Optimal ENERGY Integrated Energy Resources

Demand Side Management Potential Study Draft Results

12 July 2018

Topics for Discussion

- Summary of Key Data Sources and Assumptions
  - Measure characterizations
  - Avoided costs, loadshapes, and line losses
  - Load forecast and sales disaggregation
  - Delphi panel results
- Draft Results
  - EE
  - Demand Response
  - Rate Design
- Next Steps
  - Comments Procedure
  - Schedule

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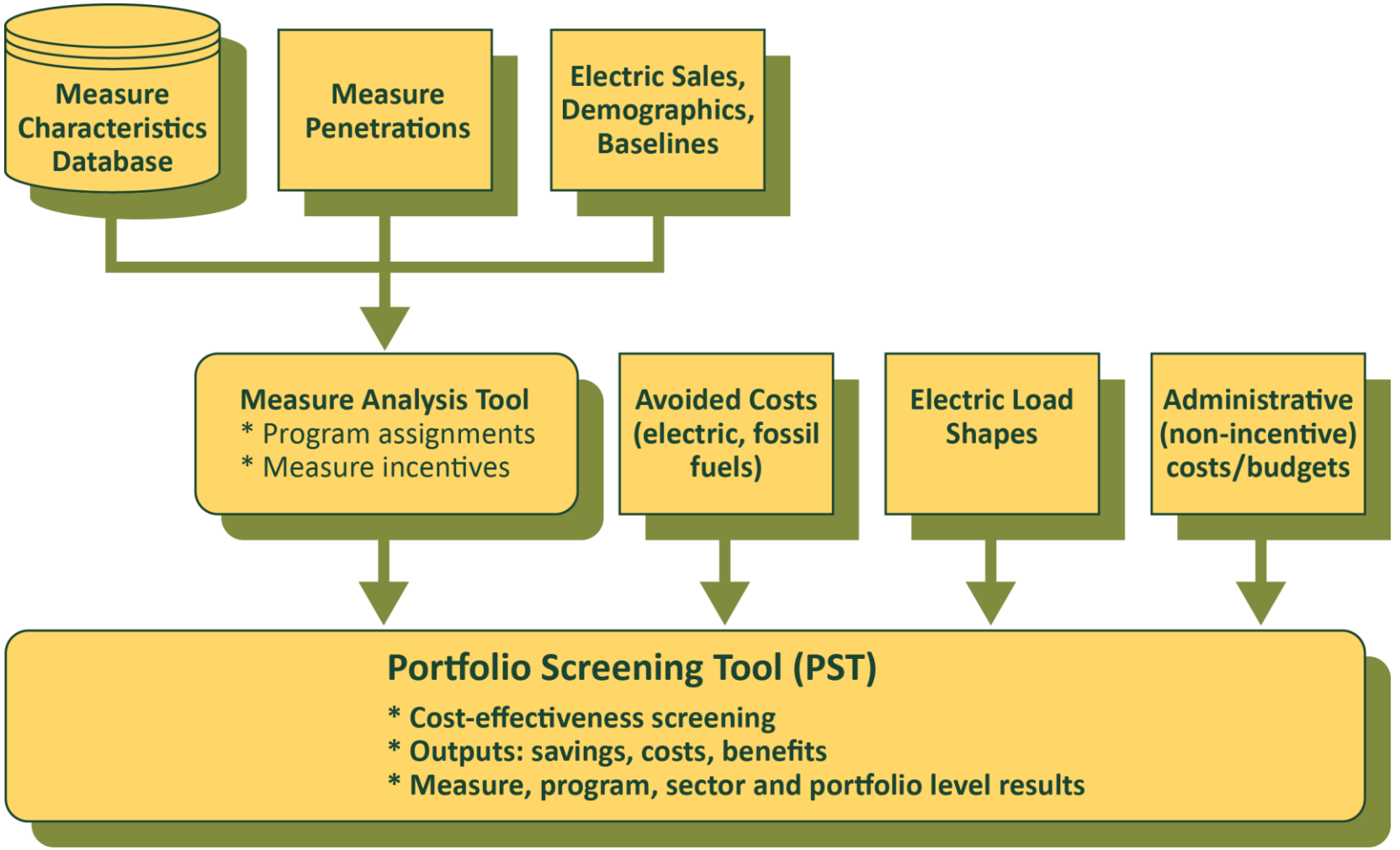
DSM Potential Study in Context

- Outputs of Potential Study become inputs to IRP
- Distinct from the study being conducted for Entergy New Orleans by Navigant
- Limited to efficiency, demand response, and rate design opportunities
- Attempting to use as much local data as practical, but no primary data collection
- Time-constrained, must be completed in four months

Analytical Workflow



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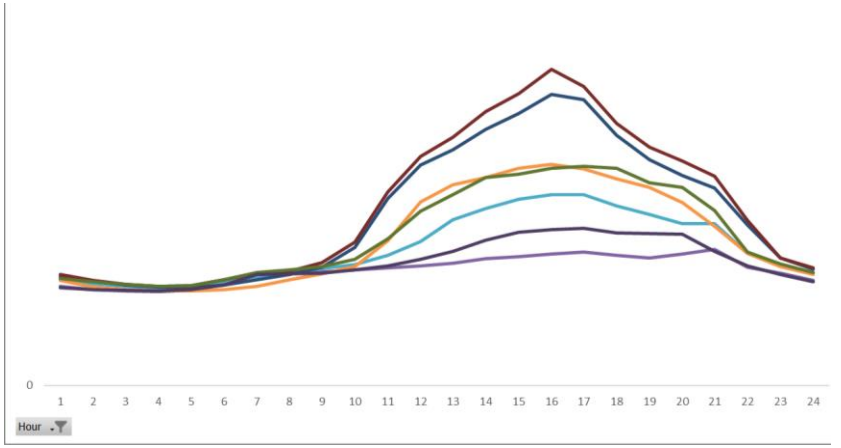
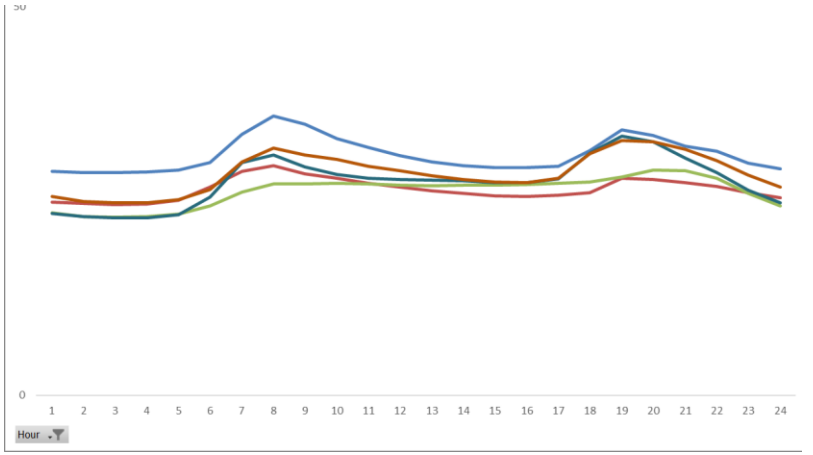
Measure Characterizations and Sources

- NOLA TRM, supplemented with other regional TRMs and Optimal's existing measure characterization database
- ENO Residential Appliance Saturation survey, supplemented with similar studies conducted more recently in nearby states
- Evaluated 215 measures across two customer sectors and 13 building types

Avoided Costs, Loadshapes, & Line Losses

- Avoided costs
  - Energy avoided costs based on ENO forecast hourly LMPs in 2018 and 2022
  - Energy periods defined based on data inspection
    - Summer: April – Oct; Winter: Nov-Mar
    - Summer peak hours: 11 – 21 weekdays
    - Winter peak hours: 7-10 and 18-22 weekdays
  - Capacity avoided cost from ENO forecast: new gas turbine
- Loadshapes from EPRI database for SERC
- Line losses as per ENO





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Load Forecast and Sales Disaggregation

- Load forecast from ENO as to be used in the IRP
  - Projected savings from current EnergySmart programs added back in
  - Load growth from new construction in line with ENO forecasts
- C&I building type disaggregation based on ENO data on energy usage by SIC code
- End use disaggregation based on EIA data such as CBECs and RECs

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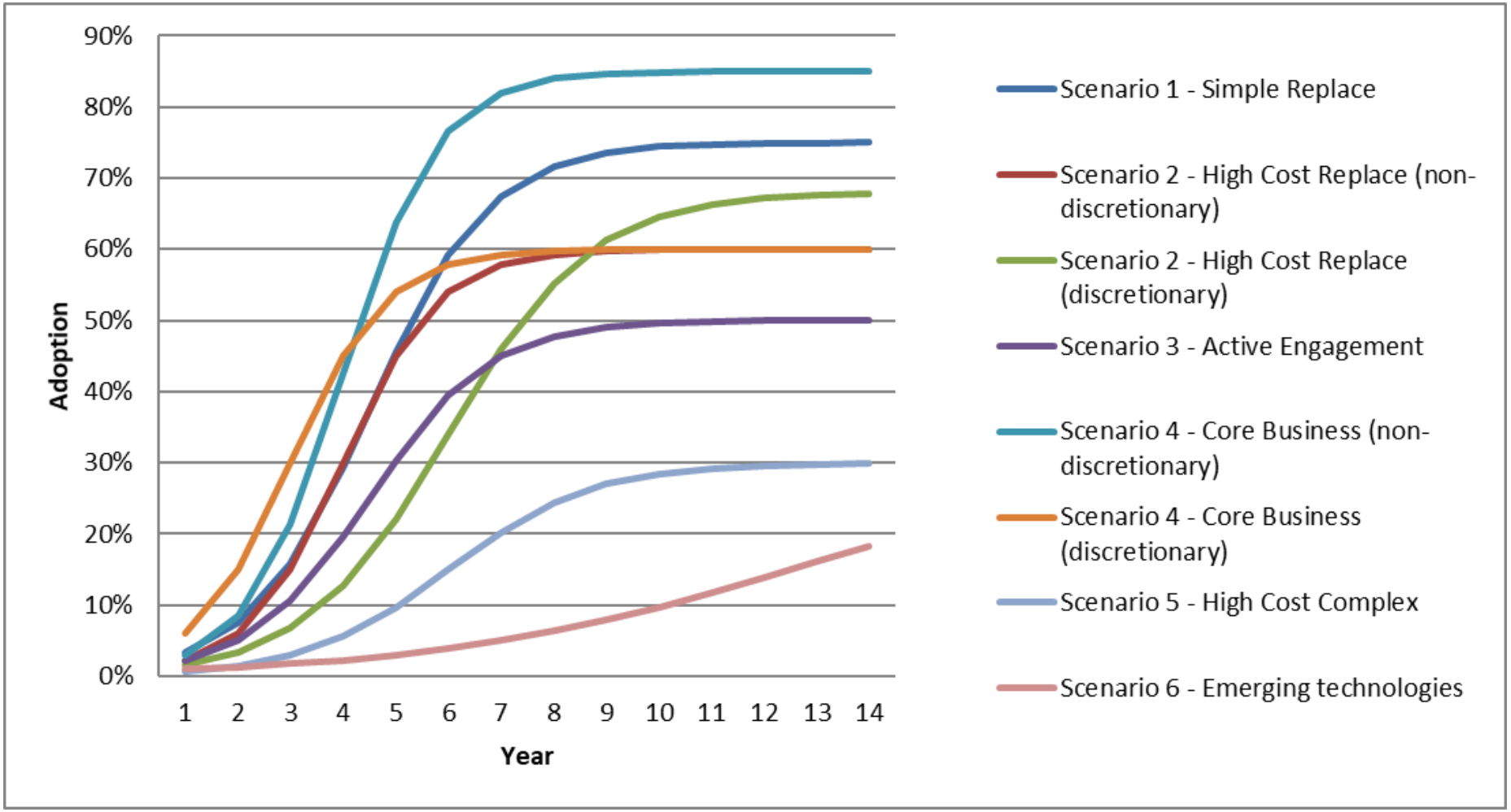
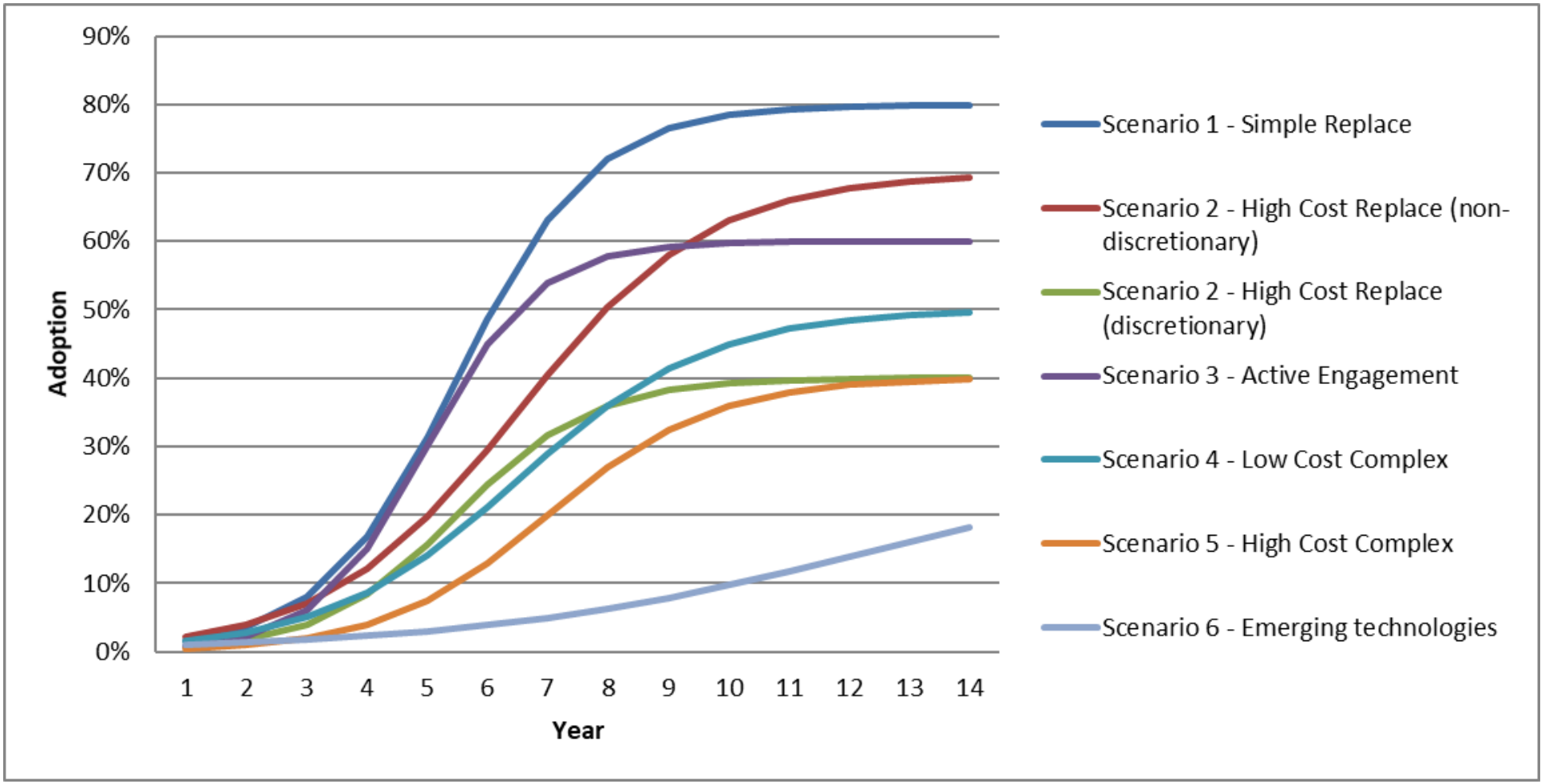
Delphi Panel Process

- Two panels, residential and C&I
  - Eight participants on C&I panel, nine on residential
  - Panelist included academics, property managers, trade allies, contractors, architects/developers, program planners/implementers, distributor/manufacturing reps, and governmental officials
- Developed adoption curves for several generic measure types
  - Simple, low-cost replacement
  - High-cost replacement (both discretionary and market-driven)
  - Active Engagement
  - Low Cost Complex (Res) *or* Core Business (C&I)
  - High Cost Complex
  - Emerging Technologies

Adoption Curves – C&I



Adoption Curves – Residential



Draft Results: 20 year Potential

Cumulative Potential Savings Relative to Sales Forecast, 2037(NOLA)

	Economic	Max Achievable
Electric (GWh)	**44%**	**31%**
Residential	**45%**	**32%**
Commercial & Industrial	**43%**	**30%**

Draft Results – TRC (Economic)

Cumulative Economic Potential Total Resource Cost Test by Sector and Program, 2037 (NOLA

Sector/Program	Costs (Millions$)	Benefits (Millions$)	Net Benefits (Millions$)	BCR
Residential	**297**	**679**	**381**	**2.3**
New Construction	16	32	16	2.0
Products	99	282	183	2.9
Retrofit	182	365	183	2.0
Commerical & Industrial	**382**	**1514**	**1132**	**4.0**
New Construction	18	25	7	1.4
Equipment Replacement	112	741	629	6.6
Retrofit	253	748	495	3.0
Total	**680**	**2193**	**1513**	**3.2**

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Draft Results – TRC (Achievable)

Cumulative Max Achievable Potential Total Resource Cost Test by Sector and Program, 2037

Sector/Program	Costs (Million $)	Benefits (Million $)	Net Benefits (Million $)	BCR
Residential	**209**	**399**	**189**	**1.9**
New Construction	11	18	7	1.7
Products	70	167	97	2.4
Retrofit	128	213	85	1.7
Commerical & Industrial	**232**	**697**	**465**	**3.0**
New Construction	7	12	5	1.8
Equipment Replacement	58	224	167	3.9
Retrofit	167	461	294	2.8
Total	**441**	**1096**	**655**	**2.5**

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Top Measures

Max Achievable Potential - Commercial Electric Energy Top Sav

Measure Name	Cumulative MWh	Percent of Total
LED Tube Replacement Lamps	113,360	10.2%
Retrocommissioning/Calibration	90,334	8.1%
Compressed Air	76,332	6.9%
Refrigeration Retrofit	66,723	6.0%
Industrial Process	63,525	5.7%
Int Ltg Controls	59,785	5.4%
Variable Speed Drive: HVAC Fan	56,140	5.0%
Reach-in Storage Refrigerator	55,286	5.0%
Heat Pump Tune-Up	50,876	4.6%
High Efficiency Small Walk-In Fridge	39,884	3.6%
SubTotal	672,244	60.4%
Total	**1,113,900**	

ıx Achievable Potential - Residential Electric Energy Top Savi

Measure Name	Cumulative MWh	Percent of Total
Quality Install Heat Pump	88,120	12.1%
Air Source Heat Pump	81,830	11.3%
Window Attachments	51,154	7.0%
Efficient Windows	50,122	6.9%
Ductless Minisplit HP	46,003	6.3%
Water Heater Pipe Insulation	35,838	4.9%
EnergyStar Ceiling Fan	30,008	4.1%
Conservation Voltage Reduction	29,643	4.1%
Air Sealing	28,471	3.9%
Central AC	24,104	3.3%
SubTotal	*465,294*	*64.0%*
Total	**727,011**	

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Demand Response: Methodology

- Literature review
- Determine taxonomy of programs to examine
- Create database of demand response programs & data (both within region and from elsewhere)
- Collect data from ENO
- Estimate program savings per participant, participation rates, and costs based on program research
- Input data to demand response models

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DR Programs

- Residential incentive-based DR
  - Direct load control (DLC) program
  - Automated DR: bring your own device (BYOD) program: incentivizes WiFi-enabled thermostats that trigger AC cycling
- Residential time-based pricing DR, including
  - Peak time rebates (PTR) with and w/o enabling technologies
  - Critical peak pricing (CPP) with and w/o enabling technologies
- Commercial and industrial (C&I)
  - Standard offer program
  - Direct load control

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Data Sources

- ENO data
- Utility demand response program filings from in-region
  - Entergy Louisiana
  - Entergy Arkansas
  - Arizona Public Service
  - Oklahoma Gas & Electric
  - AEP Texas Central and other TX programs
  - Etc.
- Federal Energy Regulatory Commission (FERC) national demand response potential study
- Arcturus study on dynamic pricing

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Draft Results: Scenario 1

"Base case" and Peak-Time Rebates (PTR)

Program	Metric	2018	2027	2037
Residential direct load control (DLC) and bring your own device (BYOD)	Peak demand savings (MW)	1.97	13.6	16.8
	Cost	$207,249	$940,836	$1,126,367
NPV B/C ratio: 1.4				
Residential peak time rebate w/ and w/o tech.	Peak demand savings (MW)	5.17	9.54	10.6
	Cost	$171,212	$315,827	$351,929
NPV B/C ratio: 1.9				
Commercial & industrial Standard Offer Program (SOP)	Peak demand savings (MW)	0.35	3.63	7.50
	Cost	$13,103	$135,296	$279,416
NPV B/C ratio: 2.7				

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Draft Results: Scenario 2

"High case" and Critical Peak Pricing (CPP)

Program	Metric	2018	2027	2037
Residential direct load control (DLC) and bring your own device (BYOD)	Peak demand savings (MW)	3.94	27.3	33.6
	Cost	$414,499	$1,881,673	$2,252,735
NPV B/C ratio: 1.4				
Residential critical peak pricing w/ and w/o tech.	Peak demand savings (MW)	5.83	10.8	12.0
	Cost	*draft results not yet available		
NPV B/C ratio: N/A				
Commercial & industrial Standard Offer Program (SOP)	Peak demand savings (MW)	2.46	6.79	11.9
	Cost	$83,780	$241,111	$426,359
NPV B/C ratio: 2.8				

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Rate Design: Methods and Data Sources

- Revenue neutral rate structures
- Price response results from previous studies to estimate changes in consumption
- Load research sample provided by ENO
- Revenue/sales data from 2018 FERC Form 1
- Only covers residential customer class

Rate Design: Rate Iterations

- Existing rate two-part rate
  - $8.07/month customer charge
  - Flat summer energy rate
  - Declining two-tier (or “block”) winter energy rates
- Rates modeled
  - Time of use rate: 2:1 summer to winter peak/off peak ratio, 3:1 summer peak to off peak ratio
  - Inclining block rate: two-tier inclining block rate in both summer and winter
  - Seasonal rate with higher customer charge: two scenarios ($25 and $50/month)

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Rate Design: Results

Rate	Change in energy consumption	Change in peak demand
Optional TOU	-0.5%	-4.4%
Default TOU	-0.9%	-7.9%
Inclining block	-2.1%	N/A
$25/month	+3.6%	N/A
$50/month	+8.9%	N/A

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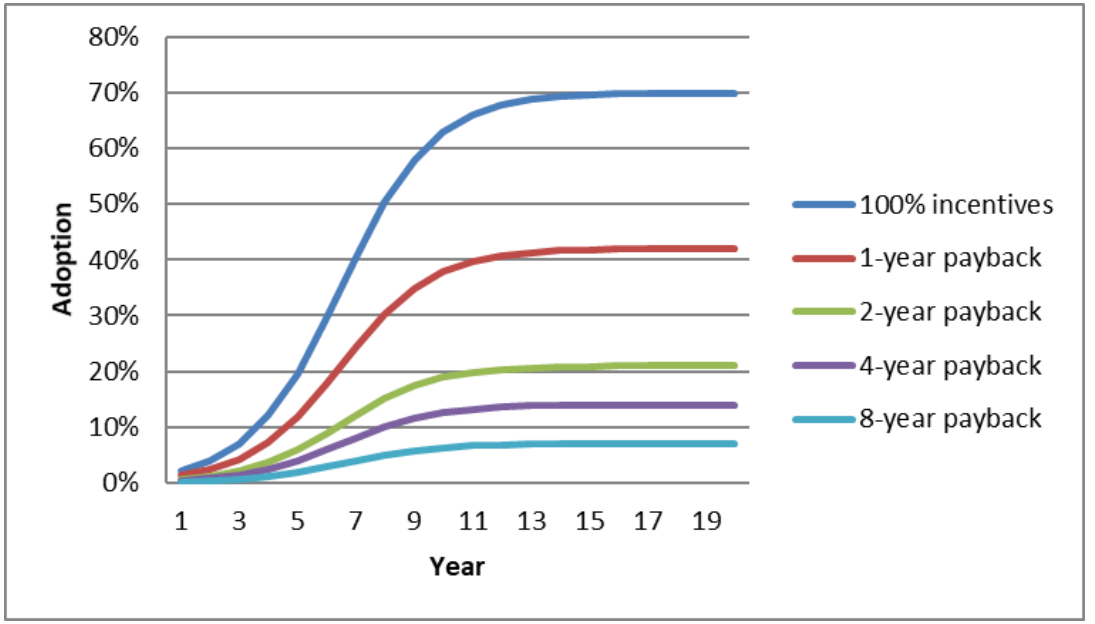
Next Steps

- “Program” Achievable potential for EE
- Refine peak demand reduction estimates
- Sensitivity analysis on discount rate
- Additional discussion items for report



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Additional Discussion Items for Report

- Meta-analysis comparing results to other studies in Louisiana and Southeastern US
- Qualitative discussion on RIM test, including estimated rate and total bill impacts from EE
- Qualitative discussion of other likely but difficult to quantify benefits (e.g., DRIPE)

Study Timeline

- Comments received – June 23
- Draft Report/meeting – August 15
- Comments on draft report – August 24
- Final Report – August 31