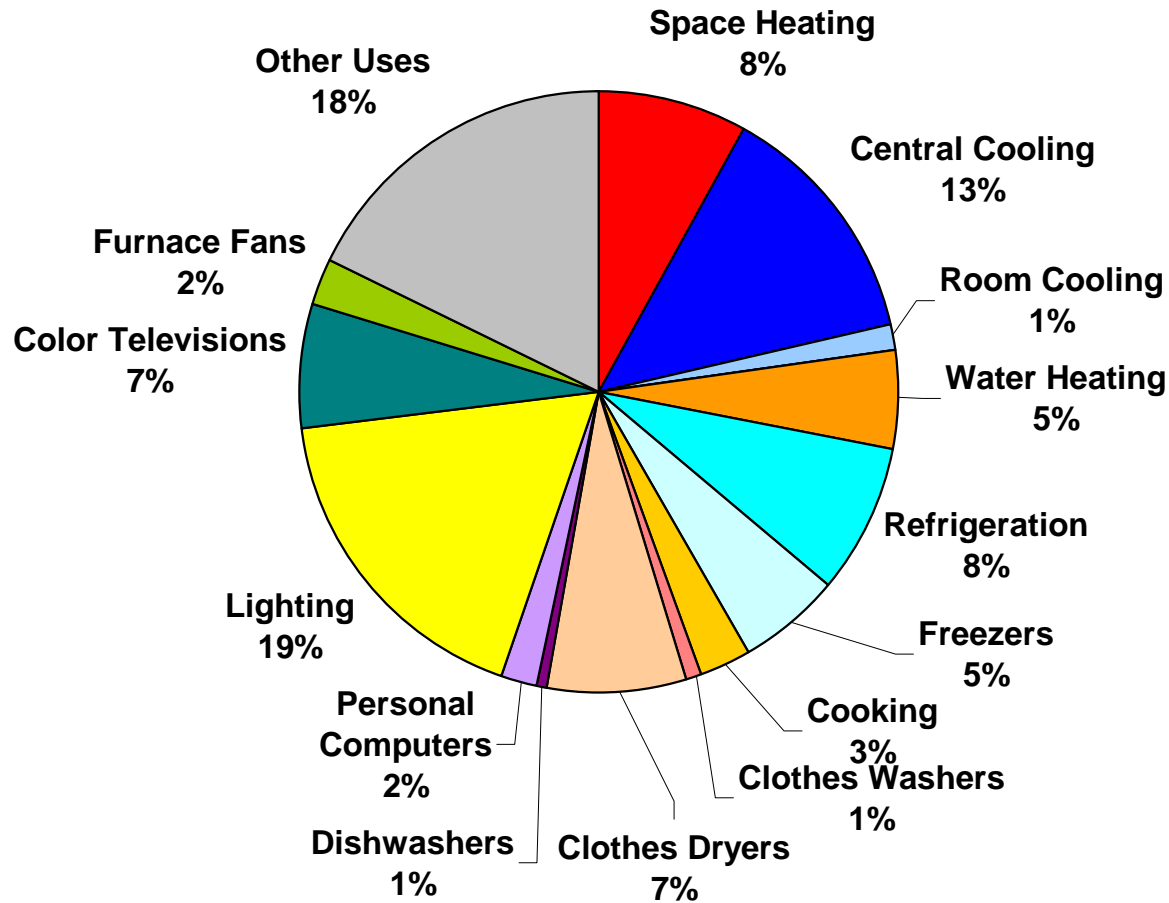
Plot of Conserved Natural Gas and Costs of Conserved Natural Gas



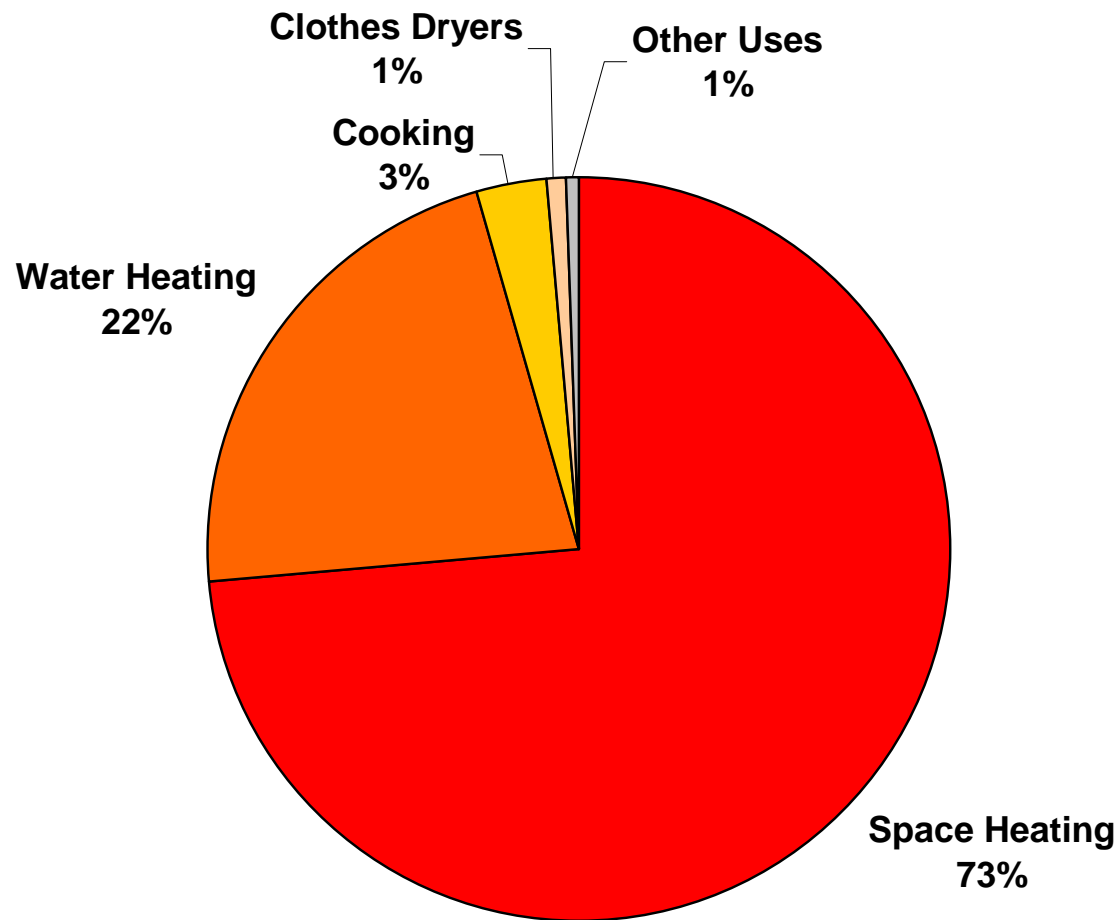
Baseline Market Profiles

- Developed by Ingrid Rohmund, currently with Global Energy Partners, and Energy Insights. Energy Insights was a subcontractor to Summit Blue for this project.
- Data sources include:
 - EIA form 861 information and EIA natural gas sales data.
 - Energy Insights' Energy Market Profiles reports.
 - Kansas utility data, such as residential and commercial appliance and customer equipment surveys, and energy forecasts.

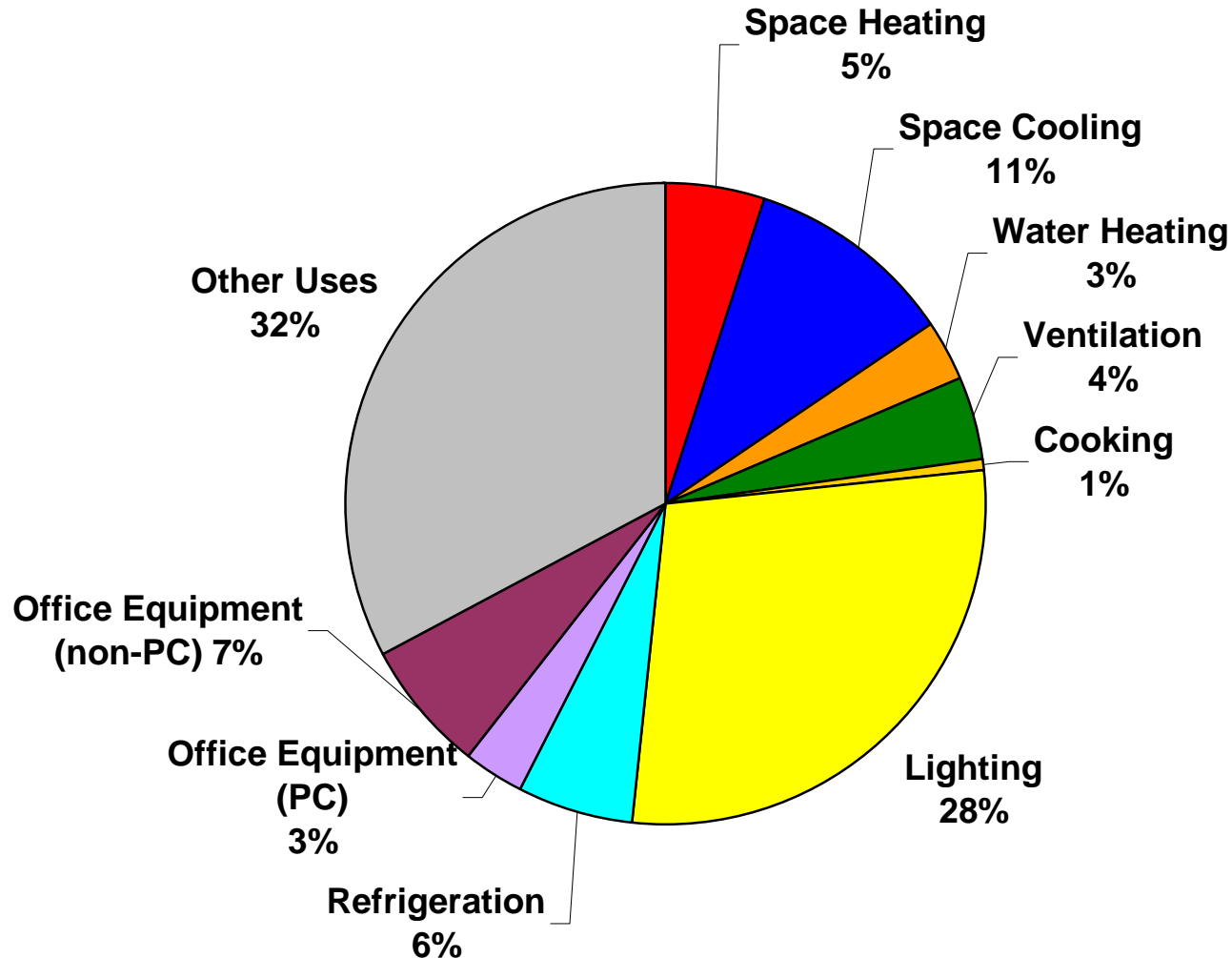
Residential Electric Consumption Profile by End Use



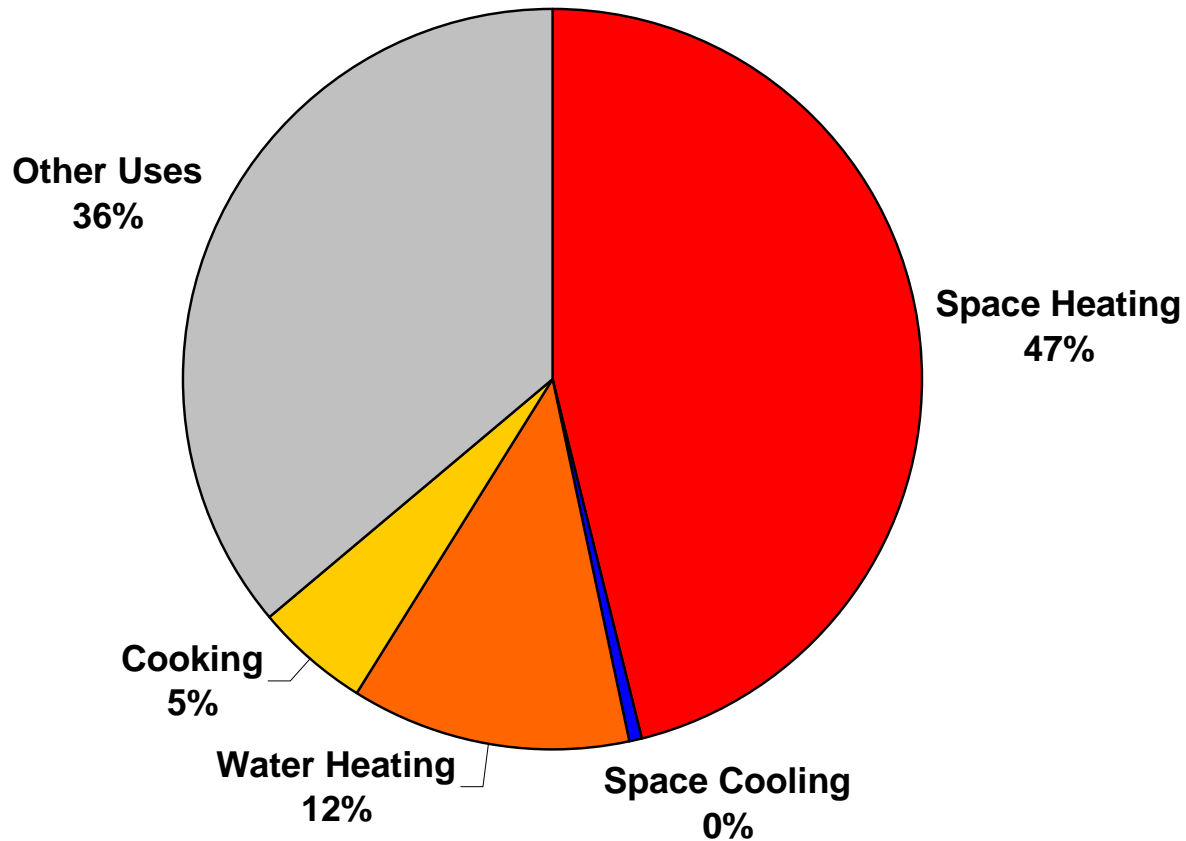
Residential Gas Consumption Profile by End Use



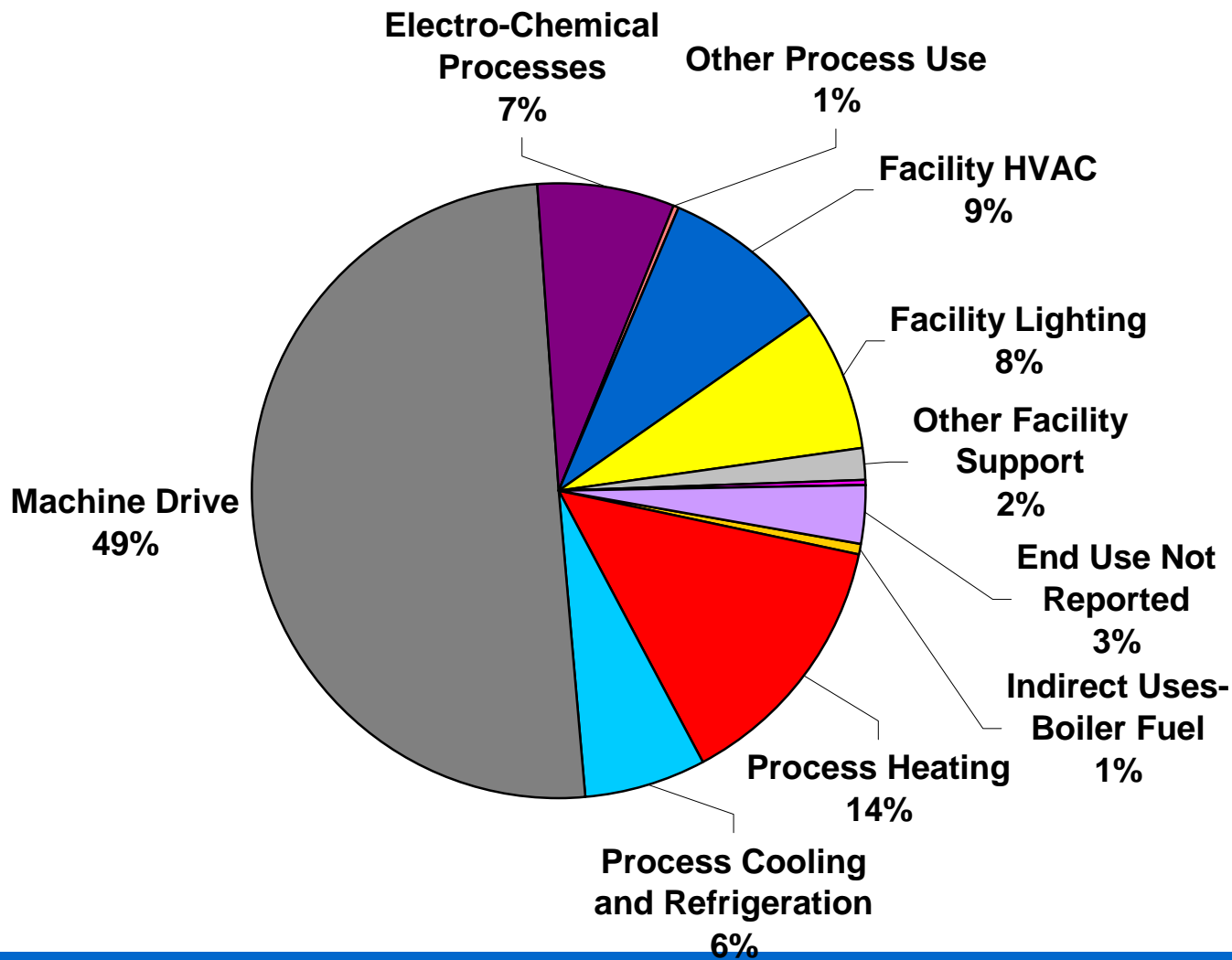
Commercial Electric Consumption Profile by End Use



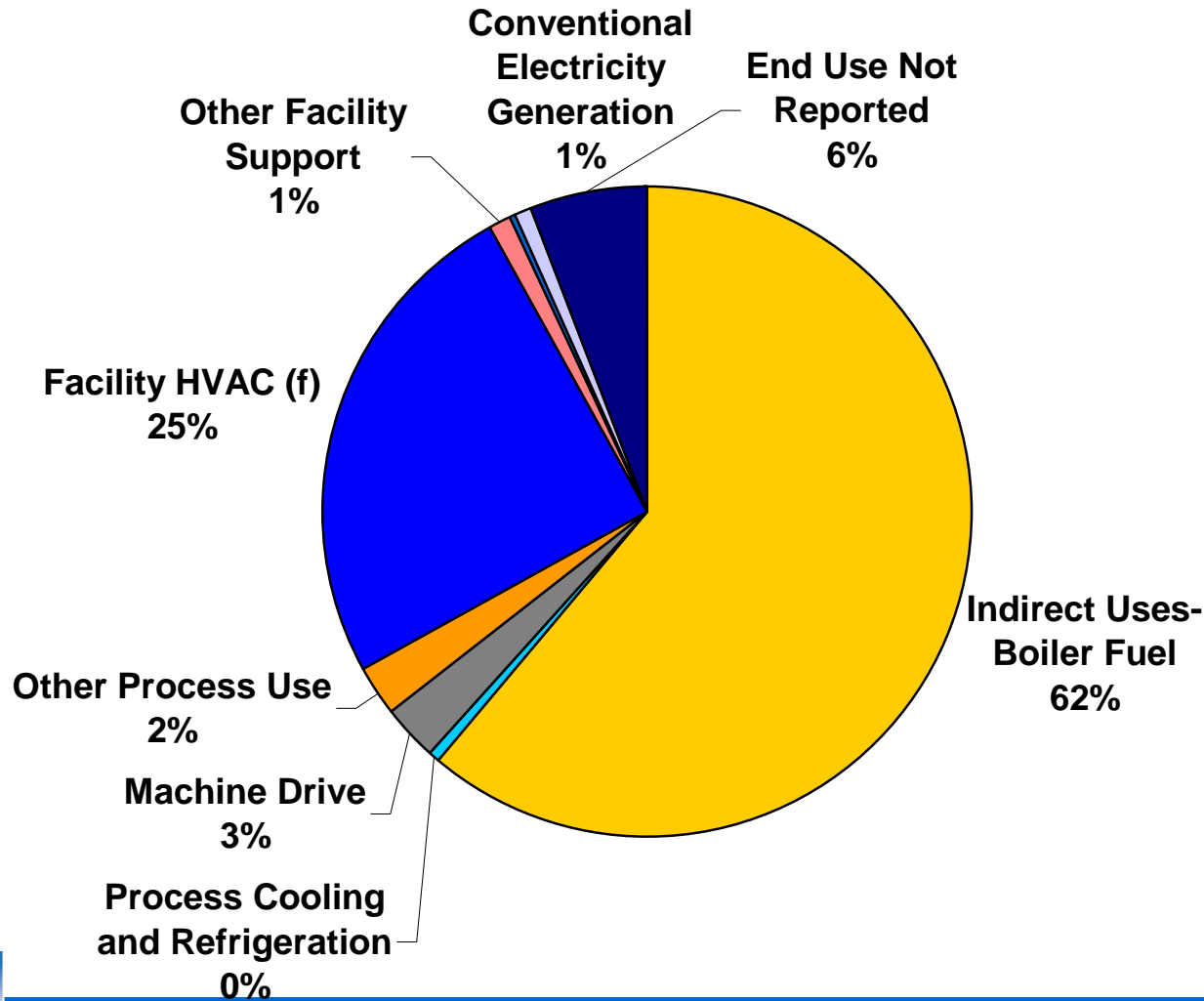
Commercial Gas Consumption Profile by End Use



Industrial Electric Consumption Profile by End Use



Industrial Gas Consumption Profile by End Use



EE Measure Characterization

- Estimated five key parameters for each measure: energy and demand savings, lifetimes, incremental and total costs.
- Used building simulation models to estimate the savings for weather dependent measures such as insulation and efficient HVAC systems.
- Used published sources to estimate the characteristics of non-weather dependent measures such as efficient refrigerators.
- The California Database of Energy Efficiency Resources (DEER) was generally the starting point for lifetime and cost estimates. Costs adjusted for Kansas.

Residential Appliance Characteristics Table

Measure Name	Base Technology	Program Decision Type	Energy Impact (kWh/Unit)	Peak Impact (W/Unit)	Technology Life	Cost if Retrofit (RET)	Cost if Replace on Burnout (ROB) or NEW
Pool Pump - Two Speed	Inefficient Single Speed Pool Pump	ROB/NEW	1400.00	540.00	10	\$539.30	\$182.18
H.E. Refrigerator	Refrigerator: Side Mount Freezer without through-the-door ice. Fresh volume=18cf, Freezer volume=5cf	ROB/NEW	64.00	10.88	18	\$98.38	\$98.38
Refrigerator Recycling	Standard Refrigerator	RET/NEW	1946.00	300.00	10	\$147.75	\$0.00
Freezer Recycling	Standard Freezer	RET/NEW	1662.00	256.00	10	\$147.75	\$0.00
H.E. Clothes Dryer	Electric Clothes Dryer EF=3.01. Single Family, 416 dry cycles	ROB/NEW	48.00	18.30	13	\$238.24	\$238.24
H.E. Clothes Washer (EI WH, EI Dry)	MEF=1.04, 2.65 capacity, electric water heat and electric dryer	ROB/NEW	447.00	186.40	13	\$592.77	\$592.77
H.E. Clothes Washer (EI WH, Gas Dry)	MEF=1.04, 2.65 capacity, electric water heat and gas dryer	ROB/NEW	321.36	134.01	13	\$592.77	\$592.77
H.E. Clothes Washer (Gas WH, EI Dry)	MEF=1.04, 2.65 capacity, gas water heat and electric dryer	ROB/NEW	127.58	53.20	13	\$592.77	\$592.77
Energy Star Dish Washer	EF=0.46, 215 wash cycles	ROB/NEW	97.00	30.75	13	\$133.64	\$133.64

EE Measure Cost Effectiveness Results

- Benefit-cost analysis was done using Summit Blue's DSM Resource Assessment Model.
- Electric avoided costs estimates were received from KCP&L and Midwest Energy. Used the averaged results.
 - Avoided energy costs for 2008 vary from 2 cents/kWh to 44 cents/kWh depending on season and time of day.
 - Avoided capacity costs start at \$123/kW-year and escalate.
- Used natural gas avoided cost estimates from Xcel Energy Minnesota, as Kansas data was not available. Xcel Energy's estimates are publicly provided as part of their DSM regulatory filings.
 - Commodity cost: \$9/MCF in 2007.
 - Peak demand cost: \$1/MCF saved in 2007.

EE Benefit-Cost Analysis Tests

- Total Resource Cost Test (TRC). Most widely used test. Evaluates whether EE is cheaper than supply side options. Benefits are avoided costs due to EE. Costs are EE measure costs + program administrative costs.
- Utility Cost Test (UCT). Evaluates whether EE is cost effective to the utility. Benefits are avoided costs due to EE. Costs are total EE program costs.
- Rate Impact Test (RIM). Evaluates whether EE will cause utility rates to increase or decrease. Benefits are avoided costs due to EE. Costs are total program costs plus “lost revenues” due to DSM.
- Participant Test. Evaluates whether EE is cost effective to customers. Benefits are energy bill savings due to EE. Costs are the net EE measure costs.

Cost Effectiveness Results

- Analysis produced results for all four California standard tests, but we focused on the results of the most widely used test: the total resource cost test (TRC).
- About 75% of residential EE measures analyzed passed the TRC test and the Participant Tests. A majority of ENERGY STAR appliances measures failed the TRC test and participant test. Most other end use category measures passed these two tests.
- About 50% of residential measures passed the RIM test. All lighting measures failed the RIM test, but most other measures passed the RIM test.
- Almost all (95%) measures passed the Utility Test.

EE Potential Estimation Approach

- Use a three step process to estimate “achievable” EE potential:
 - Estimate technical and economic potential. Technical potential means the maximum amount of DSM technically feasible, not considering economic or market barriers. For measures to be considered “cost effective” for economic potential, they had to pass the TRC test.
 - Estimate preliminary achievable potentials for each measure.
 - Calibrate the overall and end use achievable potential estimates to the EE benchmarking results. The primary benchmarks used for this purpose are annual savings of 0.5% to 1.5% of baseline energy sales, depending on sector and fuel type.
- Summit Blue’s approach to estimating EE potential is to develop estimates that are realistic but stretching. Our advice is generally not to try to catch up with California in the short to medium term.
- Catching up with Iowa and Minnesota should be sufficiently challenging in the medium term.

Draft Residential Electric EE Potential Estimates for 2028

- Technical potential: 7,300 GWh, 43% of forecast sales, or about 2% of forecast sales per year on average.
- Economic potential: 6,000 GWh, 36% of forecast sales.
- Base case market potential: 1,800 GWh, 11% of forecast sales, or about 0.5% of forecast sales per year on average. This is about the median for the benchmarked utilities actual DSM program savings. The 20 year cost for this EE is \$157 million, or about \$8 million per year.
- High case market potential: 3,100 GWh, 18% of forecast sales, or about 0.9% of forecast sales per year on average. This equals the highest savings Midwest utility results, Interstate P&L (Iowa) and Minnesota Power. The 20 year cost for this EE is \$395 million, or about \$20 million per year.

Distribution of Residential Electric Savings by End Use

- Lighting: 68%.
- HVAC: 25%.
- Appliances and other: 4%.
- Water heating: 3%.

Preliminary Base Case C&I EE Potential Estimates

- Median results for commercial/industrial EE programs from benchmarked utilities:
 - Energy savings: 0.7% of annual sales
 - Demand savings: 0.6% of peak demand
 - Spending: 1.8% of revenue
 - Cost of conserved energy: \$0.14/kWh
- Representative Midwest utilities
 - Interstate Power and Light (Iowa)
 - Otter Tail Power (Minnesota)

Preliminary High Case C&I EE Potential Estimates

- High savings and low cost Midwest C&I DSM program results from benchmarked utilities:
 - Energy savings: 1.0% of annual sales
 - Demand savings: 1.0% of annual peak demand
 - Spending: 1.8% of annual revenue
 - Cost of conserved energy: \$0.10/kWh
- Representative Midwest utilities
 - MidAmerican Energy (Iowa)
 - Xcel Energy (Minnesota)

Approximate Distribution of C&I Electric Savings by End Use

- Lighting: 40%
- Custom, Motors, and Process: 40%
- HVAC: 15%
- Refrigeration, water heating, other: 5%

Preliminary Base Case Natural Gas EE Potential Estimates

- Median results for natural gas EE programs from benchmarked utilities:
 - Energy savings: 1.0% of annual sales
 - Spending: 2.4% of revenue
 - Cost of conserved energy: \$22/MCF
- Representative utilities
 - CenterPoint Energy (Minnesota)
 - Interstate Power and Light (Iowa)
 - MidAmerican Energy (Iowa)
 - People's Gas/Aquila (Iowa)

Preliminary High Case Natural Gas EE Potential Estimates

- High savings and low cost results for natural gas EE programs from benchmarked utilities:
 - Energy savings: 1.5% of annual sales
 - Spending: 1% - 2% of revenue
 - Cost of conserved energy: \$10-20/MCF
- Representative utilities
 - Interstate Power and Light (Minnesota)
 - Xcel Energy (Minnesota)

Approximate Distribution of Natural Gas Savings by End Use

- Heating: 75%
- Custom/process: 20%
- Other: 5%

Conclusions

- Most EE measures analyzed are cost effective from the perspectives of the TRC, Utility, and Participant tests.
- Most residential measures, except lighting, pass the RIM test.
- Median residential and C&I electric EE program savings is about 0.6% -0.7% of baseline sales annually.
- High savings Midwest electric utilities save 0.9% - 1.0% of baseline sales per year.
- Cost of conserved electricity is about \$0.13 - \$0.18/kWh for high savings Midwest utilities.
- Median natural gas EE program savings is about 1.0% of baseline sales.
- High savings Midwest gas utilities save about 1.5% of baseline sales annually.
- The cost of conserved natural gas by high savings utilities can be \$10/MCF or less, and up to \$20/MCF.

Discussion

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