ANNUAL STAKEHOLDER MEETING

Market Potential Study (MPS) Methodology

July 10, 2014

Presented by the Statewide Evaluation Team:

Nexant

GDS Associates, Inc.
Engineers and Consultants

research/into/action

APEX ANALYTICS, LLC

Market Potential Study (MPS) Introduction

- Study commenced in March, 2014
- Study scheduled to be complete at the end of 2014
  - Public comment period on results in early 2015
- Study will include an assessment of energy efficiency
  - Demand response study will be conducted separately, with outcome integrated at the conclusion to both studies
- Working Phase II methodology similar to final methodology used for Phase I study
  - Will continue to discuss, revise, and refine methodology over next several months

Planned Tasks & Schedule

1) Prepare & Distribute MPS Methodology (Complete)

2) Submit MPS Data Request & Collect Data (Complete)

3) Develop Disaggregated Baseline Forecast (July)

4)Draft Measure List (Complete)

5) Conduct Measure Savings & Cost Research (September)

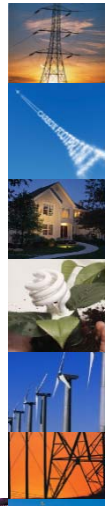
6) Determine Technical Potential & Supply Curves (September)

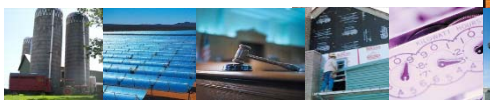
7) Determine Measure Cost Effectiveness and Economic Potential (October)

8) Determine Achievable/Program Potential Scenario(s) (October)

9) Research DSM Program Spending and Savings Performance (October)

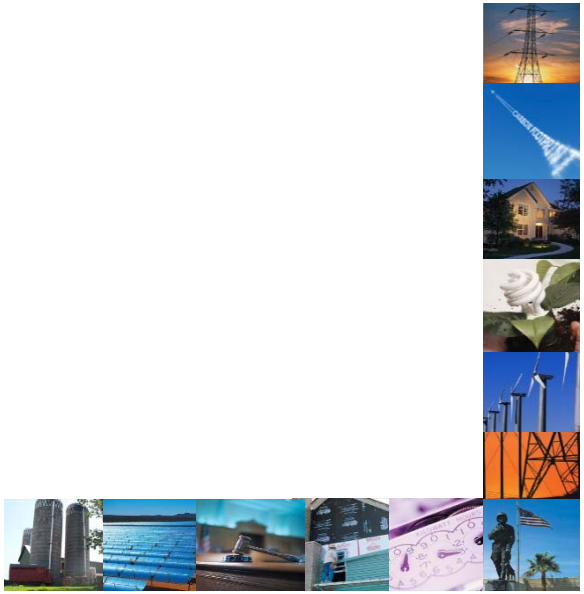
10) Prepare Final Report and Appendices (December)





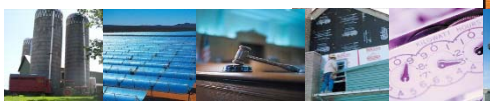
Market Potential Study Methodology

METHODOLOGY OVERVIEW



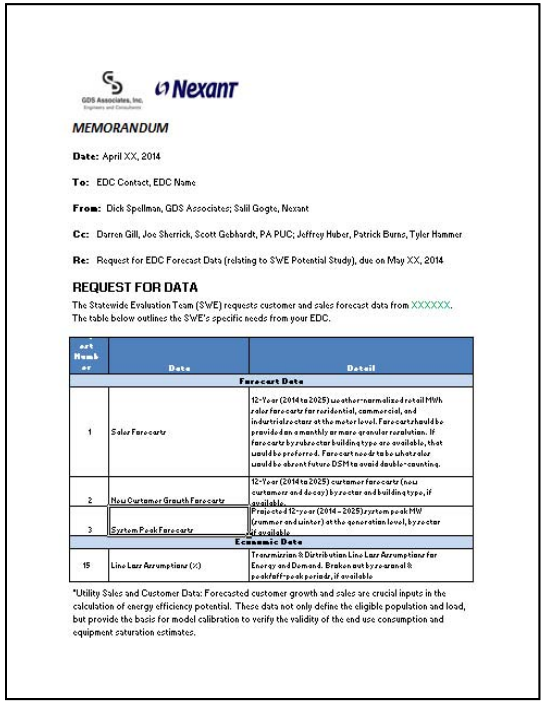
Required Data/Data Sources

Historical & Forecast Load --- EDC Data Request	Avoided Costs --- EDC Data Request	Line Losses --- EDC Data Request	General Modeling Assumptions --- EDC Data Request
Measure Savings --- PA TRM (2015)	Measure Costs --- 2014 Incremental Cost Database Update	Useful Lives --- PA TRM (2015)	Load Shapes & Coincidence Factors --- 2014 Metering / EDC Data Request
Baseline Saturation Data --- EDC Data Request/2014 Baseline	Energy Efficient Saturation Data -- 2014 Baseline Data	Market Adoption Rates --- WTP Results / EDC Data	Non-Incentive Costs --- EDC Data / Benchmarking



EDC Data Requests

- High Priority Data Request Items
  - EDC Load Forecasts & Line Losses
- Medium Priority Data Request Items
  - Participation Metrics, Saturation Studies, Measure Cost Data, Load Shapes & Coincidence Factors
- Low Priority Data Request Items
  - EDC Avoided Energy & Capacity Costs, Inflation Rates, Discount Rates



GDS Associates, Inc.
Engineers and Consultants

Nexant

MEMORANDUM

Date: April XX, 2014

To: EDC Contact, EDC Name

From: Dick Spellman, GDS Associates; Salil Gogte, Nexant

Cc: Darren Gill, Joe Sherrick, Scott Gebhardt, PA PUC; Jeffrey Huber, Patrick Burns, Tyler Hammer

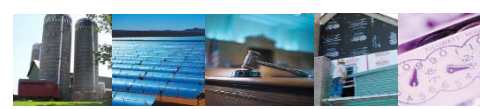
Re: Request for EDC Forecast Data (relating to SWE Potential Study), due on May XX, 2014

REQUEST FOR DATA

The Statewide Evaluation Team (SWE) requests customer and sales forecast data from XXXXXX. The table below outlines the SWE's specific needs from your EDC.

est Numb er	Data	Detail
	Forecast Data	
1	Sales Forecasts	12-Year (2014 to 2025) weather-normalized retail MWh sales forecasts for residential, commercial, and industrial sectors at the meter level. Forecasts should be provided on a monthly or more granular resolution. If forecasts by subsector building type are available, that would be preferred. Forecast needs to be what sales would be absent future DSM to avoid double-counting.
2	New Customer Growth Forecasts	12-Year (2014 to 2025) customer forecasts (new customers and decay) by sector and building type, if available.
3	System Peak Forecasts	Projected 12-year (2014 – 2025) system peak MW (summer and winter) at the generation level, by sector if available.
	Economic Data	
15	Line Loss Assumptions (%)	Transmission & Distribution Line Loss Assumptions for Energy and Demand. Broken out by seasonal & peak/off-peak periods, if available

*Utility Sales and Customer Data: Forecasted customer growth and sales are crucial inputs in the calculation of energy efficiency potential. These data not only define the eligible population and load, but provide the basis for model calibration to verify the validity of the end use consumption and equipment saturation estimates.



Nexant research into action APEX ANALYTICS, LLC

Measure Characterization - Breakouts

Electric

Residential

Non-Residential

Building/Home Type

Construction Type

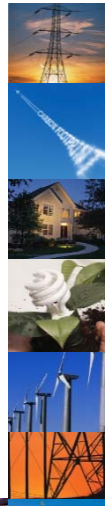
(Existing vs. New Construction)

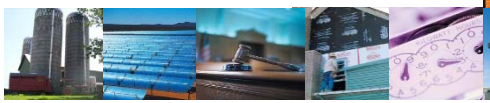
Equipment Status

(Replace on Burnout vs. Retrofit)

Income Type

(Low Income - Residential Only)



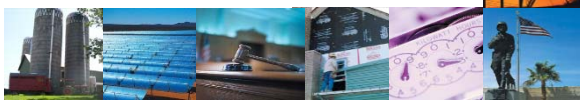


C/I Segmentation Example (Preliminary)

Sector	Segment
Industrial	Mfg: Chemicals & Plastics
	Mfg: Computers & Electronics
	Mfg: Food
	Mfg: Metals
	Mfg: Paper
	Mfg: Plastics
	Mfg: Other
	Mining
	Other Non-Mfg
Institutional	Education
	Healthcare
	Government / Public Service
	Non-profit
	Other Institutional
Commercial	Grocery
	Lodging
	Office
	Restaurant
	Retail
	Warehouse
	Misc.

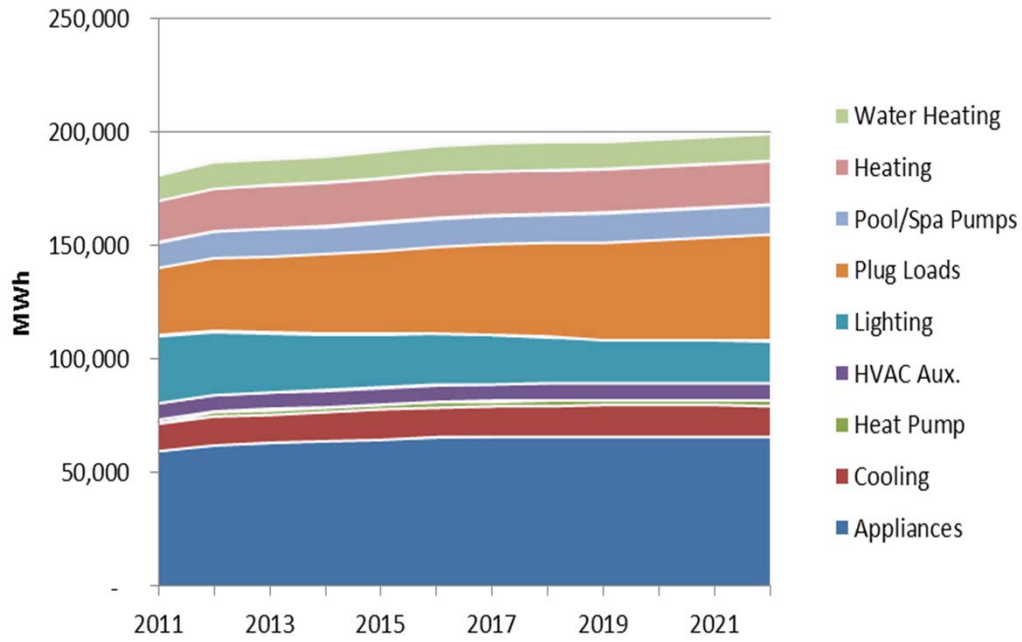
Indusial End Use	Equipment Types		
HVAC	Central HVAC Improvements	Unitary HVAC Improvements	
Motors	Motors: Motor Improvements	Motor O&M	
Lighting	High Bay	Linear Fluorescent	Task Lighting
Fans	Fans: Motor Improvements		
Pumps	Pumps: Motor Improvements		
Process Heating	Process Heat Improvements	Process Heat O&M	
Process Cooling	Process Cool Improvements	Process Cooling O&M	
Process Air Compressor	Process Air: Air Comp Improvements	Process Air: Motor Improvements	
Process Refrigeration	Process Refrig: Motor Improvements	Process Refrigeration O&M	
Process Other	Other Improvements	Process Other O&M	Process Air O&M
Other	Bldg Improvements		

Commercial End Use	Equipment Types				
Linear Fluorescent Lighting	T12	T8	HPT8	T5	Lin Fluor Lighting Other
High Bay Lighting	Linear Fluorescent High Bay	Metal Halide High Bay	High Pressure Sodium High Bay	Mercury Vapor High Bay	High Bay Lighting Other
Other Interior Lighting	Incandescent	CFL	Exit Signs	Int Lighting Other	
Street Lighting	Street Lighting	Street Lighting Other			
Exterior Building Lighting	Building Mounted Exterior	Parking Garage	Pole Mounted	Ext Building Lighting Other	
Space Cooling Unitary	Split System	Room AC	Packaged DX	Space Cooling Unitary Other	
Space Cooling Central	Packaged Central Plant/Chiller	Space Cooling Central Other			
Space Heating	Packaged Central Plant	Electric resistance	Unit Heater	Space Heating Other	
Heat Pump	Air Source	Ground/Water Source	Ductless	Heat Pump Other	
Refrigeration	Display Case	Refrigerator	Freezer	Central Refrigeration	Refrigeration Other
Water Heating	Central w Storage Tank	Heat Pump	Heat Recovery	Self-Contained	Water Heating Other
Cooking	Oven	Range	Steamer	Fryer	Cooking Other
Plug Load	Computer	Appliance	Office Equip	Plug Load Other	
Motors	Ventilation	Space Cooling Water Pump	Space Heating Water Pump	Water Heating Water Pump	Motors Other
Other	Other Other				



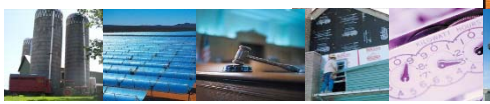
FORECAST DISAGGREGATION (EXAMPLE)

- Forecast disaggregated end-uses and segments into the future, considering:
  - Expected growth and decay
  - Codes and standards



RESIDENTIAL FORECAST CALIBRATION

- Calibrate Energy Modeling Results to Total Residential Forecast Load
  - Develop Housing Prototypes based on 2014 Baseline Study Results
  - Use end-use energy consumption model outputs
  - Use EDC-specific end-use saturation data from baseline study
    - *Ex: Total # of homes * Total % of homes w/ central cooling * central cooling end-use consumption estimate = Total Residential Cooling Load*
  - Compare sum of all end-use loads to total residential forecast
- Calibration checks currently underway
  - Using both REM/Rate & BeOpt to compare results
- Complete all EDCs in July
  - Share individual EDC results, housing prototype characteristics, and end-use saturation assumptions for individual EDC review and comment



Draft Measure Lists

- Includes all measures included in the draft 2015 PA TRM
- Includes "universe" of possible energy-efficiency measures for all sectors
- 'Emerging' Technologies included
  - Ex: Smart Thermostats, Showerstart,
- Extensive research on measure parameters across study horizon
  - Code baseline update
  - Measure costs
  - Measure Life
- Additional emphasis on lighting measures due to market diversity and traditionally large share of DSM savings

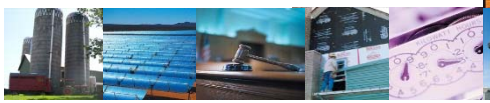
LED Replacement Bulb Price Forecast

- MPS will recognize expected decrease in LED replacement bulbs costs over time

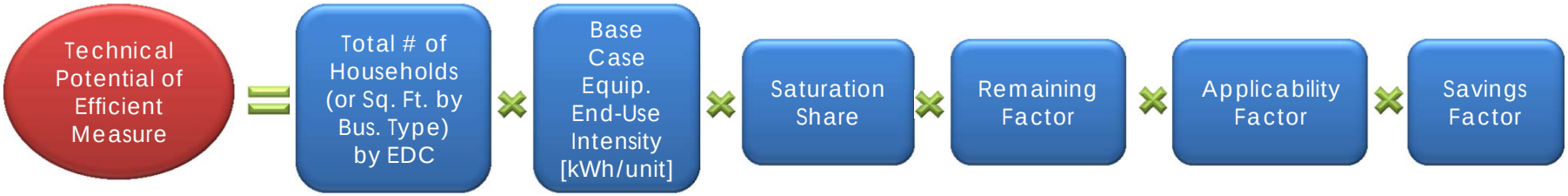
- Current available sources include: DOE MYPP, EIA Technology Forecast Updates (Navigant), NEEP RLS, IMS Research
- Reviewing A19 (standard) and PAR38 (reflector) bulbs
- Will also recognize increased efficacy; reduced LED wattages over time

Types of DSM Potential

- Not Technically Feasible → **Technical Potential**
- Not Technically Feasible → Not Cost Effective → **Economic Potential**
- Not Technically Feasible → Not Cost Effective → Market & Adoption Barriers → **Achievable Potential**
- Not Technically Feasible → Not Cost Effective → Market & Adoption Barriers → Program Design, Budget & Time Constraints → **Program Potential**



General Modeling Approach



Where:

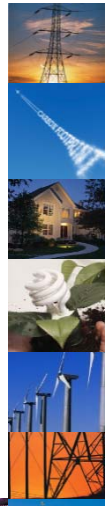
Base Case Equipment End Use Intensity = the electricity used per customer per year by each base-case technology in each market segment. This is the consumption of the electrical energy using equipment that the efficient technology replaces or affects.

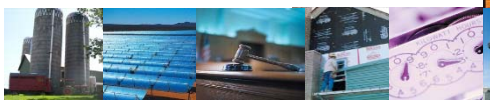
Saturation Share = the fraction of the end use electrical energy that is applicable for the efficient technology in a given market segment. For example, for residential water heating, this would be the fraction of all residential electric customers that have electric water heating in their household.

Remaining Factor = the fraction of equipment that is not considered to already be energy efficient. To extend the example above, the fraction of electric water heaters that are not already energy efficient.

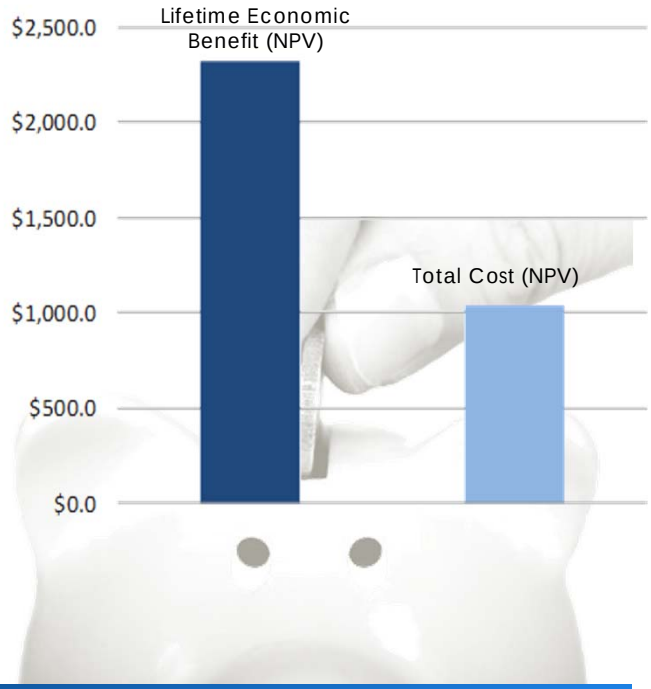
Applicability Factor = the fraction of the applicable units that is technically feasible for conversion to the efficient technology from an engineering perspective (e.g., it may not be possible to install CFLs in all light sockets in a home because the CFLs may not fit in every socket.)

Savings Factor = the percentage reduction in electricity consumption resulting from application of the efficient technology.





Determining Cost-Effectiveness



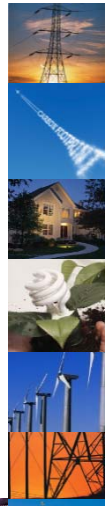
TRC Test: *As defined by the PA PUC in the latest TRC Order*

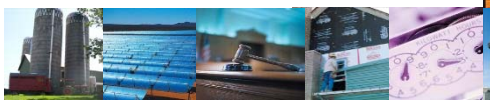
Benefits and Costs Associated with the Five Standard Cost-Effectiveness Tests Associated with DSM

Component	PCT	PACT	RIM	TRC	SCT
Energy- and capacity-related avoided costs		Benefit	Benefit	Benefit	Benefit
Additional resource savings				Benefit	Benefit
Non-monetized benefits					Benefit
Incremental equipment and installation costs	Cost			Cost	
Program overhead costs		Cost	Cost	Cost	Cost
Incentive payments	Benefit	Cost	Cost		
Bill savings	Benefit		Cost		

Source: Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects.

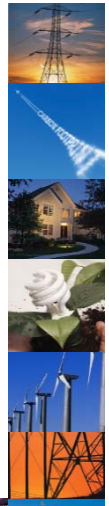
Note: Incentive payments include any equipment and installation costs paid by the program administrator.

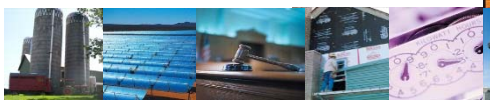




Achievable & Program Potential

- Achievable Potential
  - Scenario #1 will base achievable potential on paying incentives equal to 100% of measure incremental costs
  - Scenario #2 will base achievable potential scenario on EDCs paying incentive levels (as a % of incremental measure costs) comparable to those in effect during Program Years 4 and 5, generally 25% to 50% of the measure incremental costs
  - Achievable Potential takes into account the natural replacement cycle of equipment
- Program Potential
  - Funding levels of 2% of 2006 utility electric revenues (this is the funding cap specified in Act 129 legislation).
  - Account for specific sub-sector "set-asides" for the low-income and GNI sectors.
  - A second program potential scenario will be defined as we move closer to the achievable/potential analysis phase



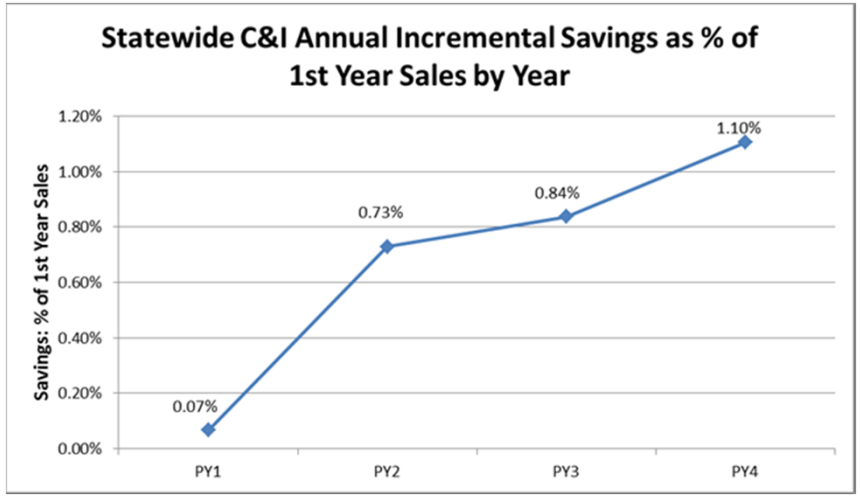


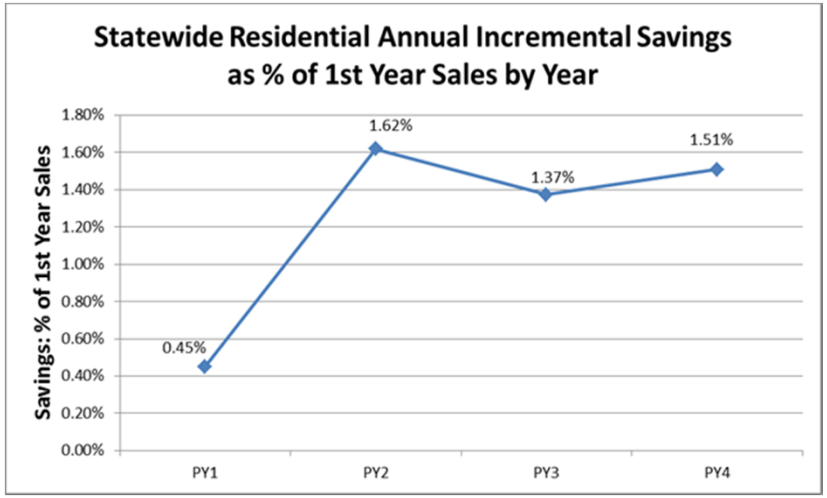
DSM Program Performance Research

- PA SWE does not generate specific, typical DSM program models for estimating program spending or savings performance
  - Program design is the responsibility of the EDCs.
- PA SWE researches
  - PA EDC historical performance
    - Program Budgets/Achieved Savings
  - 2014-2016 Utility DSM Program Plans
    - Projected Program Budgets / Projected MWh Savings
    - Limited by Publicly available data

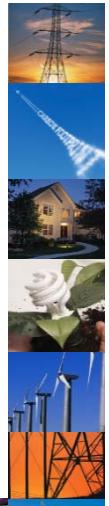
EDC PERFORMANCE BENCHMARKING

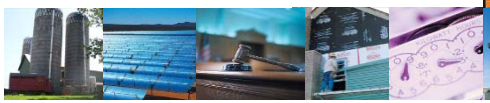
- Preliminary Findings: Annual Incremental Savings (as % of 1st Yr Sales)*





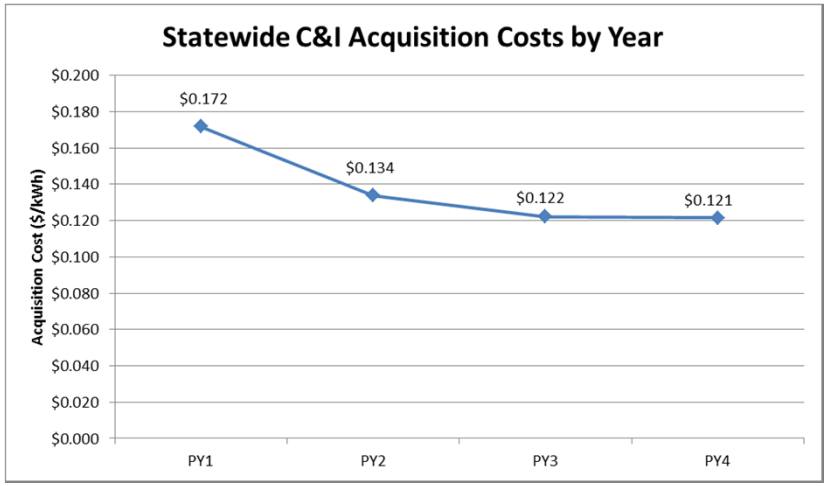
*Data compiled from EDC Annual Reports

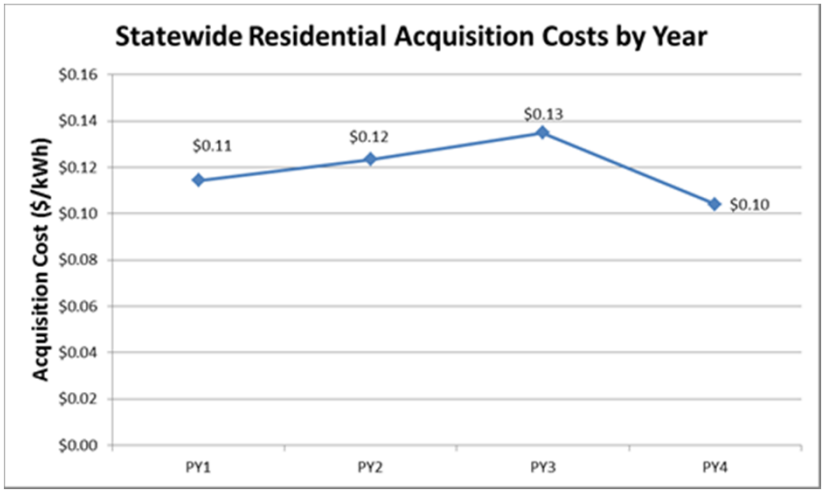




EDC PERFORMANCE BENCHMARKING

- Preliminary Findings: Acquisition Cost ($/1st Year kWh-saved)





*Data compiled from EDC Annual Reports

– Historical CFL sales represent significant portions of overall savings and program acquisition costs

OTHER STATE/UTILITY BENCHMARKS

- Total Program Administrator Cost / First Year MWh Saved
  - Based on 2009-2011 data in LBNL DSM Project Impacts Database.
  - Cost of Saved Energy based on gross savings at the meter level. Costs do not include performance incentives and participant costs.

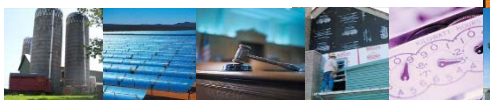
Sector	First Year CSE ($/MWh)
Commercial & Industrial	$188
Residential	$116
Low Income	$569
Cross Sector/Other	$120
NATIONAL	***$162***

The Program Administrator Cost of Saved Energy for Utility Customer-Funded Energy Efficiency Programs. LBNL. March 2014

OTHER STATE/UTILITY BENCHMARKS

- ***Developed during course of 2012 MPS***
- 2012 & 2013 Utility DSM Program Plans
- Projected Program Budgets / Projected MWh Savings
- Plans not always consistent in reporting
  - Meter vs. generation level savings
  - Gross vs. net savings
- Publicly available data

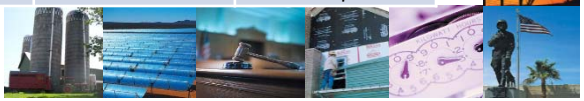
Utility	Year	($/ 1st Yr MWh)
MN Power	2013	$115.98
MN Power	2012	$116.22
Tucson Electric Power	2012	$152.19
Arizona Public Service	2012	$162.71
Consumers Energy (MI)	2013	$169.73
Consumers Energy (MI)	2012	$171.89
Unisource Electric	2012	$190.41
NV Power	2012	$197.57
ComED (IL)	2012	$222.67
ComED (IL)	2013	$223.63
Energy Trust Oregon	2012	$310.95
Efficiency VT	2012	$386.46
Efficiency ME	2013	$181.56
Efficiency ME	2012	$189.78
CT Light & Power	2012	$441.23
National Grid (MA)	2012	$419.20
NSTAR	2012	$465.06
National Grid (RI)	2012	$477.62



OTHER STATE/UTILITY BENCHMARKS

- ***Updated Data Gathering for MPS***
  - *Still underway*
- 2014-2016 Utility DSM Program Plans
- Plans not always consistent in reporting
  - Meter vs. generation level savings
  - Gross vs. net savings

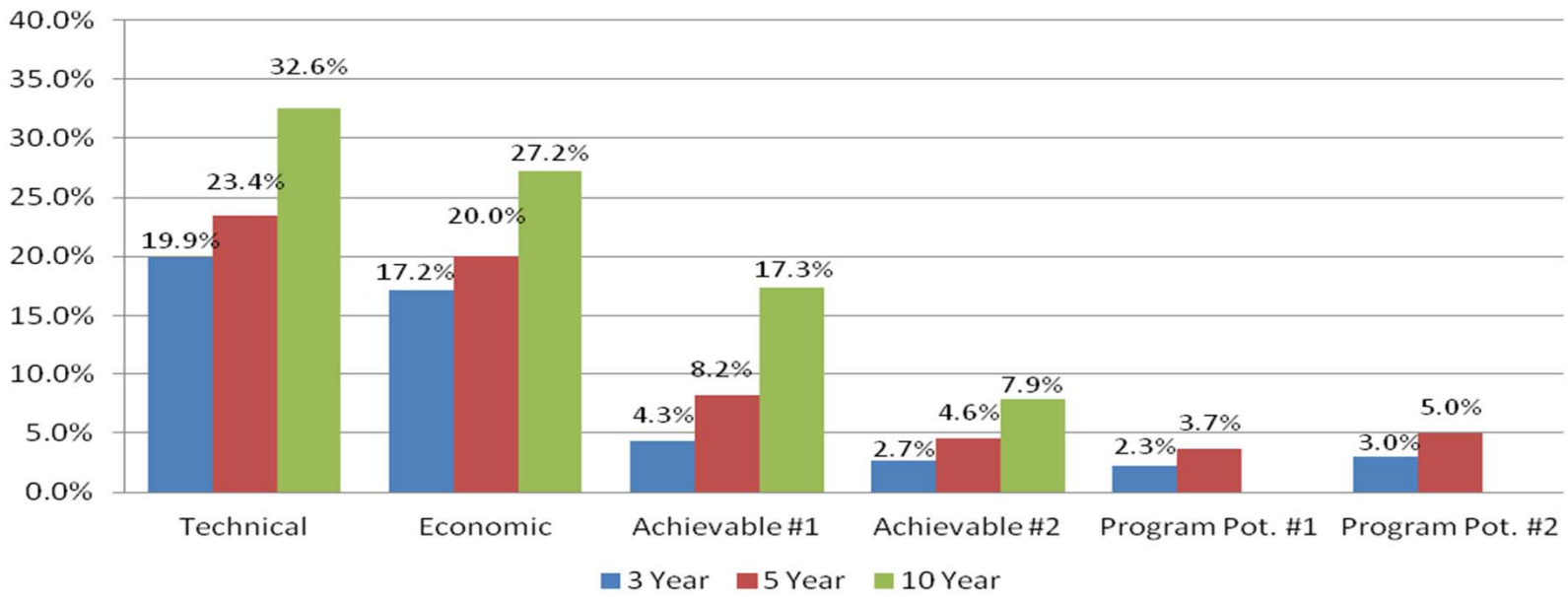
Utility	Year	($/ 1stYr MWh)
MN Power	2016	$149.36
MN Power	2015	$145.90
MN Power	2014	$141.34
Tucson Electric Power	2015	$114.15
Tucson Electric Power	2014	$114.15
Consumers Energy (MI)	2015	$173.67
Consumers Energy (MI)	2014	$175.54
NV Power	2015	$243.04
NV Power	2014	$228.14
ComED (IL)	2016	$250.72
ComED (IL)	2015	$243.21
ComED (IL)	2014	$234.87
AEP-OHIO	2016	$194.05
AEP-OHIO	2015	$192.07
Efficiency ME	2016	$301.42
Efficiency ME	2015	$303.02
Efficiency ME	2014	$306.08
CT Light & Power	2015	$464.09
CT Light & Power	2014	$472.78
National Grid (MA)	2015	$362.85
National Grid (MA)	2014	$373.22



Model Outputs

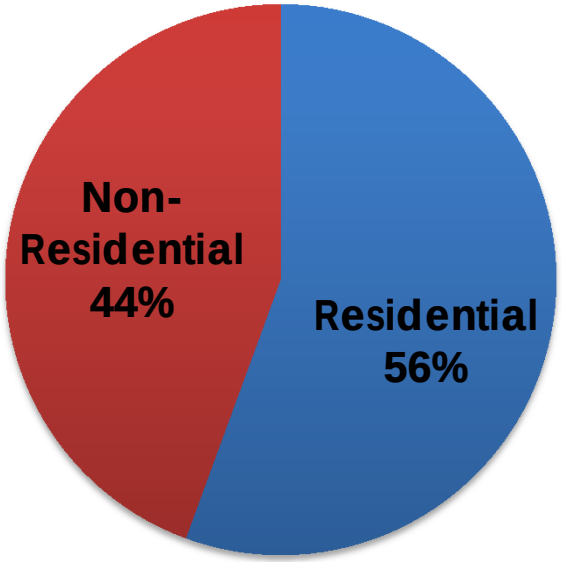
- Technical, Economic, and Achievable Potential
  - By Measure, End-Use, Building Type
- Energy, Demand, and Gas Impacts by Measure
  - Incremental Annual
  - Cumulative Annual
- Installed Units for Each Measure
  - Incremental / Cumulative Annual
- Installed Cost by Measure
  - Incentives
  - Participant Share
- Non-Incentive Costs by Program/Sector

Model Outputs (Example – Prior Study)

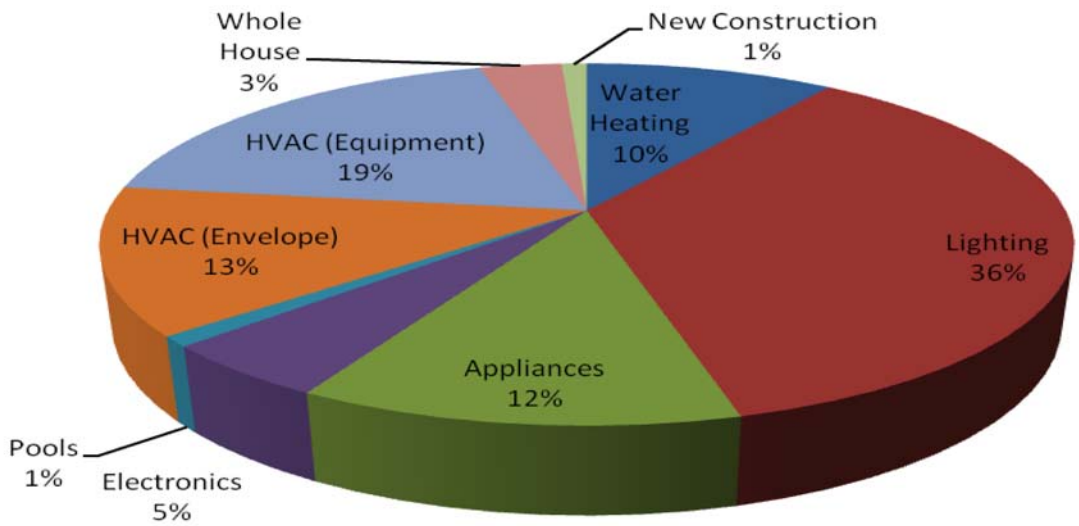
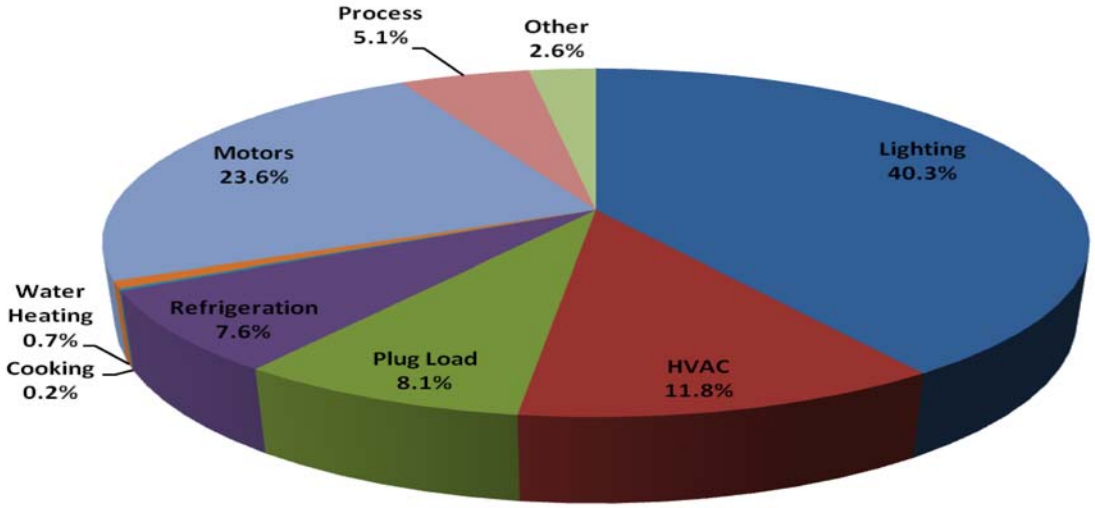


(Energy Efficiency Potential as a Percent of Forecasted Pennsylvania kWh Sales For the Baseline Period of June 2009 through May 2010)

Model Outputs (Potential Segmentation)



Model Outputs (Residential Potential Example)



Model Outputs(Non- Residential Potential Example)