Electric and Natural Gas DSM Market Potential Study for Ameren Illinois

SAG Meeting

May 29, 2012

Chicago, IL
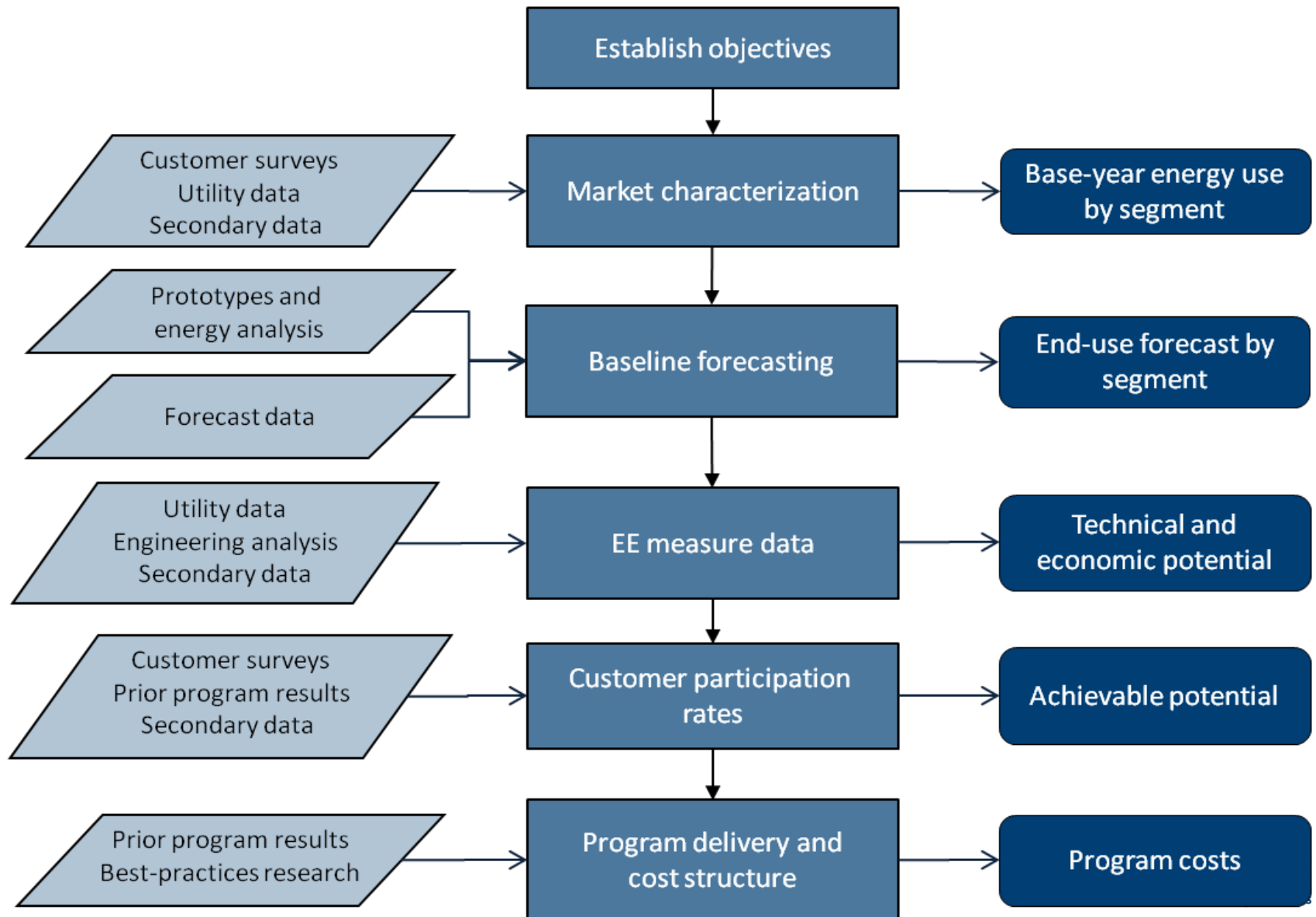
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Agenda

- Study Overview
- Market Research
- Base-year Market Characterization
- Baseline Forecast
- Potential Analysis
- Supply Curves
- Wasted Energy

Study Objectives

Primary objectives:

- Develop 3-year plan for electric and natural gas EE programs implemented in Cycle 3 (2014-2017)

- Develop EE potential estimates for 2017-2024 for benchmarking and future analyses

- Conduct market research to better represent customers in the Ameren Illinois service territory

- Quantify wasted energy due to customer behavior

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Overview of Analysis Approach

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                        │ Establish objectives│
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                                  │
   ╱───────────────╱              ▼                  ┌──────────────────┐
  ╱ Customer surveys╱   ┌─────────────────────┐      │ Base-year energy │
 ╱  Utility data    ╱──▶│ Market              │─────▶│ use by segment   │
╱   Secondary data  ╱   │ characterization    │      └──────────────────┘
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Customer surveys
Utility data
Secondary data
→ Market characterization → Base-year energy use by segment

Prototypes and energy analysis
Forecast data
→ Baseline forecasting → End-use forecast by segment

Utility data
Engineering analysis
Secondary data
→ EE measure data → Technical and economic potential

Customer surveys
Prior program results
Secondary data
→ Customer participation rates → Achievable potential

Prior program results
Best-practices research
→ Program delivery and cost structure → Program costs

Market Research

- ◉ Objective: Identify equipment saturations, building characteristics, measure applicability and saturations, occupant behavior, and interest in programs

- ◉ Identify composition of the C&I sectors

- ◉ Two types of surveys:
  - – Appliance saturation
  - – Program interest

- ◉ Formal sample design to develop a statistically representative sample (preliminary sample sizes below)

Customer Class	Survey Strategy	Saturation Survey Sample Size	Program Interest Survey Sample Size
Residential	Online	700	700
Small and Medium Business	Online	700	700
Large Business	On-Site	100 integrated surveys	

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Online Surveys

- Recruit via direct mail; postcard with website address and unique code

- 20-30 minute comprehensive questionnaire

- Conduct in June and July

- Customers receive an incentive for participating in the survey

- Saturation survey covers building characteristics, saturation of end uses, saturation of technology, saturation of energy efficiency measures and demographics/firmographics

- Program interest survey covers awareness and participation in utility programs, perception of effectiveness of programs, likely participation in future programs, psychographics relating to customer decision making, and demographics/firmographics

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Onsite Surveys

- Engineers from Washington University at St. Louis will conduct the onsite surveys

- Recruit by phone

- Target all of the Top 10 customers and a sample of the remainder

- Conducted between June and mid-August

- Combine saturation and program interest survey

- Customer receives an incentive for participating in the survey

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Energy Efficiency Potential Analysis

- Market characterization
- Analysis segmentation
- Market profiles
- Baseline forecast
- Technology identification and assessment
- Potential estimates

Market Characterization

- Base year – June 2010-May 2011
- Develop control totals – number of customers, annual use, and peak load by sector
- Identify electric only, gas only, combined customers

Sector	Total Electric Sales	Summer Peak Demand	Total Natural Gas Sales
2011	*MWh*	*MW*	*Therms*
Residential	11,577,339	3,338	568,504,827
Commercial	12,413,779	2,501	206,582,033
Industrial	12,579,918	1,695	932,672,453
Streetlighting	337,773	-	
Total	**36,908,809**	**7,534**	**1,707,759,312**

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Analysis Segmentation

Dimension	Segmentation Variable	Dimension Examples
Dimension 1	Sector	Residential Commercial (by Rate Class) Industrial (by Rate Class)
Dimension 2	Segment	Residential: single family, multi-family Commercial: office, retail, grocery, health, lodging, restaurant, etc Industrial: Food products, Oil & gas, etc
Dimension 3	Vintage	Existing and new construction
Dimension 4	Fuel	Electricity and natural gas
Dimension 5	End uses	Cooling, heating, ventilation, lighting, water heat, refrigeration, motors, etc. (as appropriate by sector)
Dimension 6	Appliances/end uses and technologies	Technologies such as lamp type, air conditioning equipment type, motors by size, etc.
Dimension 7	Equipment efficiency levels for new purchases	Baseline and an array of higher-efficiency options as appropriate for each technology

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Energy Market Profiles

End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)	Usage (GWh)
Cooling	Central AC	86%	3,985	3,433	1,587
Cooling	Room AC	13%	3,188	410	190
Space Heating	Electric Resistance	5%	18,214	910	421
Space Heating	Electric Furnace	0%	18,943	-	-
Combined Heat/Cool	Air Source Heat Pump	13%	14,004	1,820	842
Combined Heat/Cool	Geo-Thermal Heat Pump	0%	9,242	-	-
Water Heating	Water Heater	24%	2,793	663	307
Interior Lighting	Screw-in	100%	1,242	1,242	574
Interior Lighting	Linear Fluorescent	100%	243	243	112
Exterior Lighting	Screw-in	85%	374	318	147
Exterior Lighting	Linear Fluorescent	85%	73	62	29
Appliances	Refrigerator	100%	891	891	412
Appliances	Freezer	42%	376	157	73
Appliances	Second Refrigerator	20%	1,326	265	123
Appliances	Clothes Washer	96%	561	540	250
Appliances	Clothes Dryer	84%	821	693	321
Appliances	Combined Washer/Dryer	0%	786	-	-
Appliances	Dishwasher	61%	173	105	49
Appliances	Cooking	71%	750	533	247
Electronics	Personal Computer	65%	470	306	142
Electronics	Color TV	96%	313	300	139
Electronics	Other Electronics	100%	343	343	159
Miscellaneous	Pool Pump	13%	2,671	339	157
Miscellaneous	Furnace Fan	68%	431	293	136
Miscellaneous	Other Miscellaneous	100%	194	194	90
Total				**14,069**	**6,505**

Residential Electricity

Pie chart: Cooling 26%, Space Heating 11%, Combined Heating/Cooling 11%, Water Heating 6%, Interior Lighting 10%, Exterior Lighting 3%, Appliances 21%, Electronics 7%, Miscellaneous 5%

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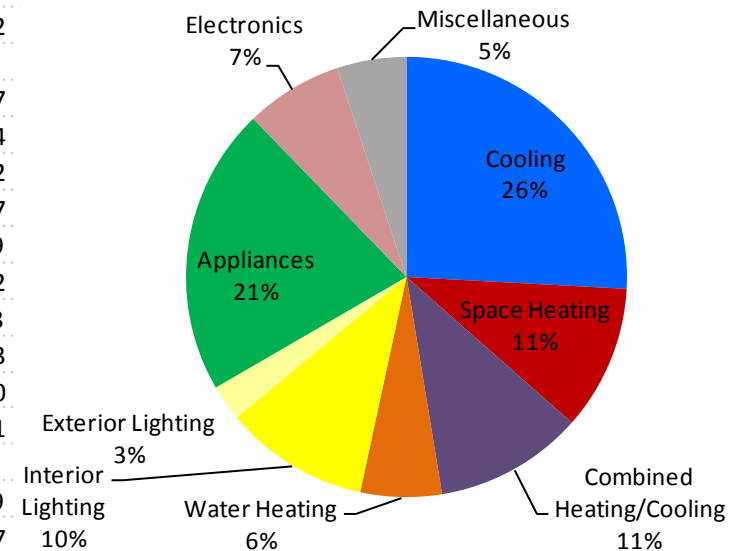
Sources for Base-year Market Characterization

Data Element	Ameren data	Customer surveys	BEST modeling	Secondary data*
Sector-level characterization	X			
Segment-level size and use	X	X		
End-use/ technology saturations		X		X
UECs/EUIs			X	X
Peak factors				X

*Includes Illinois TRM and EnerNOC databases: Energy Market Profiles, EnergyShape, DEEM

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Baseline Forecast

- The baseline forecast is an end-use forecast that includes:
  - Customer growth/new construction
  - Trends in appliance saturations
  - Response to changes in prices and other drivers (income, etc.)
  - Effects of building codes and appliance standards "on the books"
  - Consumer purchase decisions regarding efficiency options
- It is the metric against which savings are measured

End Use	Technology	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Cooling	Central AC	SEER 13													
	Room AC	EER 9.8			EER 11.0										
Cooling/Heating	Heat Pump	SEER 13.0/HSPF 7.7			SEER 14.0/HSPF 8.0										
Space Heating	Electric Resistance	Electric Resistance													
	Electric Furnace	Electric Furnace													
Water Heating	Water Heater (<=55 gallons)	EF 0.90			EF 0.95										
	Water Heater (>55 gallons)	EF 0.90			Heat Pump Water Heater										
Lighting	Screw-in/Pin Lamps	Incandescent			Advanced Incandescent - tier 1					Advanced Incandescent - tier 2					
	Linear Fluorescent	T8													
Appliances	Refrigerator/2nd Refrigerator	NAECA Standard			25% more efficient										
	Freezer	NAECA Standard			25% more efficient										
	Dishwasher	Conventional (355 kWh/yr)		14% more efficient (307 kWh/yr)											
	Clothes Washer	Conventional (MEF 1.26 for top loader)				MEF 1.72 for top loader		MEF 2.0 for top loader							
	Clothes Dryer	Conventional (EF 3.01)			5% more efficient (EF 3.17)										

Baseline Forecast – Residential Example
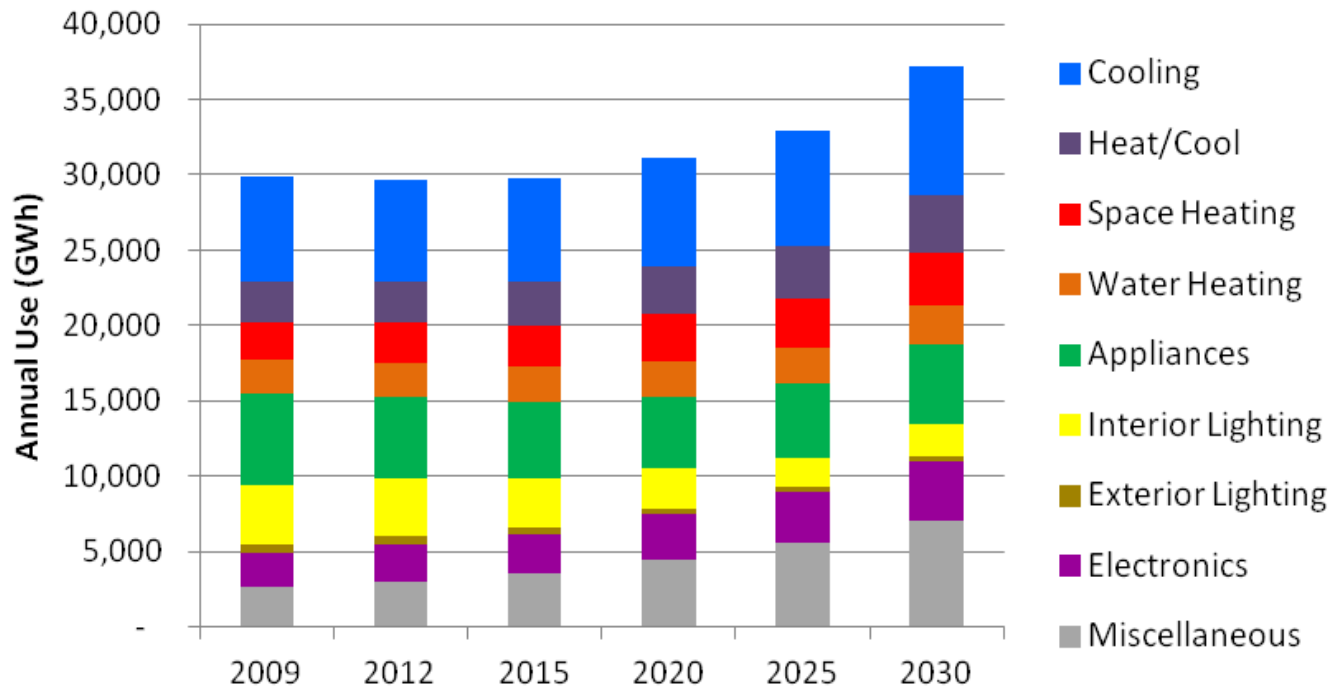
Measure Identification and Analysis

Process

- Develop preliminary list using
  - Ameren Illinois programs
  - EnerNOC databases
  - Illinois TRM
- Review with Ameren
- Review with Cycle 3 program designers, implementers and evaluators
- Review with stakeholders
- Develop final list

Data Development

- Characterization includes
  - Description of measure
  - Costs
  - Savings
  - Applicability
  - Lifetime
- Data sources
  - Ameren Illinois data
  - Illinois TRM
  - EnerNOC databases
  - BEST simulations

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Example of Equipment Measure Data

Efficiency set for Room AC includes

- Baseline in 2011 = EER 9.8 (becomes EER 11 in 2015)
- E1 = EER 10.8 (ENERGY STAR), 9% savings relative to EER 9.8
- E2 = EER 11, 10% savings
- E3 = EER 12.0, 18% savings

Residential air conditioner standards:

	Today's Efficiency or Standard Assumption	1st Standard (relative to today's standard)
		2nd Standard (relative to today's standard)

End Use	Technology	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Cooling	Central AC	SEER 13													
	Room AC	EER 9.8			EER 11.0										

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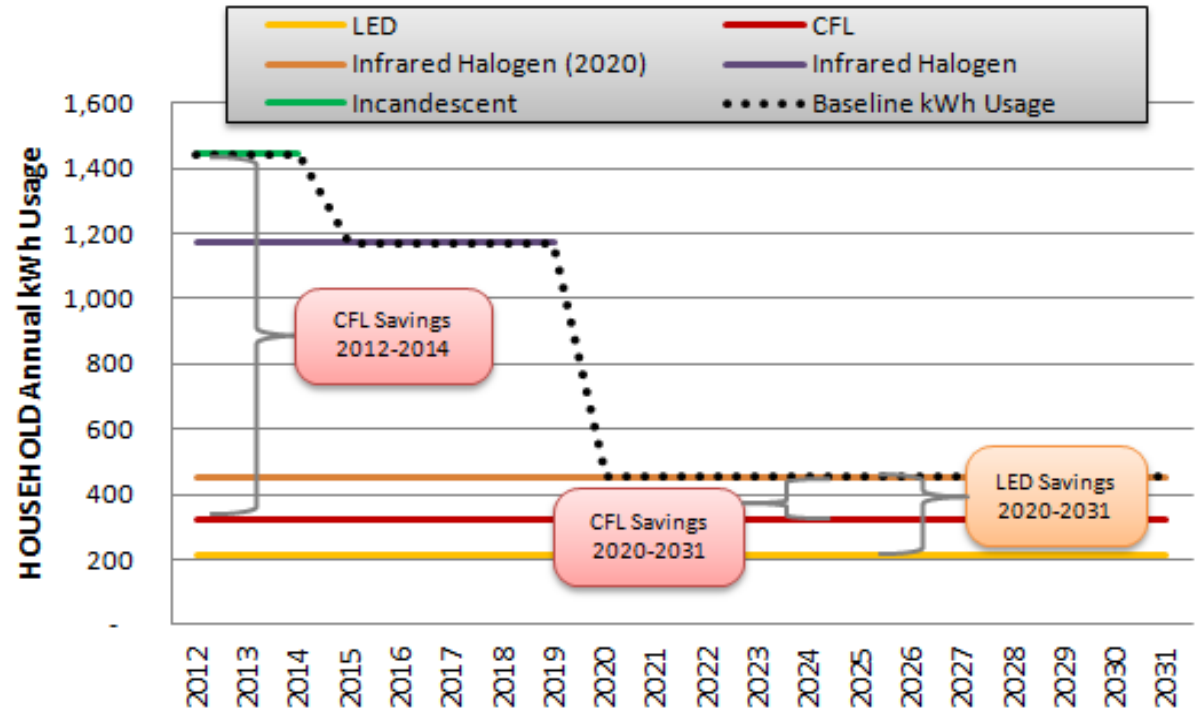# Interaction of Measures and Standards

EISA Phase 1
- Effective in 2014
- Creates new baseline

EISA Phase 2
- Effective in 2020
- Creates another new baseline

Lighting options:
- Incandescent (until 2014)
- Infrared halogen (2012 and 2020)
- CFL
- LED

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Potential Estimates

Efficiency Level	Energy Use (kWh/yr) in 2012	Off Market	B/C Ratio	Status
EER 9.8	614	2014	n/a	Baseline until 2014
EER 11.0	547		1.1	Baseline after 2014, Economic
EER 10.8 (ENERGY STAR)	586	2014	1.8	
EER 12.0	502		0.9	Technical

◉ Technical potential: Most efficient option taken, regardless of cost

- Equipment is replaced at time of failure
- Other devices are phased in over time according to complexity and cost using diffusion curve

◉ Economic potential: Most efficient cost-effective option (determined by TRC test) is taken

◉ Achievable potential: Represents what customers will actually do. Requires participation rates at the measure level.

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# Example of Results from Potential Analysis
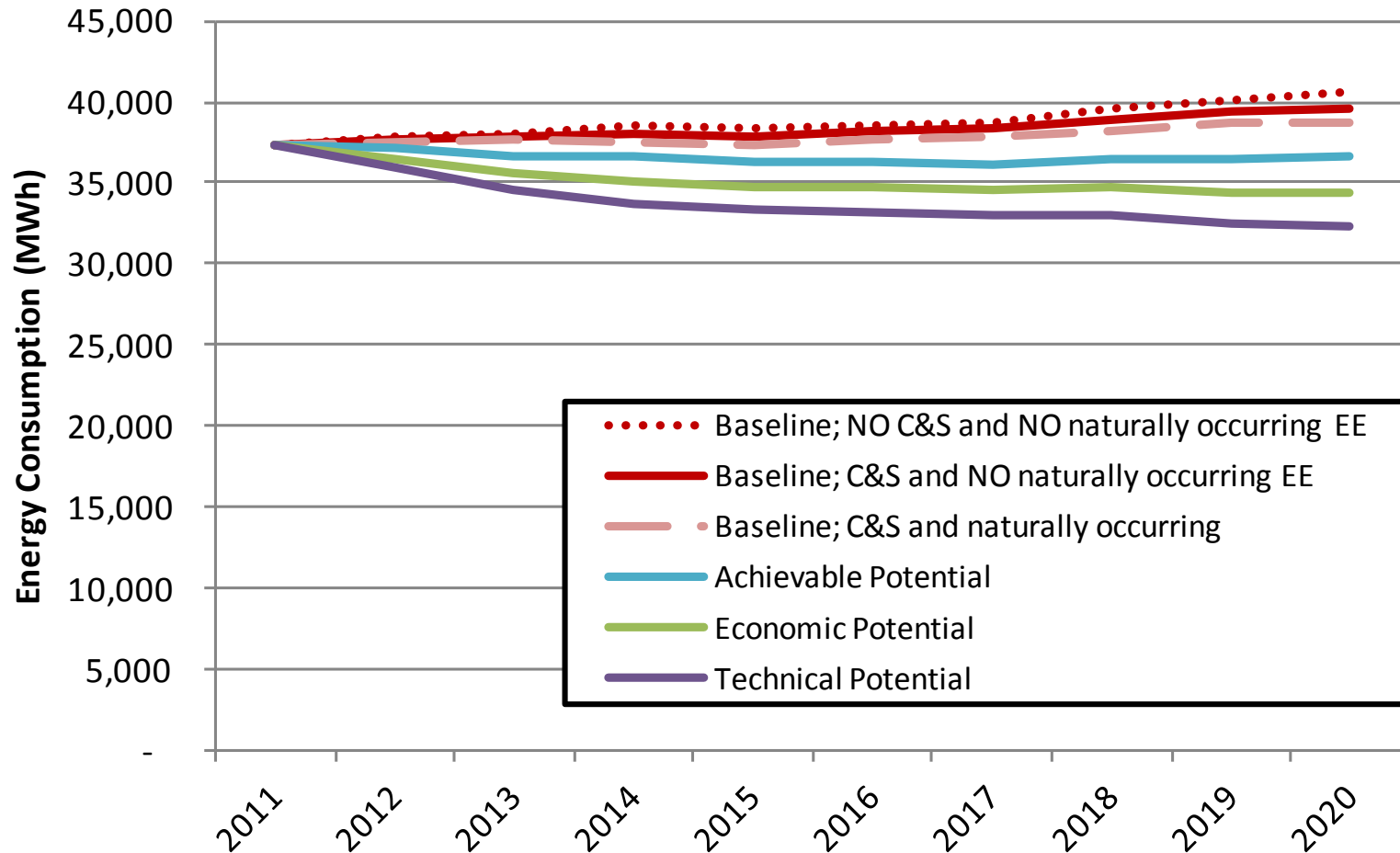
Achievable Potential – Residential Savings
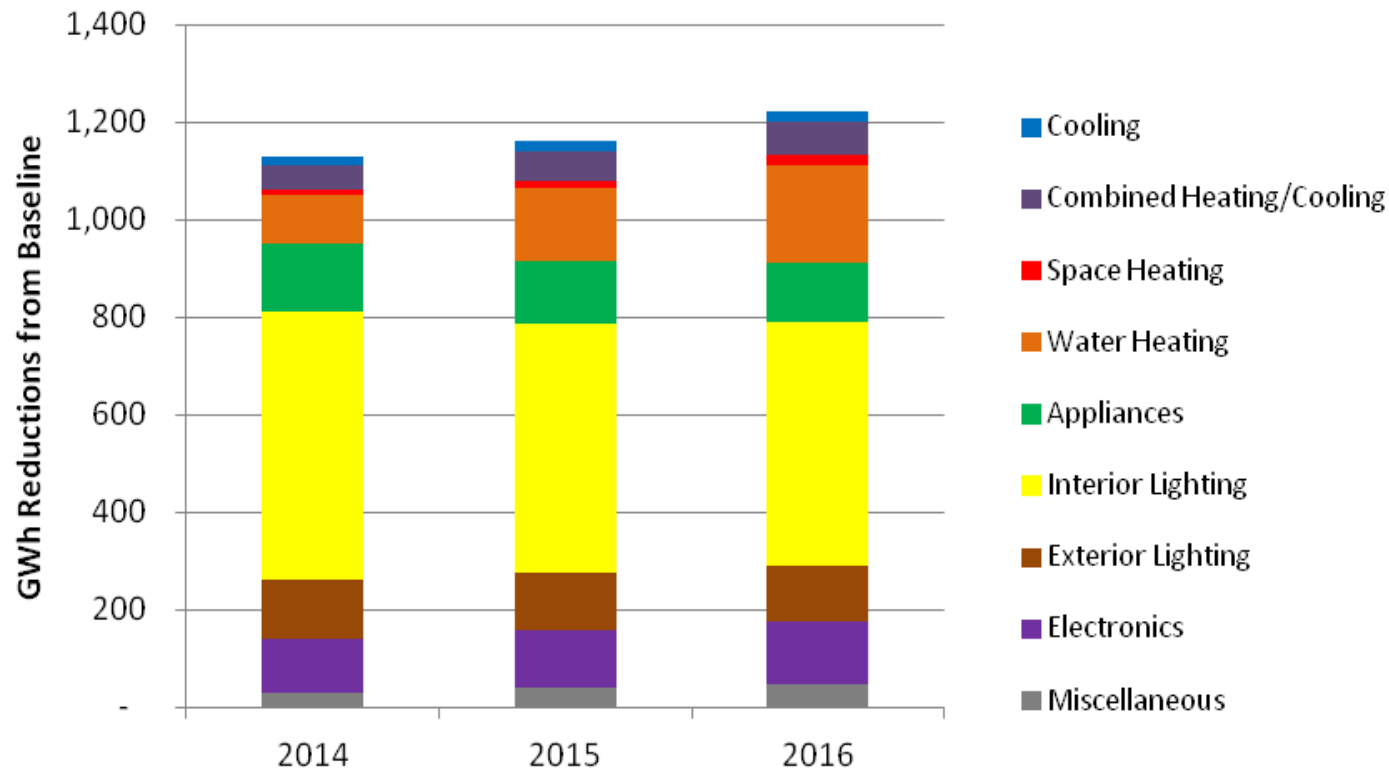
Supply Curves

- Electric and natural gas supply curves (annual 2014-2017)
- Achievable in aggregate all rate classes, with and without rate cap limits
- Achievable disaggregated by rate class
- Achievable disaggregated by rate class by rate cap limits
- Achievable disaggregated by rate class by 0.5% increments above rate cap limits up to estimated limit of achievable potential
- Achievable disaggregated for "bundled service" customer segment (electricity only)

CCE for 2030
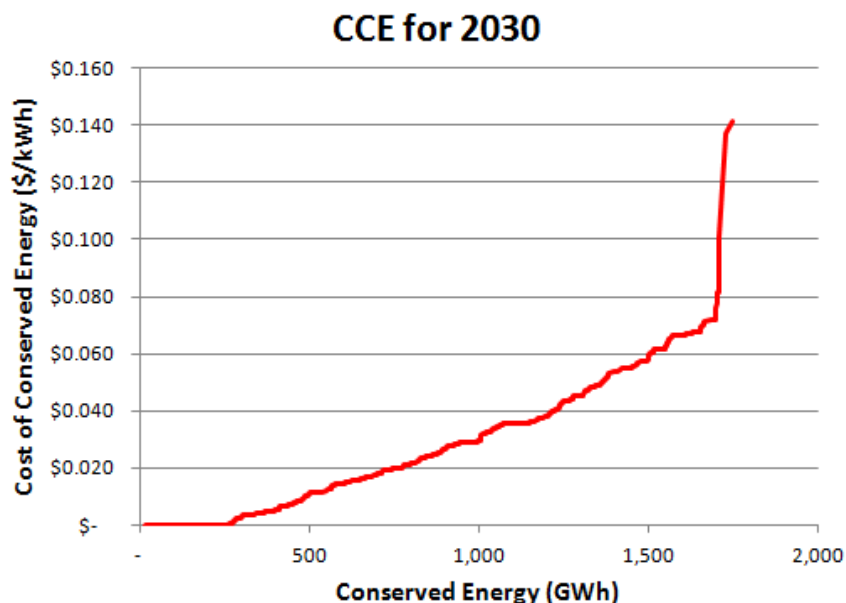
Wasted Energy Potential

◉ Definition of "wasted energy" - excessive energy use that is a result of a customer's behavioral choices

◉ Quantify wasted energy in the base year

– Use customer surveys to identify the behaviors

– Use engineering analysis to estimate the amount of energy associated with the behaviors

◉ Estimate achievable potential related to wasted energy

– Identify measures that eliminate waste associated with customer behavior

▪ Programmable thermostats

▪ HVAC maintenance and duct sealing

▪ Occupancy sensors

– Wasted energy potential = savings from these measures

Project Schedule

Description	Task	April 2012	May	June	July	August	September	October	November	December	January 2013
Kick-off meeting	1										
Revised statement of work	1										
Received Ameren billing data	2										
Sample design											
Questionnaire design	2										
Research plan	2										
Online surveys	2										
On-site surveys	2										
Market research analysis	2										
Market profiles	3										
Baseline forecast	3										
EE Measure database	3										
Potential analysis	3										
Draft and final supply curves	4										
Program-related info to AEG	4										
Wasted energy analysis	5										
Draft report	6,7										
In-person final presentation	6,7										
Drop dead delivery date	6										

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THANK YOU!

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