Energy Trust of Oregon

Energy Efficiency Resource Assessment Overview and Considerations for Improvements

September 22, 2017

Agenda

- Purpose and background
- Modeling Process
- Considerations for improvements

About

- Independent nonprofit
- Serving 1.6 million customers of Portland General Electric, Pacific Power, NW Natural, Cascade Natural Gas and Avista
- Providing access to affordable energy
- Generating homegrown, renewable power
- Building a stronger Oregon and SW Washington

Purpose and Background

Resource Assessment Overview

What is a resource assessment?

- Estimate of cost-effective energy efficiency resource potential that is achievable over a 20-year period

Energy Trust uses a model in *Analytica* that was developed by Navigant in 2015

Background – How is RA used?

- Informs utility IRP work & strategic planning / program planning
- Does not dictate what annual savings are acquired by programs
- Does not set incentive levels

Modeling Process

Inputs

- Utility service territory data
  - Customer counts, 20-year load forecasts
  - Avoided costs, line losses, discount rate
- Building characteristics
  - Heating and hot water fuel, measure saturations
- Measure assumptions
  - Savings, costs, O&M, NEBs, measure life, load profile, end use, baseline, technical suitability, achievability rates

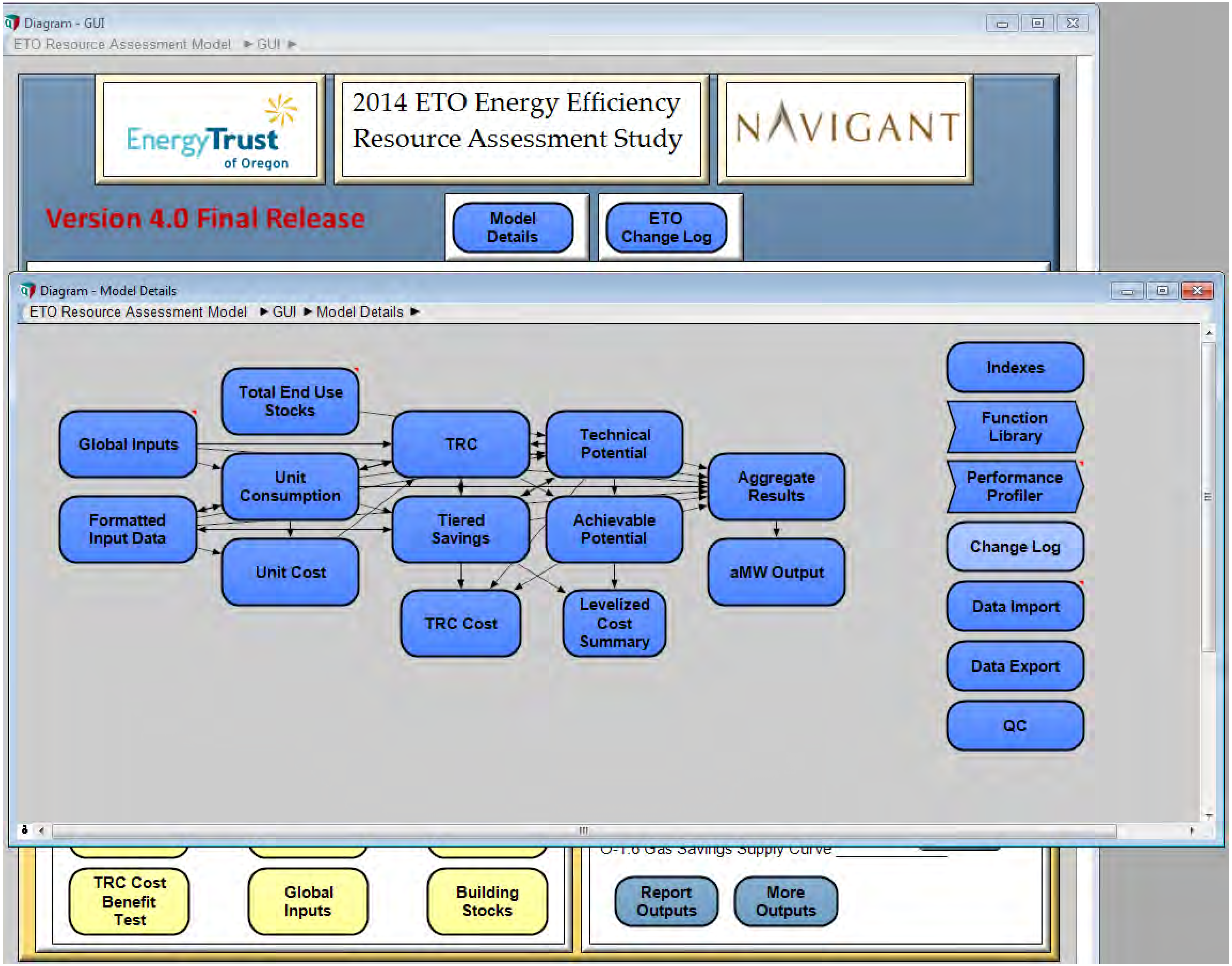


Diagram - GUI
ETO Resource Assessment Model ► GUI ►
2014 ETO Energy Efficiency Resource Assessment Study
EnergyTrust of Oregon
NAVIGANT
Version 4.0 Final Release
Model Details
ETO Change Log
Diagram - Model Details
ETO Resource Assessment Model ► GUI ► Model Details ►
Total End Use Stocks
Global Inputs
TRC
Technical Potential
Unit Consumption
Aggregate Results
Formatted Input Data
Tiered Savings
Achievable Potential
Unit Cost
aMW Output
TRC Cost
Levelized Cost Summary
Indexes
Function Library
Performance Profiler
Change Log
Data Import
Data Export
QC
TRC Cost Benefit Test
Global Inputs
Building Stocks
Report Outputs
More Outputs

Outputs

Not technically feasible	Technical Potential			
Not technically feasible	Market barriers	Achievable Potential		
Not technically feasible	Market barriers	Not cost-effective	Cost-Effective Potential	
Not technically feasible	Market barriers	Not cost-effective	Program design, market penetration	Program Savings Projection

Cost-Effectiveness Testing

Total Resource Cost (TRC) test BCR

- TRC benefit cost ratio (BCR) =
  NPV of Benefits / Total Resource Cost

Benefits

- Savings x Avoided Costs
- Quantifiable non-energy benefits

Total Resource Measure Costs

- Full cost of EE measure or incremental cost of installing efficient measure over baseline measure

Cost-Effectiveness Override in Model

Energy Trust applied this feature to measures found to be NOT Cost-Effective in the model but are offered through programs.

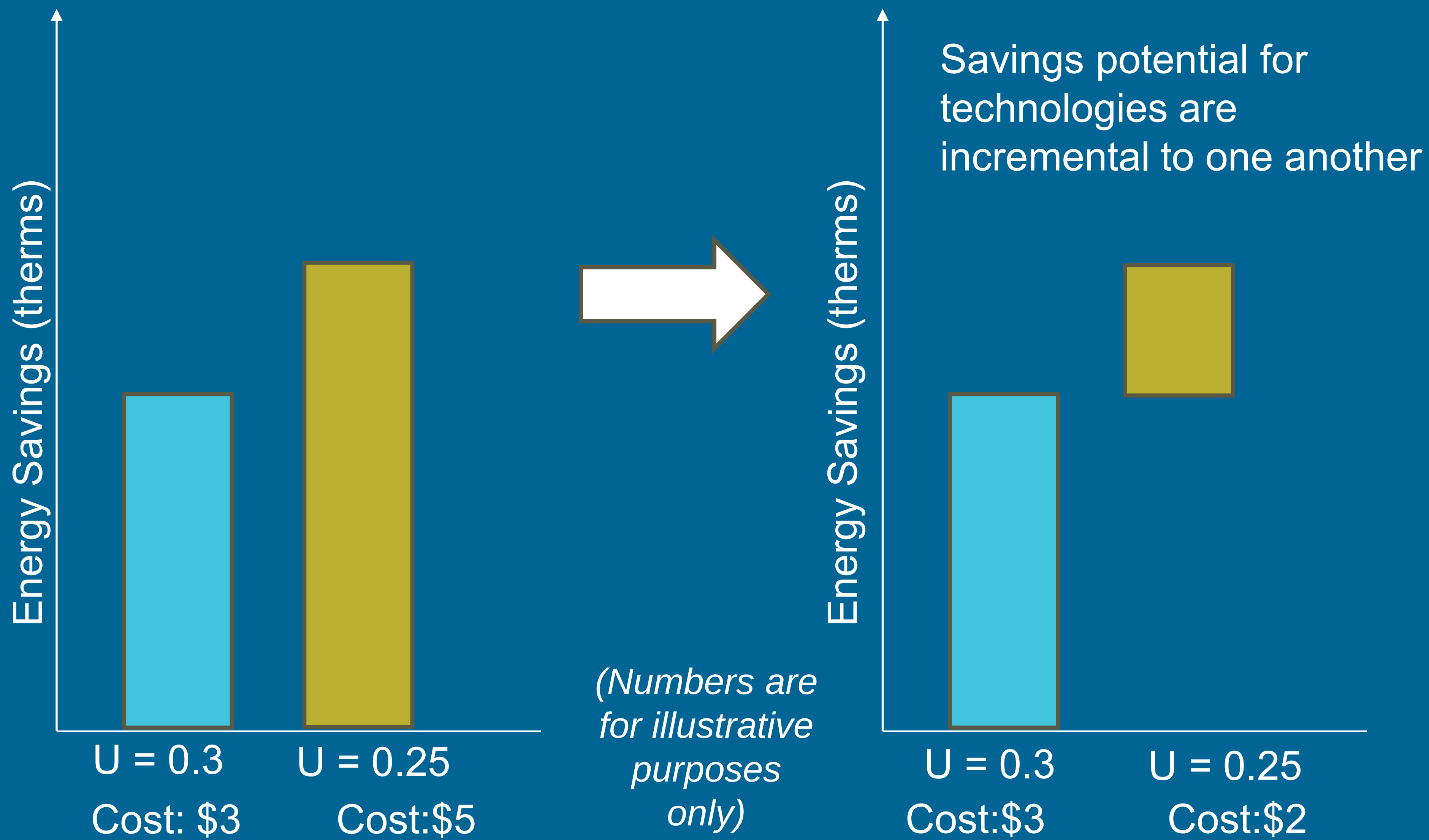
Reasons:

1. Blended avoided costs may produce different results than utility specific avoided costs
2. Measures expected to be cost-effective in the future are sometimes offered under an OPUC exception

Model Assumptions

- Uses incremental measure savings approach for potential instead of market shares
- Includes known emerging technologies
- Factors in known codes & standards
- Uses CBSA EUI data to translate utility load forecasts to stock forecasts
- Utilizes 3rd party research and survey work to inform measure saturation and density (e.g. RBSA)

Incremental Measure Savings Approach (competition groups)

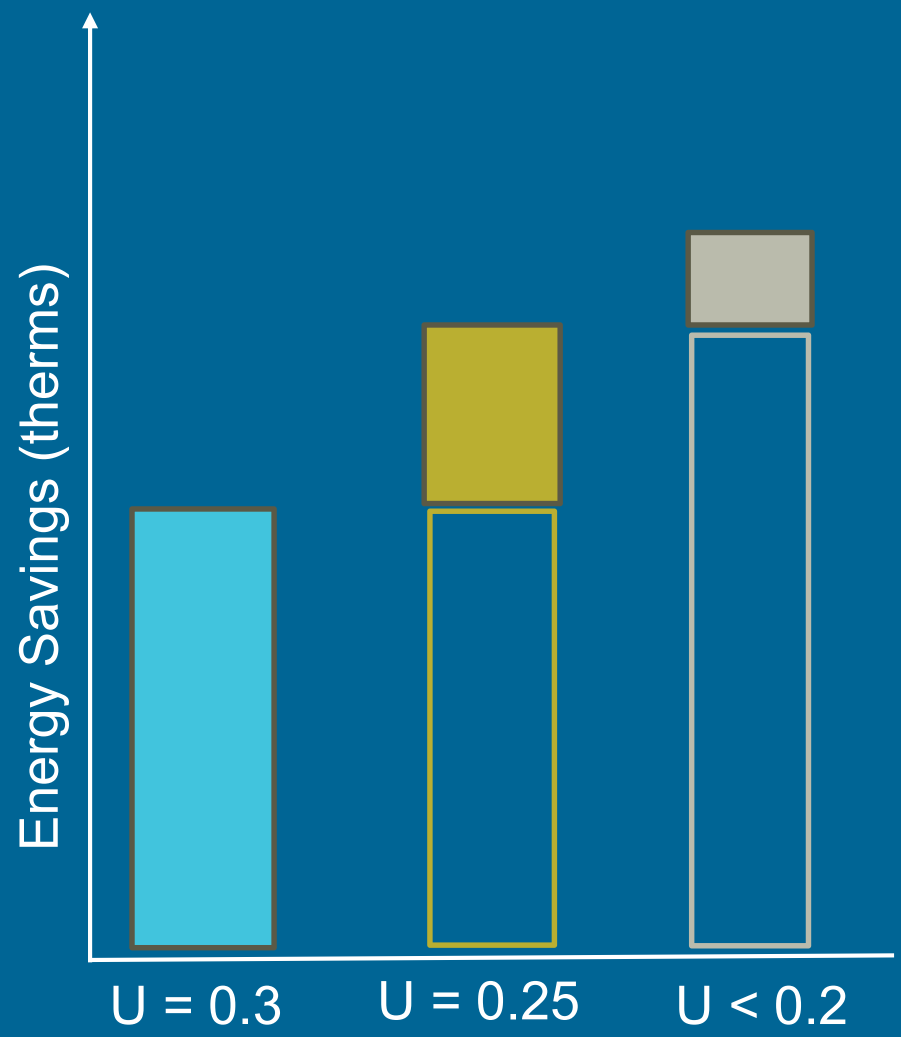


Emerging Technologies

- Includes some emerging technologies
- Factors in changing performance and cost over time
- Uses risk factors to hedge against uncertainty

	Risk Factor for Emerging Technologies				
Risk Category	10%	30%	50%	70%	90%
Market Risk (25% weighting)	High Risk: • Requires new/changed business model • Start-up, or small manufacturer • Significant changes to infrastructure • Requires training of contractors. Consumer acceptance barriers exist.			Low Risk: • Trained contractors • Established business models • Already in U.S. Market • Manufacturer committed to commercialization	
Technical Risk (25% weighting)	High Risk: Prototype in first field tests. A single or unknown approach	Low volume manufacturer. Limited experience	New product with broad commercial appeal	Proven technology in different application or different region	Low Risk: Proven technology in target application. Multiple potentially viable approaches.
Data Source Risk (50% weighting)	High Risk: Based only on manufacturer claims	Manufacturer case studies	Engineering assessment or lab test	Third party case study (real world installation)	Low Risk: Evaluation results or multiple third party case studies

Define Emerging Tech. Measures Incrementally in Their Competition Groups



(Numbers are for illustrative purposes only)

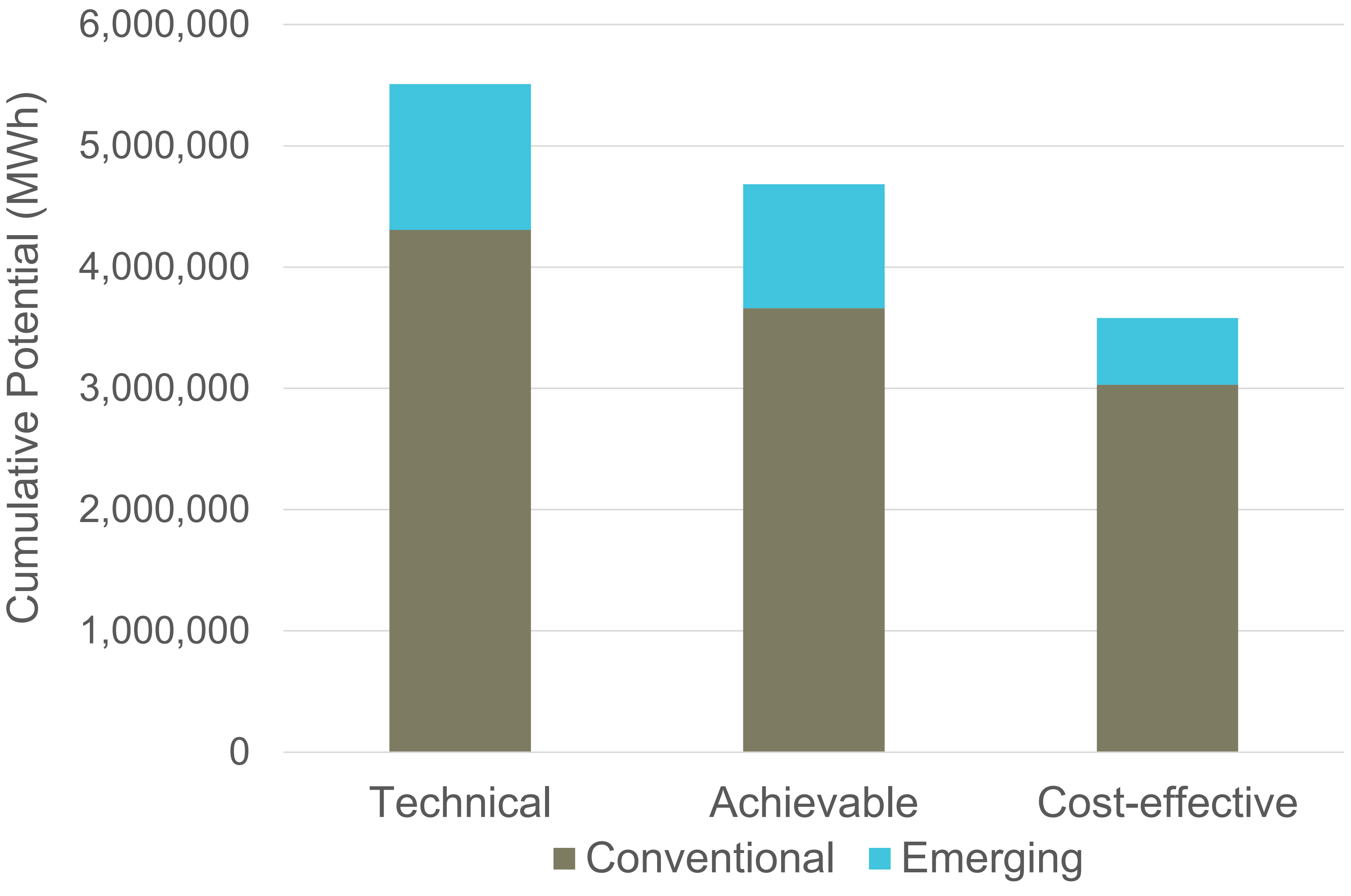
Current Emerging Technologies

Residential	Commercial	Industrial
• AFUE 98/96 Furnace • ER SH to Heat Pump • Heat Pump (HP Upgrade) • Window Replacement (U<.20) • Absorption Gas Heat Pump Water Heater • Advanced CO2 Heat Pump Water Heater • Smart Devices Home Automation • Advanced Heat Pump • HP Dryer	• AC Heat Recovery, HW • Advanced Package A/C RTU • Advanced Refrigeration Controls • Advanced Ventilation Controls • Energy Recovery Ventilator • Gas-fired HP HW • Gas Fired HP, heating • High Bay LED • Highly Insulated Windows • Smart/Dynamic Windows • Supermarket Max Tech Refrigeration • VIP, R-35 wall (vacuum insulated panel) • Com - Hybrid IDEC- (indirect-direct evap. Cooler)	• Advanced Refrigeration Controls • Advanced LED Lighting Retrofits • Gas-fired HP Water Heater • Switched reluctance motors • Wall Insulation- VIP, R0-R35

Emerging Tech. Under Development

Residential	Commercial	Industrial
• AFUE 98/96 Furnace • CO2 HPWH update • Deep Behavior Savings • Net Zero Homes • Window Attachments • HP Dryer update	• Rooftop HVAC/ DOAS • High Efficiency Circulation Pumps • Path to Net Zero Buildings • Smart/Dynamic windows update	• Engineered Compressed Air Nozzles

Contribution of Emerging Technologies



Example Measure: Residential Heat Pump Water Heater- Tier 1, Heating Zone 1

Key Measure Inputs:

- Baseline: 0.9 EF Water Heater ($590)
- Measure Cost: $1,230-$1,835 ($600 RETC)
- Competing Measures: Tier 2 HPWH, CO_2 HPWH
- Lifetime:12 years
- Conventional (not emerging, no risk adjustment)
- Customer Segments: SF, MF, MH
- Program Type: Replacement on Burnout
- Savings: 1,516-1,530 kWh
- Density, saturation, suitability
- No Non-Energy Benefits or O&M savings

Example Measure: Residential Heat Pump Water Heater- Tier 1, Heating Zone 1

Mid Value - Cost-effective Achievable Potential

Mid Value of Cost-effective Achievable Potential (MWh, MW, MM Therms)

Selected Replacement Type: «Totals»
Savings Type: MWh
Selected Utilities: PGE
Selected Customer Segment: «Totals»
Selected Measures — ☑ Totals
Simulation Year (year) — ☐ Totals

Selected Measures	2017	2018	2019	2020	2021	2022	20
Res Bathroom Faucet Aerators, 1.0 gpm- Gas	0	0	0	0	0	0	
Res Bathroom Faucet Aerators, 1.5 gpm- Electric	0	0	0	0	0	0	
Res Bathroom Faucet Aerators, 1.5 gpm- Gas	0	0	0	0	0	0	
Res Kitchen Faucet Aerators, 1.5 gpm- Electric	24.71K	24.53K	24.34K	24.16K	23.98K	23.8K	23.6
Res Kitchen Faucet Aerators, 1.5 gpm- Gas	0	0	0	0	0	0	
Res Kitchen Faucet Aerators, 2.0 gpm- Electric	0	0	0	0	0	0	
Res Kitchen Faucet Aerators, 2.0 gpm- Gas	0	0	0	0	0	0	
Res Showerheads - Elec DHW	85.68K	85.04K	84.4K	83.77K	83.14K	82.52K	81.
Res Showerheads - Gas DHW	2545	2526	2507	2489	2470	2451	24
Res Smart Devices Home Automation (NEW)	727.4	1441	2146	2841	3464	4096	47
Res Smart Devices Home Automation (RET)	46.11K	44.72K	43.35K	41.99K	40.66K	39.34K	38.0
Res Tankless Gas Hot Water Heater-Z1							
Res Tankless Gas Hot Water Heater-Z1 (NEW ONLY)							
Res Tankless Gas Hot Water Heater-Z2							
Res Tankless Gas Hot Water Heater-Z2 (NEW ONLY)							
Res Tier 1 Heat Pump Water Heater- Z1	8026	15.38K	22.13K	28.31K	33.98K	39.17K	43.9
Res Tier 1 Heat Pump Water Heater- Z2							
Res Tier 2 Heat Pump Water Heater-Z1	0	0	0	1095	5519	13.2K	20.2
Res Tier 2 Heat Pump Water Heater-Z1 (NEW ONLY)	3167	6369	9645	13K	15.88K	19K	22.
Res Tier 2 Heat Pump Water Heater-Z2							
Res Tier 2 Heat Pump Water Heater-Z2 (NEW ONLY)							
Totals	2.575M	2.636M	2.687M	2.752M	2.822M	2.869M	2.97

Example Measure- Tier 1 HPWH

CE Achievable Potential x Deployment Curves = Deployed DSM Savings

Cost Effective Achievable Potential from RA model (MWh)

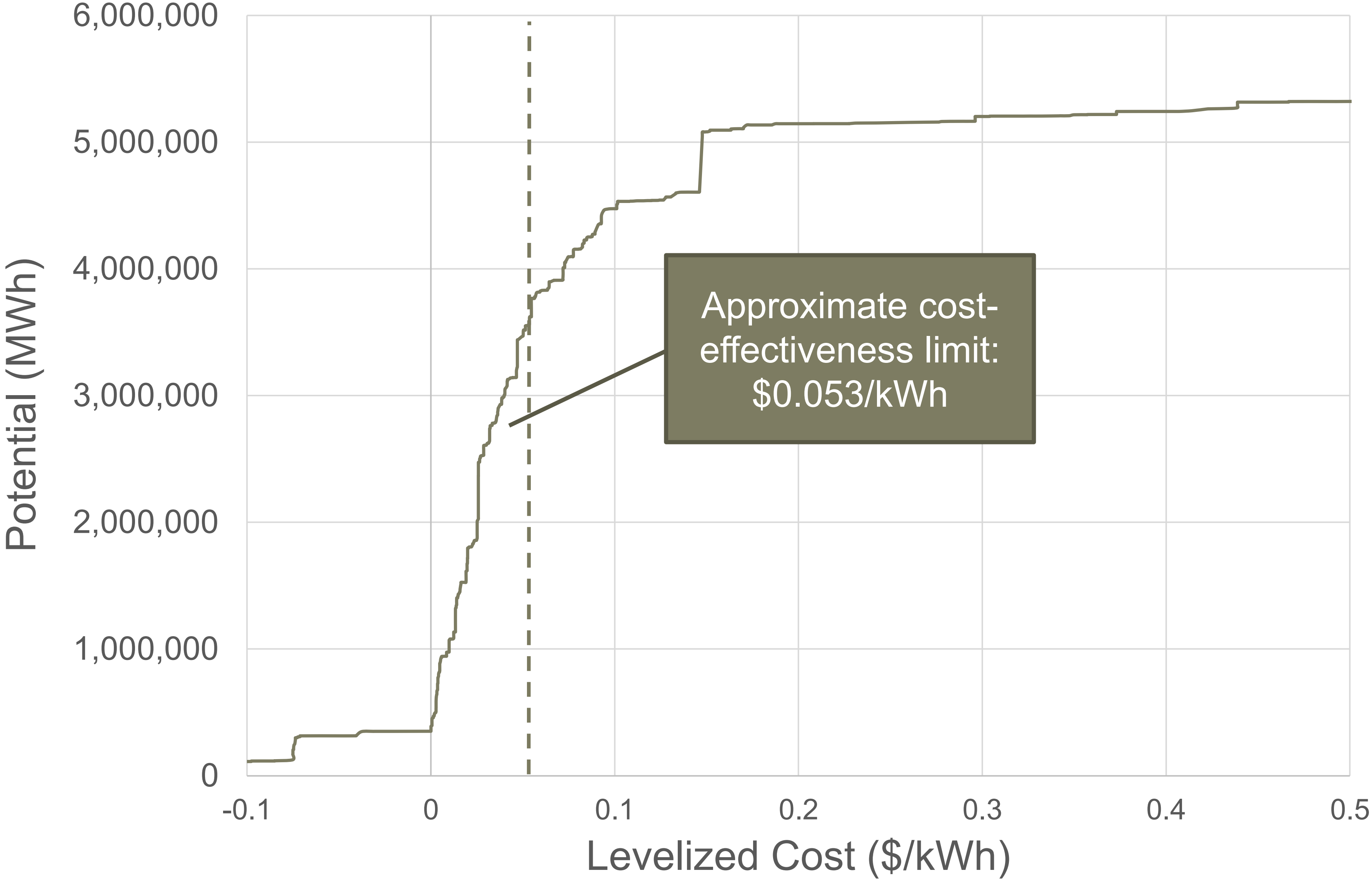
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Tier 1 HPWH Z1- Manuf.	782	1,500	2,157	2,760	3,312	3,818	4,282	4,708	5,098	5,455
Tier 1 HPWH Z1- Multifamily	3,060	5,865	8,436	10,792	12,953	14,933	16,749	18,413	19,938	21,336
Tier 1 HPWH Z1- Single Family	4,184	8,019	11,535	14,758	17,712	20,420	22,903	25,178	27,264	29,176
Total	**8,026**	**15,384**	**22,128**	**28,310**	**33,977**	**39,172**	**43,934**	**48,299**	**52,300**	**55,968**

Deployment Curves	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Com-NEW	145%	130%	130%	95%	90%	85%	85%	70%	90%	85%
Com-RET	10%	9%	9%	8%	7%	6%	6%	5%	5%	4%
Com-ROB	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
Ind-RET	9%	9%	10%	9%	8%	7%	7%	6%	6%	5%
Ind-ROB	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
RES-NEW	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%
RES-RET	11%	11%	10%	7%	6%	5%	4%	4%	4%	4%
RES-ROB	**90%**	**90%**	**90%**	**90%**	**90%**	**90%**	**90%**	**90%**	**90%**	**90%**
RES-CFL	4%	4%	5%	5%	5%	5%	5%	5%	5%	5%

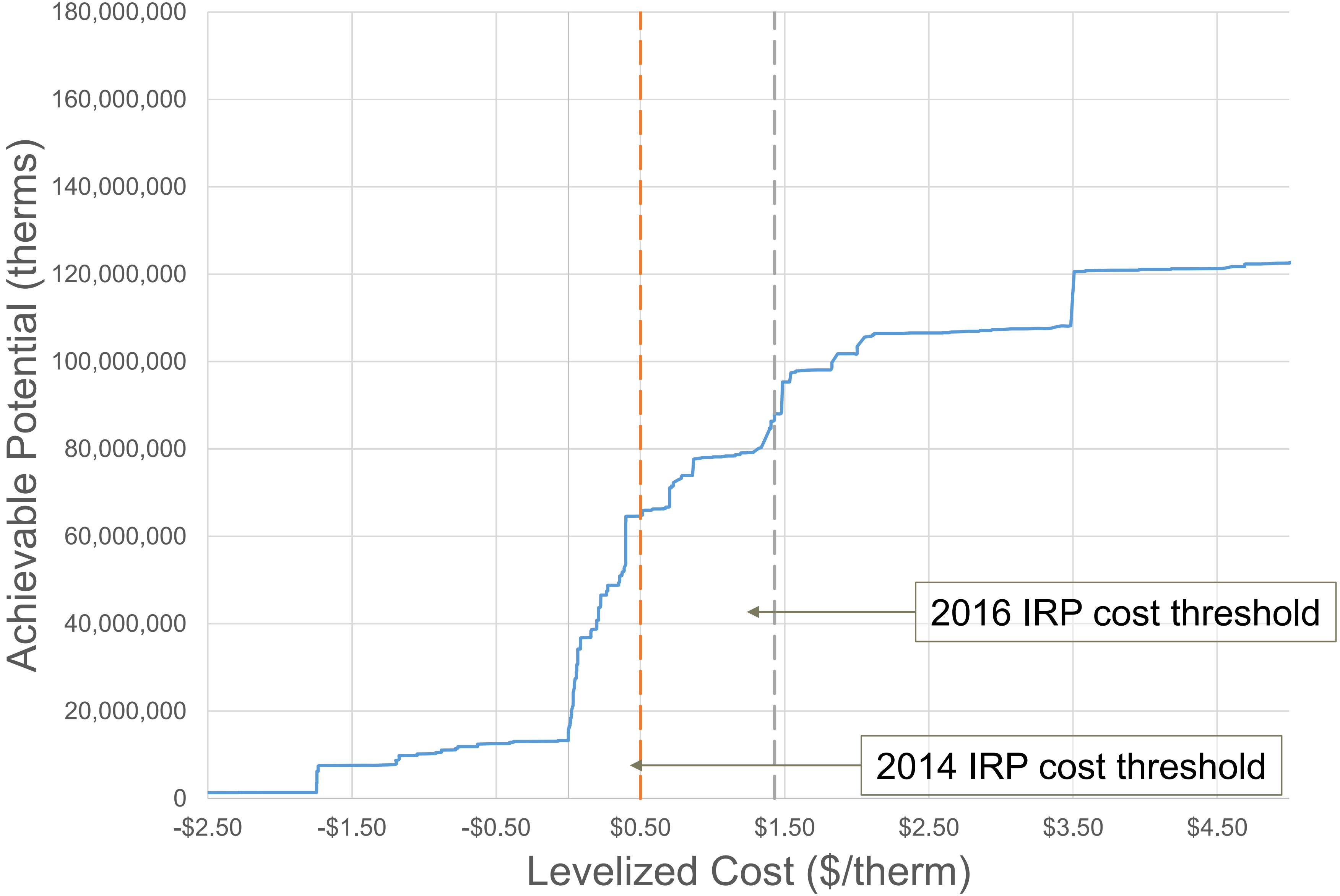
Deployed Savings (MWh)

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Tier 1 HPWH Z1- Manuf.	704	1,350	1,941	2,484	2,981	3,436	3,854	4,237	4,588	4,910
Tier 1 HPWH Z1- Multifamily	2,754	5,278	7,592	9,713	11,658	13,440	15,074	16,571	17,944	19,203
Tier 1 HPWH Z1- Single Family	3,766	7,217	10,382	13,282	15,941	18,378	20,612	22,660	24,538	26,258
Total	**7,224**	**13,845**	**19,915**	**25,479**	**30,579**	**35,255**	**39,540**	**43,469**	**47,070**	**50,371**

PGE Supply Curve – 20 year potential

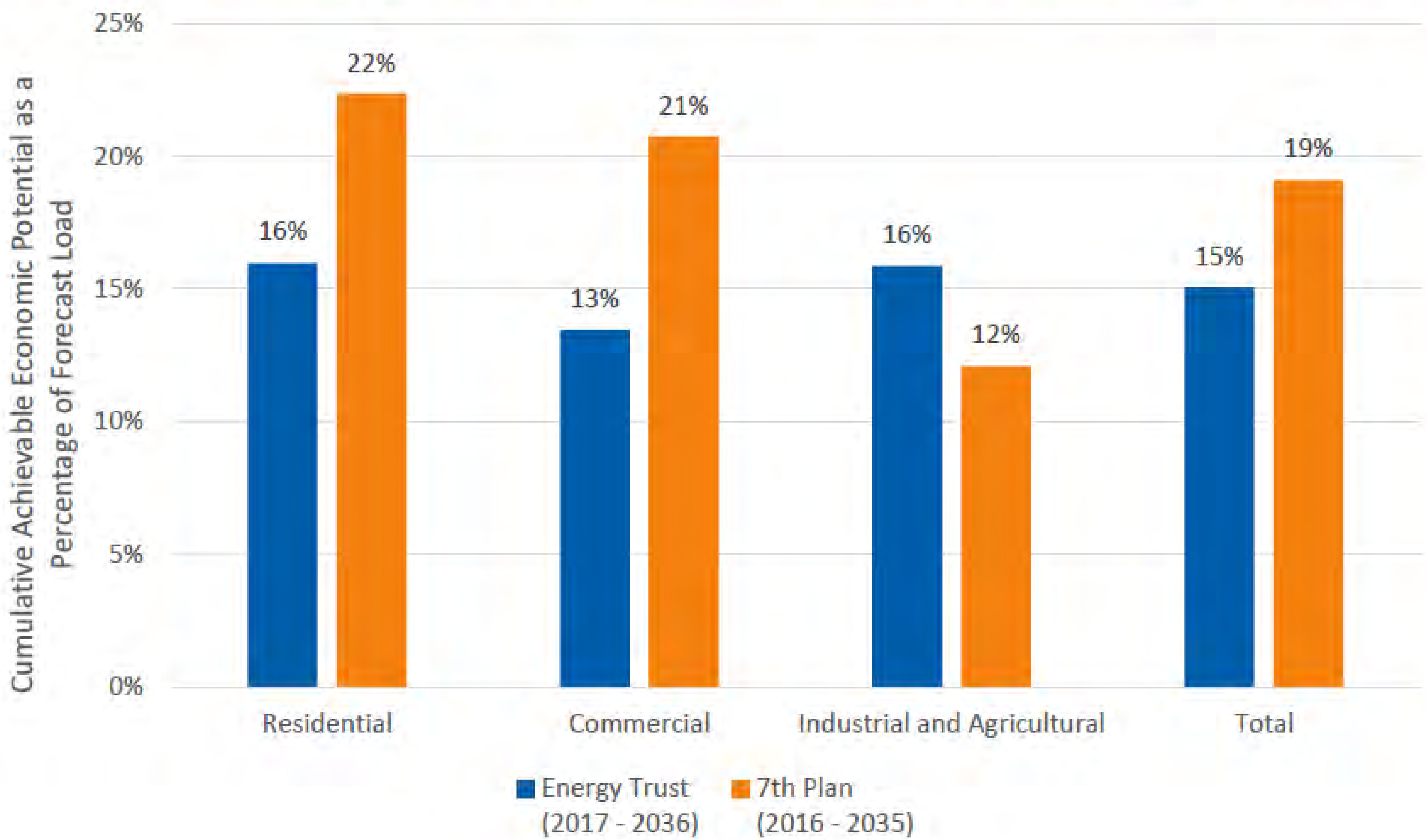


NWN Supply Curve – 20 Year Achievable Potential



Comparison to 7th Power Plan

Figure 3. Comparison of Energy Trust and 7th Plan Economic Potential as a Percentage of Forecast Load



Energy Trust Compared to 7th Power Plan

Energy Trust has

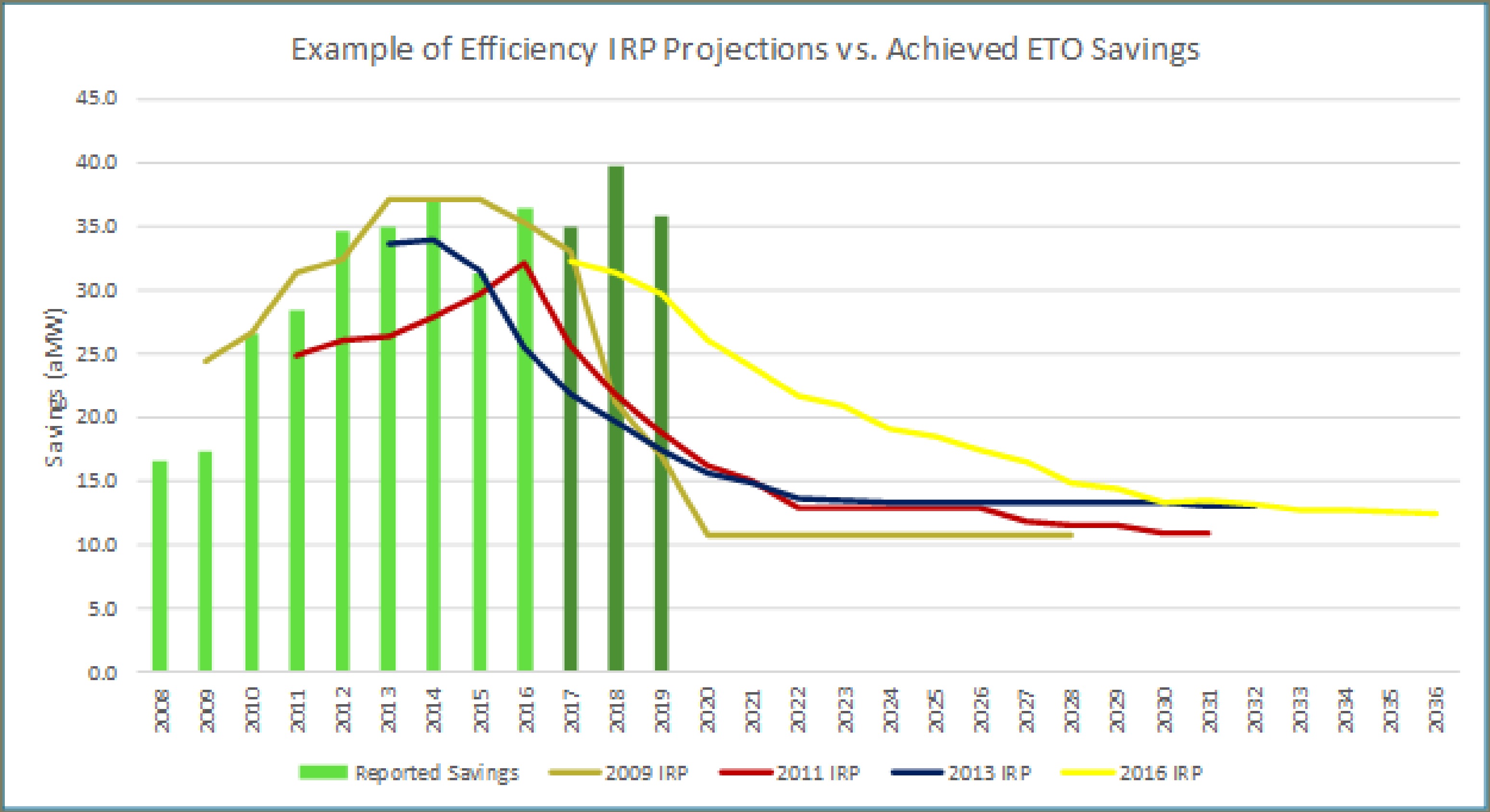
- Higher measure saturations than the region as a whole
- Lower electric space & water heat saturation
- Fewer savings from codes and standards
- More savings in the near term, fewer in out years

Considerations for Adjustments to Energy Trust forecasting

Summary of Issues

- History of performance exceeding IRP targets
- The available resource is expected to decline over time
- Energy Trust needs to refine forecasts
- Energy Trust is seeking feedback on potential refinements

History of Achievements Exceeding IRP Targets



Think About Forecast in Three Time Periods

- 1-2 years (short term)
  - Programs know best
- 3-5 years (mid term)
  - Programs and planning work together
- 6-20 years (long term)
  - Planning forecasts long-term acquisition rate

Drivers of Short Term Forecast Uncertainty

- Large new facilities
- Difficult-to-predict factors
  - Economic conditions
  - Weather
- Uncertain utility load, population growth and building forecasts
- Difficult-to-predict pace of market uptake
- Timing for modeling IRP targets and annual goal setting do not align

Drivers of Mid/long Term Forecast Uncertainty

- Several of those in previous slide
- Practice of producing single line forecasts without error bands
- Unforeseeable new technologies and solutions

Future Savings Potential

- Significant cost-effective potential remains, however;
  - Codes and standards are improving
  - Deep penetration in some markets
    - Residential lighting
    - Water flow restriction devices
  - Indicators of past success
    - Energy Trust exited fridge retirement and other appliance markets
    - More small commercial and industrial projects
  - New construction is unpredictable

Incremental Improvements to Forecasting

- Create more nimble modeling structure (2015)
- Create risk factors for emerging technology (2015)
- Iterative updates to measures, baselines and emerging technology (2016, 2017, ongoing)
- Include additional behavioral savings and near net-zero homes and buildings (2017)

History of Purpose and Pace of Forecast

- Energy Trust has historically developed a single, “firm” estimate of conservation supply
  - Energy Trust has been achieving results that exceed the forecast of “firm” resource
  - Conservative view as a large % of what was acquired over 5 years was from “non-firm” or unknown resources 5 years previously

Alternative Forecasting Approaches

- Energy Trust acquire known resource more rapidly
- Energy Trust adopt other methods to forecast based on techniques such as:
  - Simplified statistical trending
  - Physical limits approach
- Assume every commercially available technology would eventually be implemented by everyone

Potential Adjustments to Consider - 1

- Should we add 5% to entire resource potential to address unpredicted loads?
- Should we include an incremental resource adder to account for unknown future technologies?
- Should forecasts be based on a range of potential?
- What other emerging tech should we include in the forecast?

Potential Adjustments to Consider - 2

- Should we forecast a more aggressive deployment rate?
- Should we plan a project to pursue a more speculative estimation of supply?
- Is there a role for trending beyond acknowledging trends exist?
- Does it make sense to forecast to acquire all potential in 5 or 10 years?

Thank You

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