Mapping Out Energy Efficiency’s Potential

NARUC/Nigeria Electricity Regulatory Partnership
Dubai, United Arab Emirates
3-5 December, 2014

Paul Roberti, Commissioner
Rhode Island Public Utilities Commission

Rhode Island is the Smallest State in U.S.

USAID FROM THE AMERICAN PEOPLE

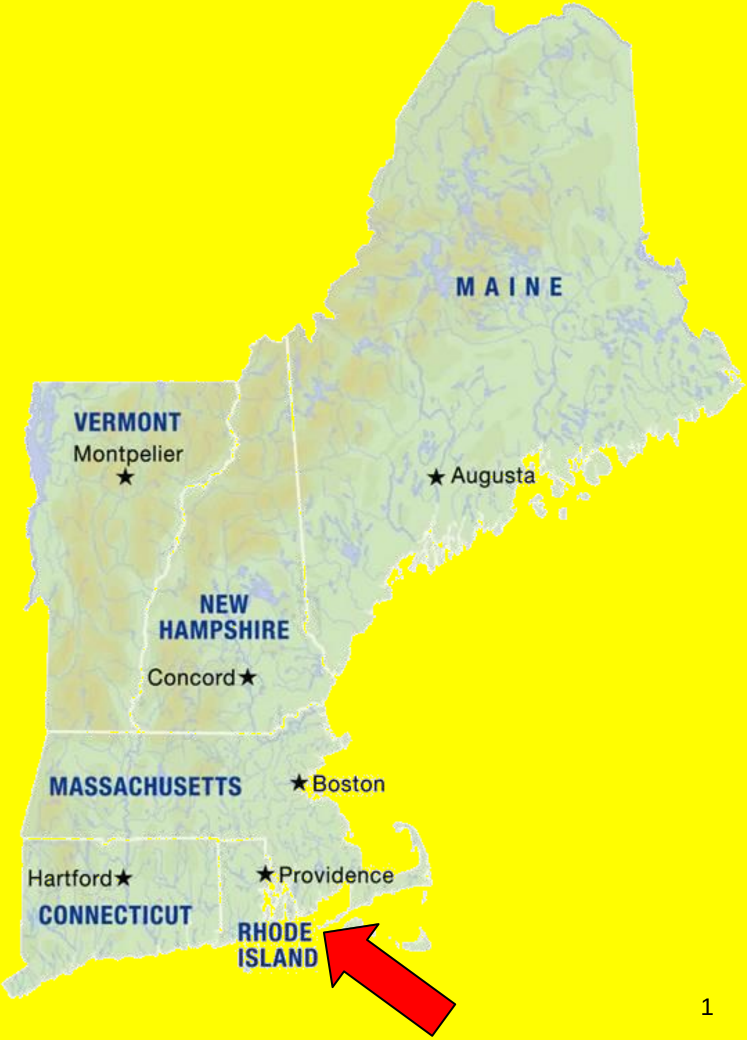
National Association of Regulatory Utility Commissioners

Key Facts – Rhode Island

- Approximately 7% of the region's population and 6% of the region's total electricity consumption
- Approximately 1,860 MW of generating capacity
  - 99% natural gas
- ISO forecasts, on average, over the next decade:
  - RI overall electricity demand to grow .8% annually (below .9% regional average)
  - RI summer peak demand to grow 1.5% (same as regional average)
- RI all-time peak: 1,989 MW (August 2006)
  - 2012 peak: 1,817 MW

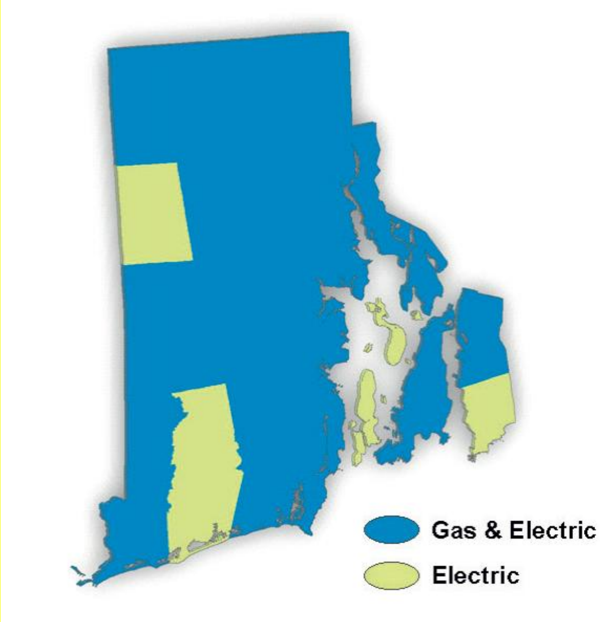
New England's Electric Power Grid at a Glance

- Interconnected Transmission among 6 States and singular bulk power market
- 6.5 million households and businesses; population 14 million
- 350+ generators
- 8,000+ miles of high-voltage transmission lines (115 kV and above)
- 32,000 megawatts of total supply and
- 28,130 megawatts all-time peak demand, set on August 2, 2006
- 500 participants in the marketplace
- $6-8 billion total energy market value in 2012



Rhode Island Electric and Gas Operations

- National Grid serves as Rhode Island’s electric and gas utility with:
  - 482,000 electric customers
  - 252,000 gas customers
  - 6,000 miles electric distribution lines
  - 3,100 miles gas mains



Note: Map does not indicate area served by Pascoag Utility District

Energy Efficiency

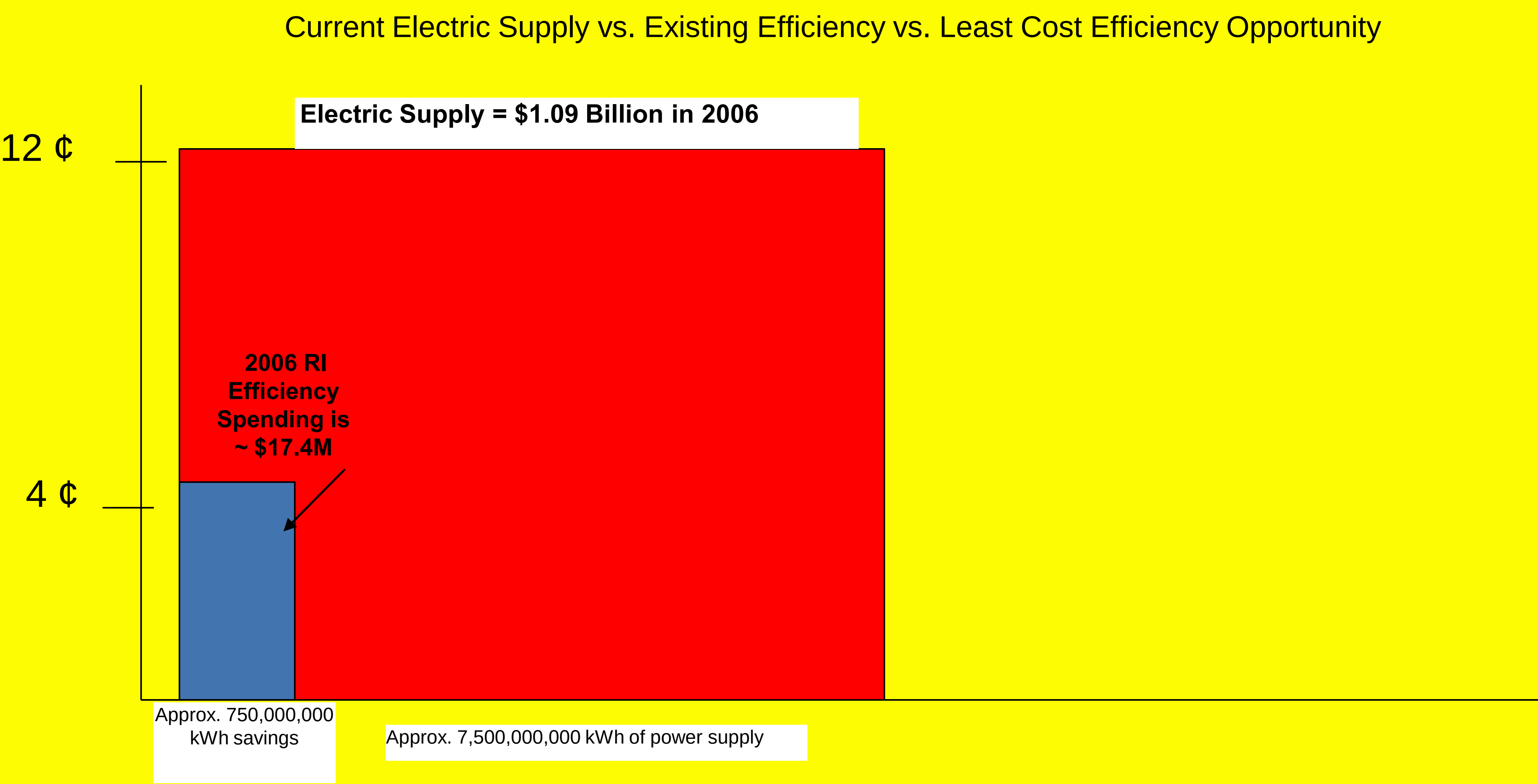
The Promising Theory Behind Energy Efficiency (EE)

Using less energy for the same amount of performance, comfort and convenience

The cheapest kWh you can buy is the one you don't use.

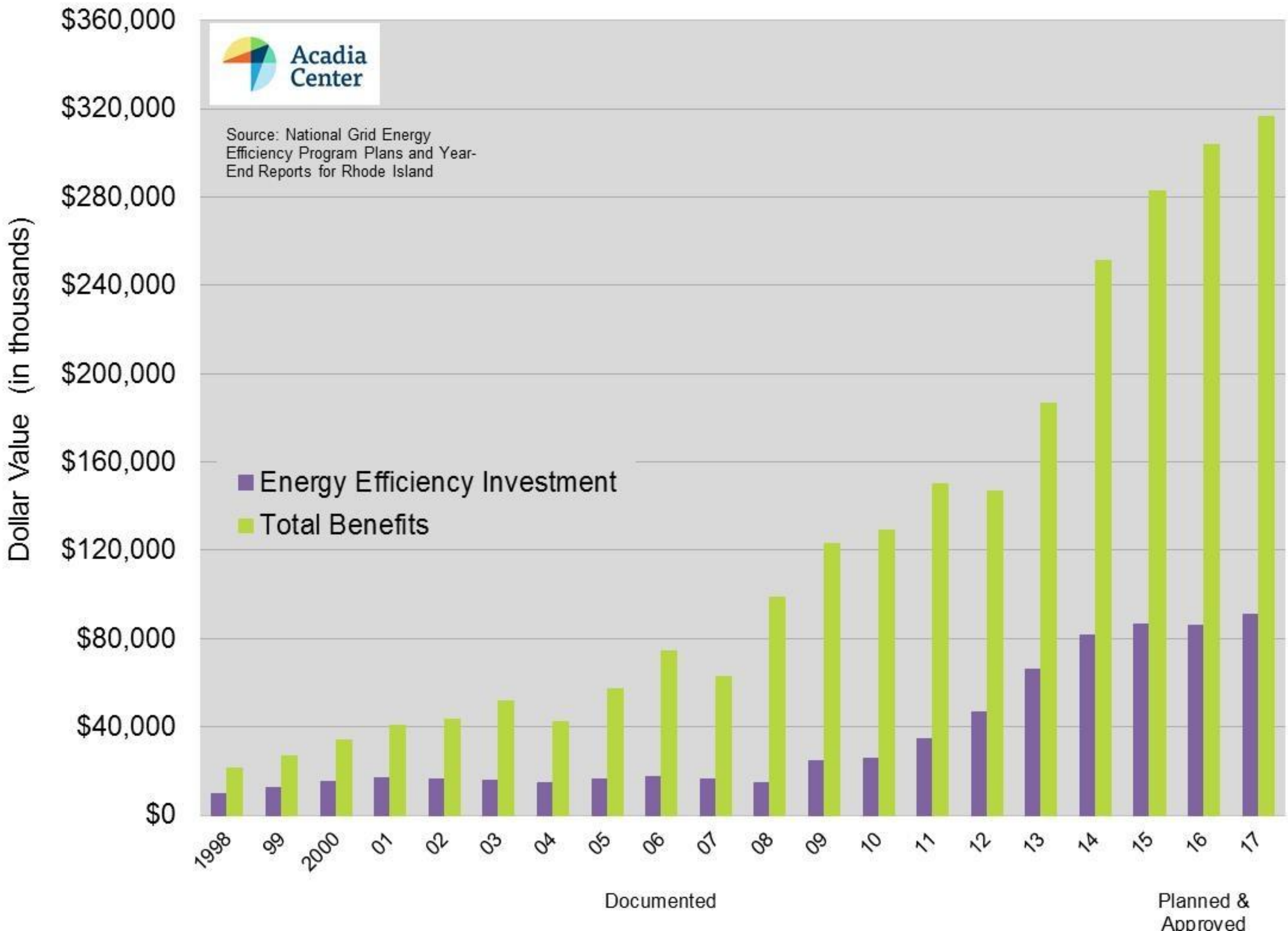
Creates benefits by procuring the cheapest kWh as a resource instead of more expensive resources

Imbalance in expenditure on high-cost supply vs. low cost efficiency resource



Ancillary Benefits of Energy Efficiency

- Improves reliability.
- Provide benefits to low-income customers.
- Helps to defer or avoid T&D investments.
- Reduces environmental compliance costs.
- Reduces environmental impacts.
- Promote local economic development and job creation.
- Promote energy independence and security.
- Provide non-energy benefits to program participants.



Acadia Center
Source: National Grid Energy Efficiency Program Plans and Year-End Reports for Rhode Island
Energy Efficiency Investment
Total Benefits
Dollar Value (in thousands)
$360,000
$320,000
$280,000
$240,000
$200,000
$160,000
$120,000
$80,000
$40,000
$0
1998
99
2000
01
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16
17
Documented
Planned & Approved

Why Should Utilities Offer EE Programs?

- Ratepayer funded efficiency programs are needed to overcome the many market barriers to energy efficiency:
  - Imperfect information.
  - Limited availability of efficiency products.
  - Lack of access to capital.
  - High transaction costs.
  - Improper price signals.
  - Split incentives.
  - Focus on short-term.
  - Limited interest, due to electricity bills not being important enough.
  - Institutional and regulatory barriers.
  - Uncertainty and risk avoidance.

Courtesy of Tim Woolf, Synapse Energy Economics

Energy Efficiency is Systematically Undervalued

- Avoided costs are often understated.
  - Some avoided costs are ignored altogether.
- Many key benefits are not accounted for.
  - Especially those that are difficult to quantify.
- Energy policy goals are not accounted for.
  - These should be included in each test.
- Discount rates undervalue future benefits.
  - The utility cost of capital is too high.
- Price impacts are overstated.
  - Comprehensive, long-term analysis is required.

Courtesy of Tim Woolf, Synapse Energy Economics

Components of the Standard Screening Tests

	Participant Test	RIM Test	Utility Test	TRC Test	Societal Test
Energy Efficiency Program Benefits:					
Customer Bill Savings	Yes	---	---	---	---
Avoided Energy Costs	---	Yes	Yes	Yes	Yes
Avoided Capacity Costs	---	Yes	Yes	Yes	Yes
Avoided Transmission and Distribution Costs	---	Yes	Yes	Yes	Yes
Wholesale Market Price Suppression Effects	---	Yes	Yes	Yes	Yes
Avoided Cost of Environmental Compliance	---	Yes	Yes	Yes	Yes
Non-Energy Benefits (utility perspective)	---	Yes	Yes	Yes	Yes
Non-Energy Benefits (participant perspective)	Yes	---	---	Yes	Yes
Non-Energy Benefits (societal perspective)	---	---	---	---	Yes
Energy Efficiency Program Costs:					
Program Administrator Costs	---	Yes	Yes	Yes	Yes
EE Measure Cost: Program Financial Incentive	---	Yes	Yes	Yes	Yes
EE Measure Cost: Participant Contribution	Yes	---	---	Yes	Yes
Non-Energy Costs (utility, participant, societal)	---	Yes	Yes	Yes	Yes
Lost Revenues to the Utility	---	Yes	---	---	---

Courtesy of Tim Woolf, Synapse Energy Economics

Implications of the Standard Tests

Test	Key Question Answered	Costs and Benefits Included	Implications
Societal Cost Test	Will there be a net reduction in societal costs?	Costs and benefits experienced by all members of society.	Most comprehensive. Best able to account for all energy policy goals.
Total Resource Cost Test	Will there be a net reduction in costs to all customers?	Costs and benefits experienced by all utility customers, including program participants and non-participants.	Indicates the full incremental costs of the resource. Generally includes full societal costs but not full societal benefits.
Utility Cost Test	Will there be a net reduction in utility system costs?	Costs and benefits to the utility system as a whole, including generation, transmission, and distribution impacts.	Indicates the impact on average custome bills.
Participant Cost Test	Will there be a net reduction in program participant costs?	Costs and benefits experienced by the customer who participates in the program.	Of limited use for cost-effectiveness screening. Useful in program design to understand and improve participation.
Rate Impact Measure	Will there be a net reduction in utility rates?	Costs and benefits that will affect utility rates, including utility system impacts plus lost revenues.	Should not be used for cost-effectiveness screening. Does not provide useful information regarding rate impacts or customer equity impacts.

Courtesy of Tim Woolf, Synapse Energy Economics

Mapping Out EE's Potential

Potential studies examine the economic and technical opportunities for energy efficiency
They are large studies built on econometric models and are designed to be valid over a period of time

Example Potential Study

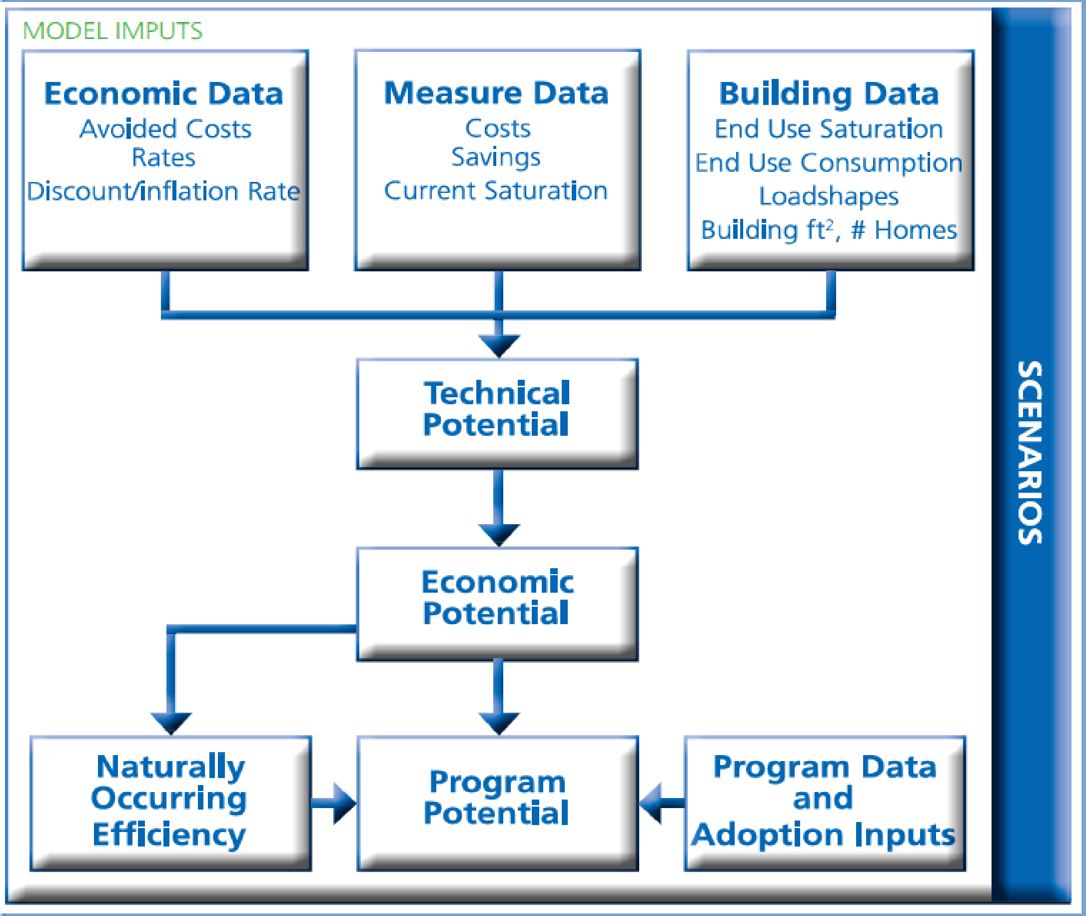


Illustration source: EERMC/DNV KEMA

Types of Potential

Technical Potential: The total demand-side resource potential from all measures considered, regardless of whether those measures are cost effective, and without regard for market barriers or the ability of programs to capture it.

Economic Potential: The total demand-side resource potential over the planning period from all measures that are cost effective, based on an adopted cost effectiveness test

Achievable Potential: The estimated maximum demand-side resources that could be captured over the planning period, given aggressive, well designed, fully-funded programs.

Supply Curves

- Potential studies estimate EE supply curves
- Supply curves provide policy makers information to establish:
  - reasonable savings targets (X-axis)
  - reasonable costs (y-axis)

Example EE Supply Curve

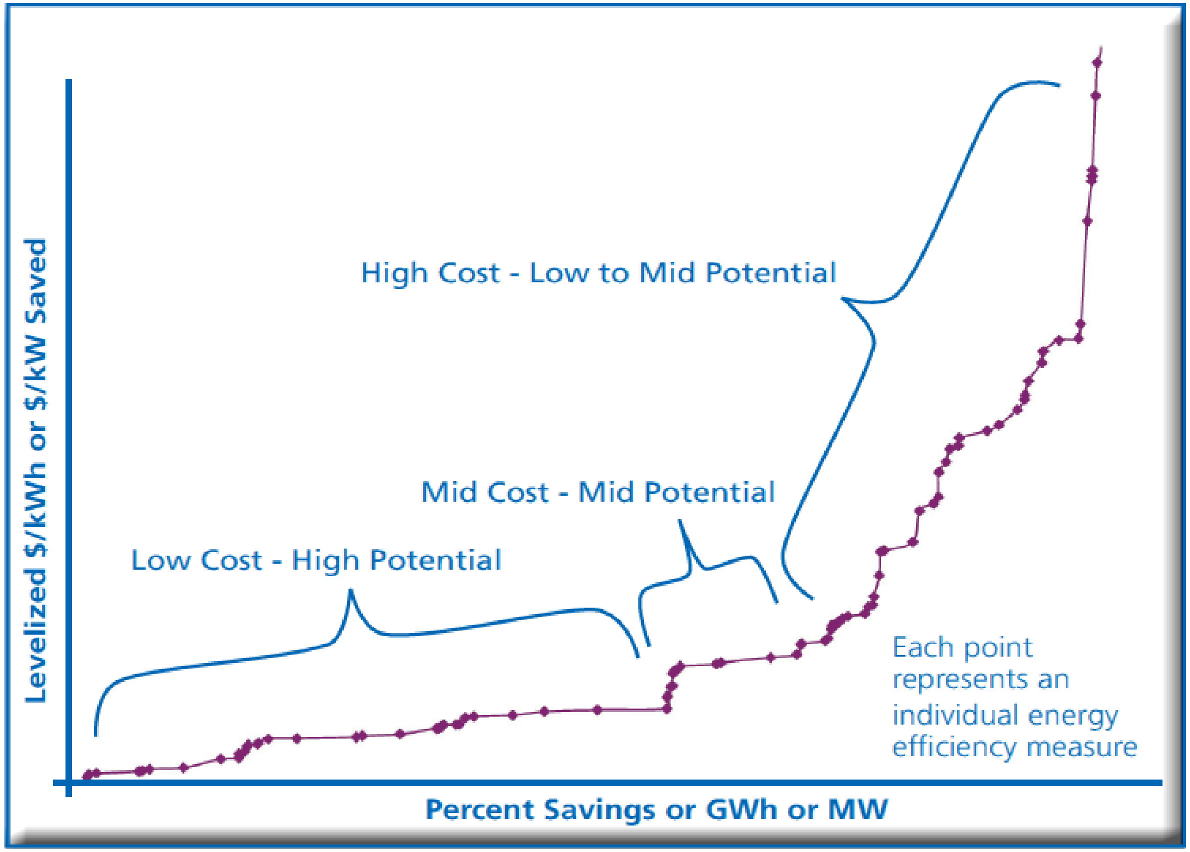
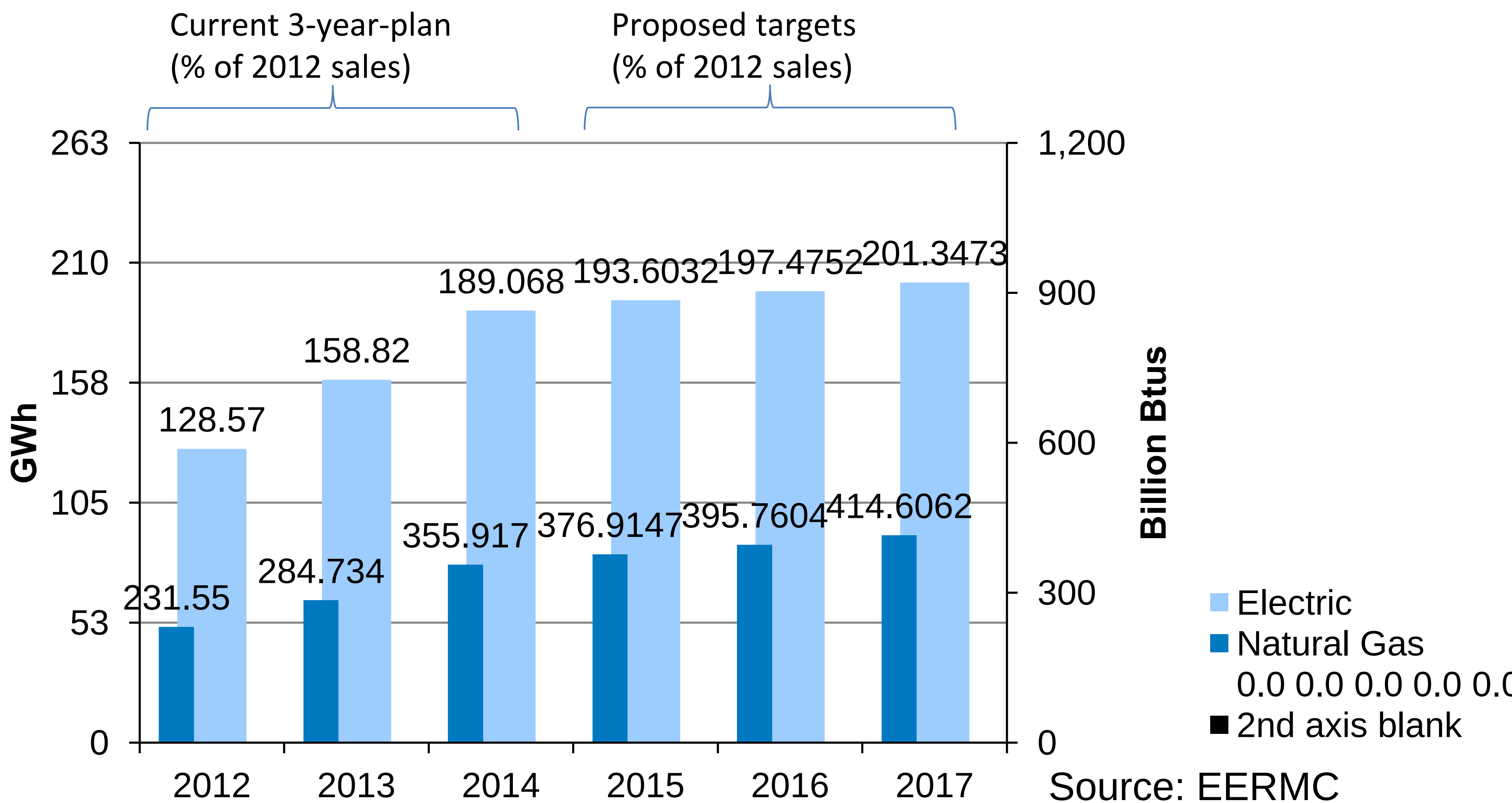


Illustration source: EERMC/DNV KEMA


Pick the low hanging
fruit first!
$$$

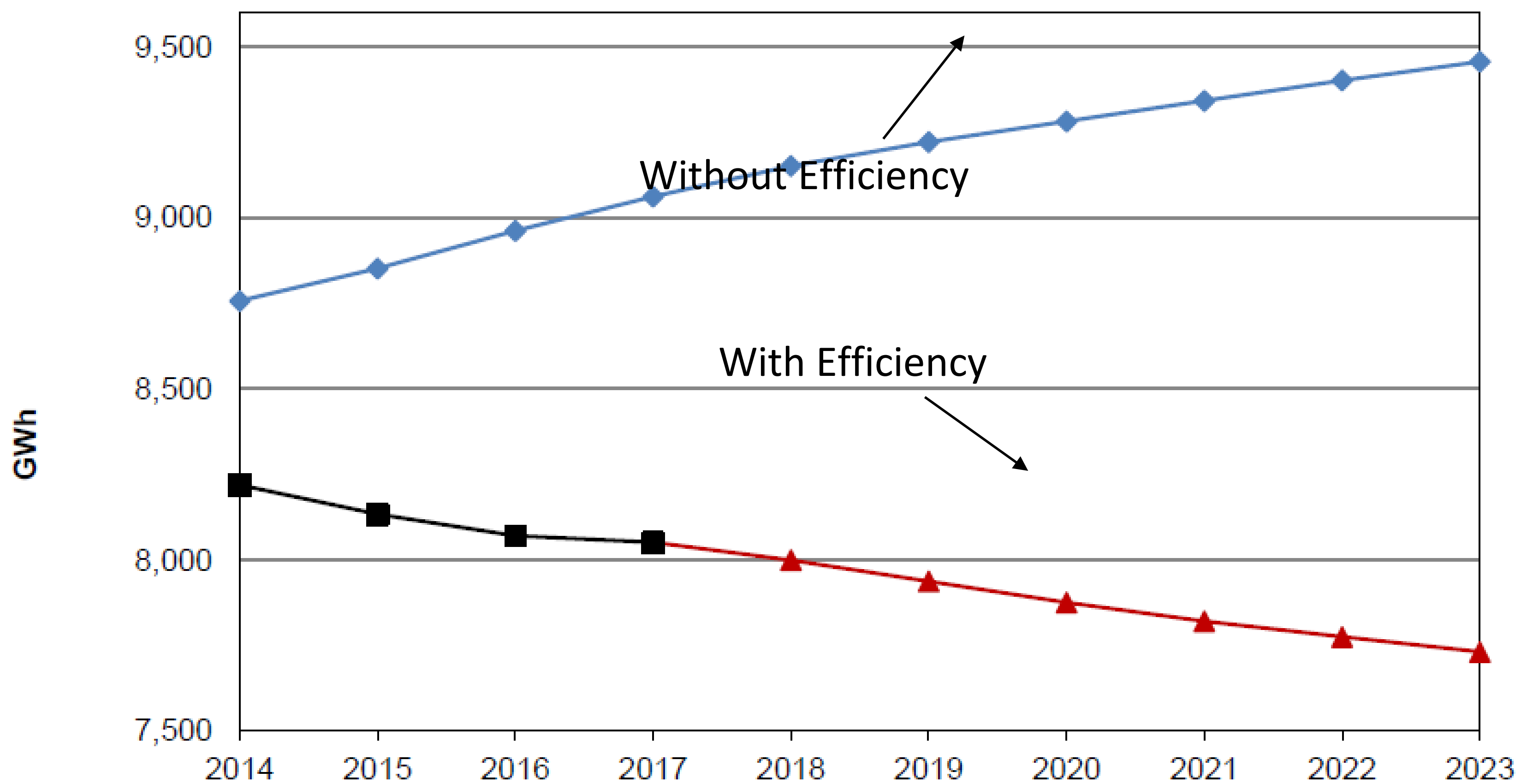
Comparing Current and Proposed Energy Savings Targets

Potential studies are used to set savings targets.
RI has gone through period of ramping up of energy efficiency since 2008;
Now a more level and sustainable program scale



Source: EERMC

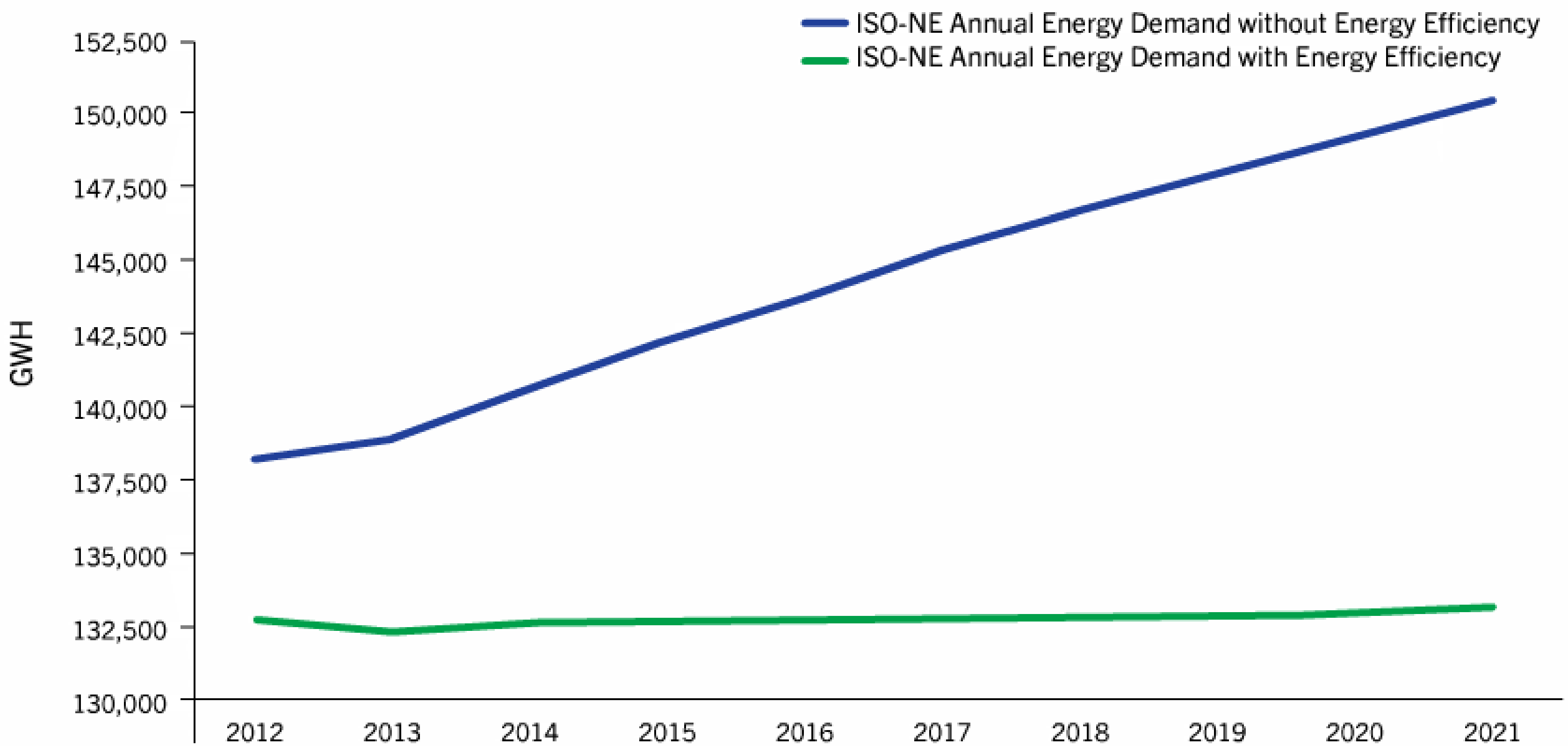
Rhode Island's Electric Load Forecast — with and without energy efficiency



Source: ISO-NE Energy Efficiency Forecast Report for 2018-2023

Efficiency Reduces Power Grid Costs

New England Demand Forecast



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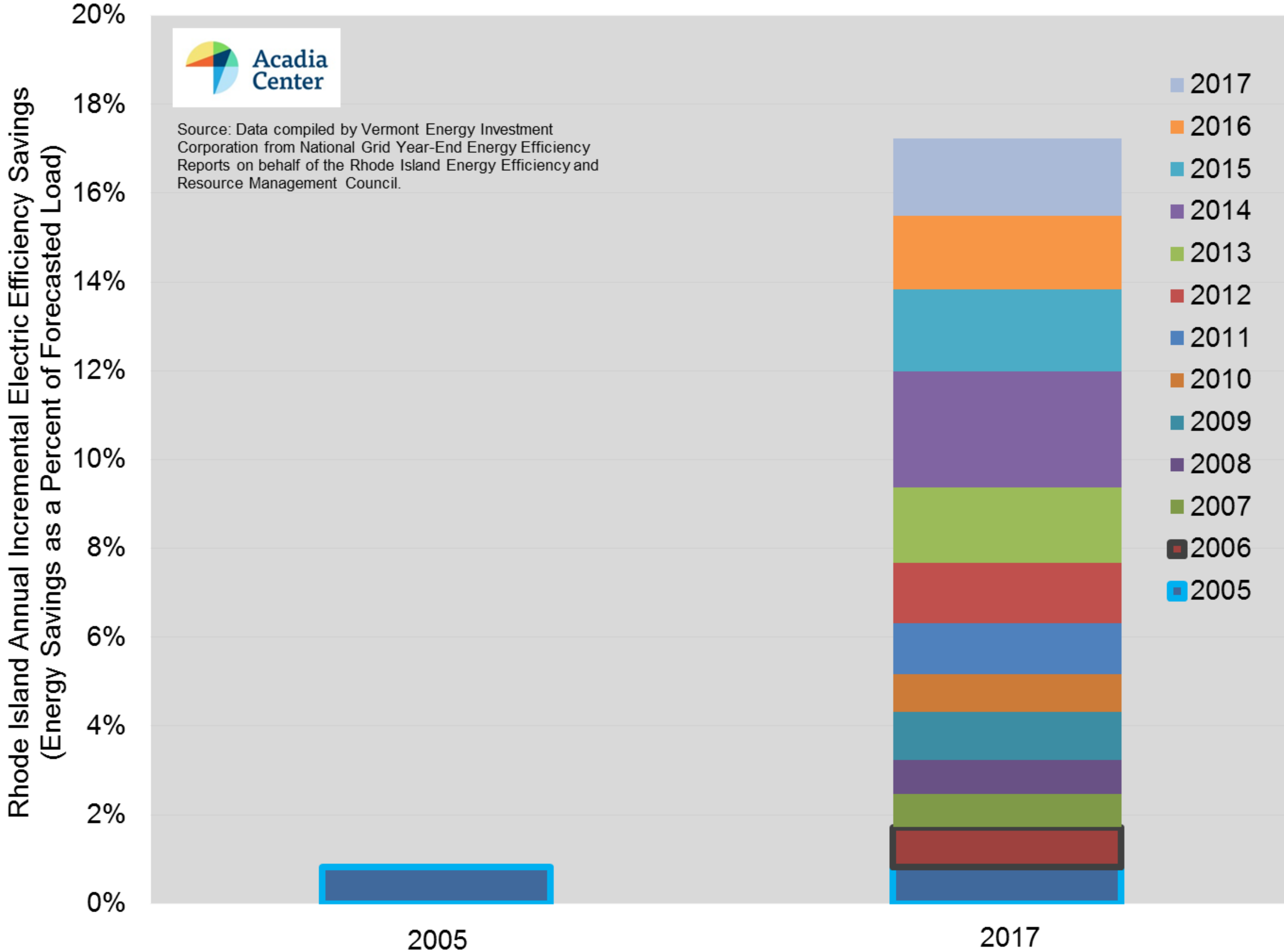
Energy efficiency investments have deffered $416 Million of transmission investment in Vermont and New Hampshire

Source: ISO-NE Data


Acadia Center
Source: Data compiled by Vermont Energy Investment Corporation from National Grid Year-End Energy Efficiency Reports on behalf of the Rhode Island Energy Efficiency and Resource Management Council.
Rhode Island Annual Incremental Electric Efficiency Savings (Energy Savings as a Percent of Forecasted Load)
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
2005
2017
2017
2016
2015
2014
2013
2012
2011
2010
2009
2008
2007
2006
2005

Targeted EE, Demand Response and Solar as a Viable Non-Wires Alternatives

- What Are They?
  - Efficient resources such as targeted energy efficiency, demand response, and distributed generation
  - Employed in an attempt to reduce or shift load resulting in deferral of a distribution or transmission investment
  - May be customer or utility owned but usually require collaboration


Courtesy: Tim Roughan, National Grid

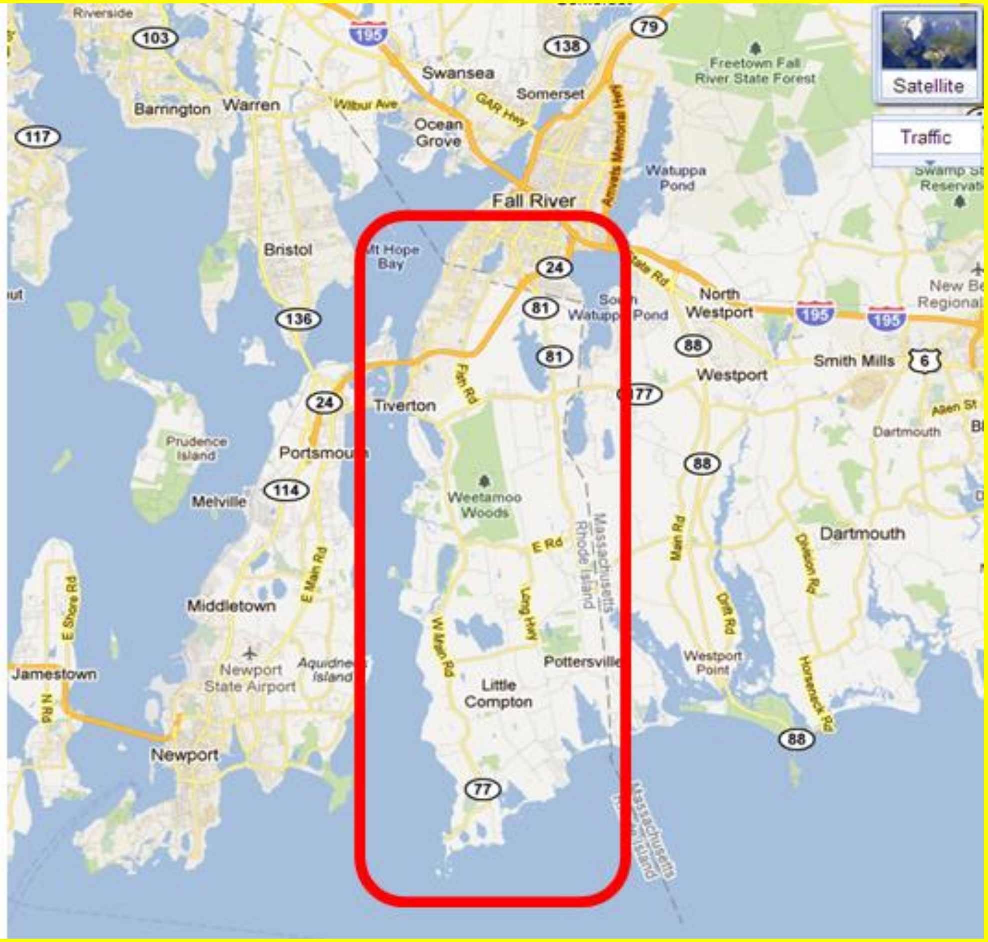
Maintaining System Reliability While Meeting Growing Electric Demands

- Least Cost Procurement Law - 2006
  - Intended to reduce the cost of energy by:
    - Increase stability through resource diversification
    - Provide for all cost effective energy efficiency
    - Integrate renewables
    - Increase accountability in planning and administration
  - Requires the development of Standards for Energy Efficiency and System Reliability Procurement documents
    - Basis for 3-year EE plans
    - Approved in 2009
    - Updated in 2011

Courtesy: Tim Roughan, National Grid

First SRP Pilot Project: Demand Link

- Two Feeders out of Tiverton substation serving Tiverton & Little Compton
  - Forecasted to be overloaded starting in 2014
  - Potential for ~5,600 affected Customers: 80% Residential, 20% C&I
  - Wires solution – substation upgrade – would have cost $2.9 million in 2014
  - Non-wires Goal: provide load relief starting in 2014, up to 1MW by 2017



Courtesy: Tim Roughan, National Grid

Pilot Design – A Collaborative Approach

- Project plan includes SRP and EE components
  - New technology, enhanced incentives, marketing and evaluation through SRP funding
  - Measures delivered through Energy*Wise* and Small Business Direct Install, the RI single family, residential and small commercial business audit programs
  - Demand response events conducted through SRP funding
- Benefit/cost analysis uses the Total Resource Cost model
  - Uses same avoided costs as the statewide programs
    - Added benefits associated with the DR events
    - Regional T&D deferral benefit is replaced with specific T&D deferral benefit as calculated as a revenue requirement for deferral years 2014 through 2017
    - Until enough actual load relief seen during peak load conditions, can not claim victory
  - Associated benefits/costs of the leveraged EE components included in BC but not claimed by SRP
  - Pilot must be cost effective over full six-year life, not in each year

Courtesy: Tim Roughan, National Grid

Demand Reduction Technologies and Methods

- 2012 Components
  - Wi-fi Thermostats for Central AC Units
  - Enhanced Promotion for EE Audits
  - DR Lighting Ballast (Commercial Only)
- 2013 Enhancements
  - Wi-fi Thermostats and Smart Plugs for Window AC Units
  - Energy Star Window AC Purchase Rebates
  - AC Unit Recycle Rebates
  - Increased Direct Marketing
  - Community Event

2014 Demand Reduction Implementation

- Continue existing portfolio of products and incentives with two enhancements:
  - Install standard LED light bulbs instead of CFLs (increases savings)
  - Enhanced load control device for larger window AC units (increases eligible customer pool)
- Introduce additional recruitment messaging
  - Add focus on community sustainability
  - Increase customer understanding of Pilot goals
  - Also continue using “save money save energy” message
  - Focus on reaching business owners/decision-makers
- Increase focus on participant communications
  - Prepare participants for DR events in 2014
  - Maximize participation per customer
  - Increase participant understanding of Pilot components, expectations and goals
- Conduct Demand Response events as necessary throughout the year

Demand Reduction Portfolio of Products Can Include Solar

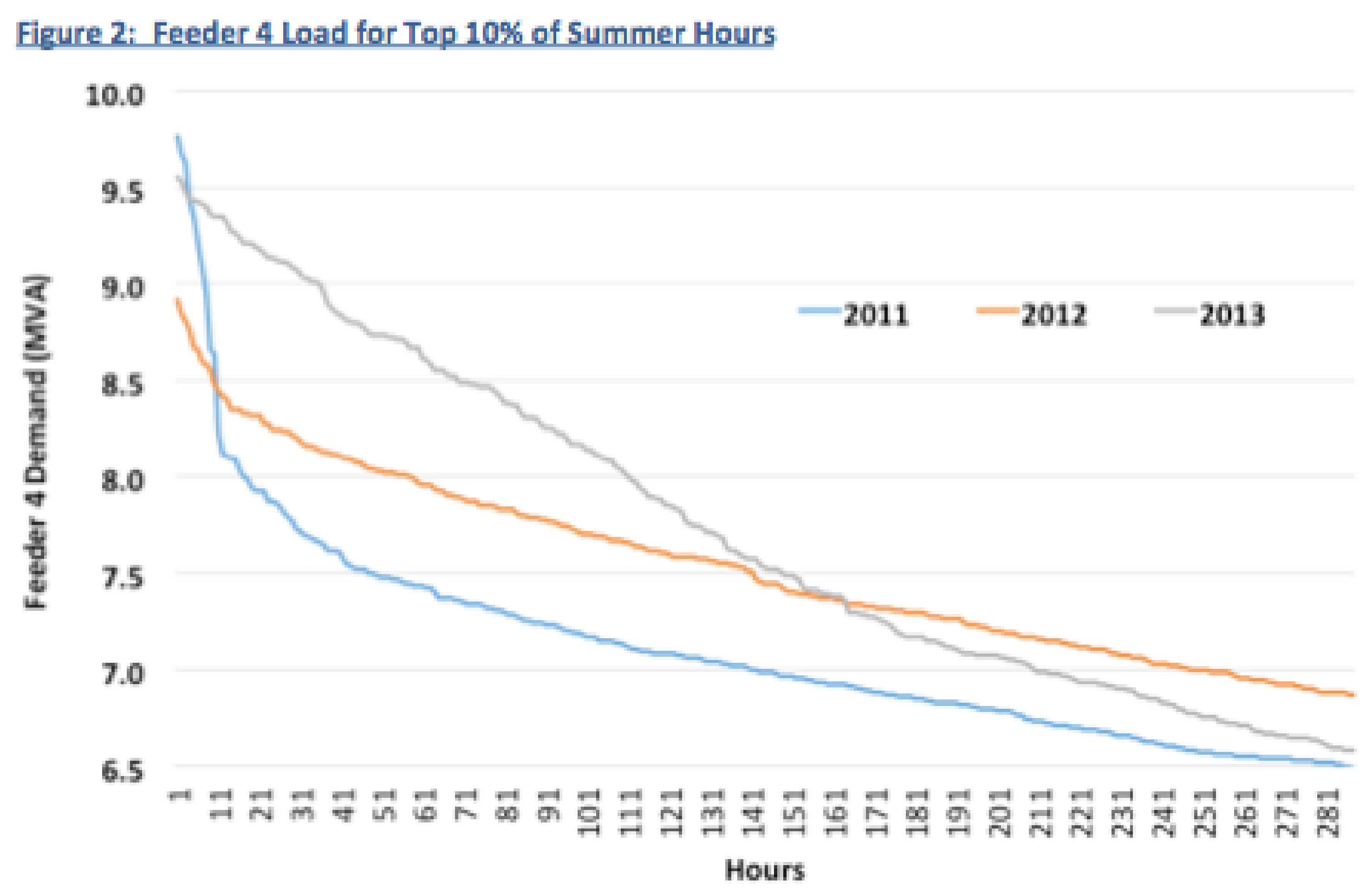
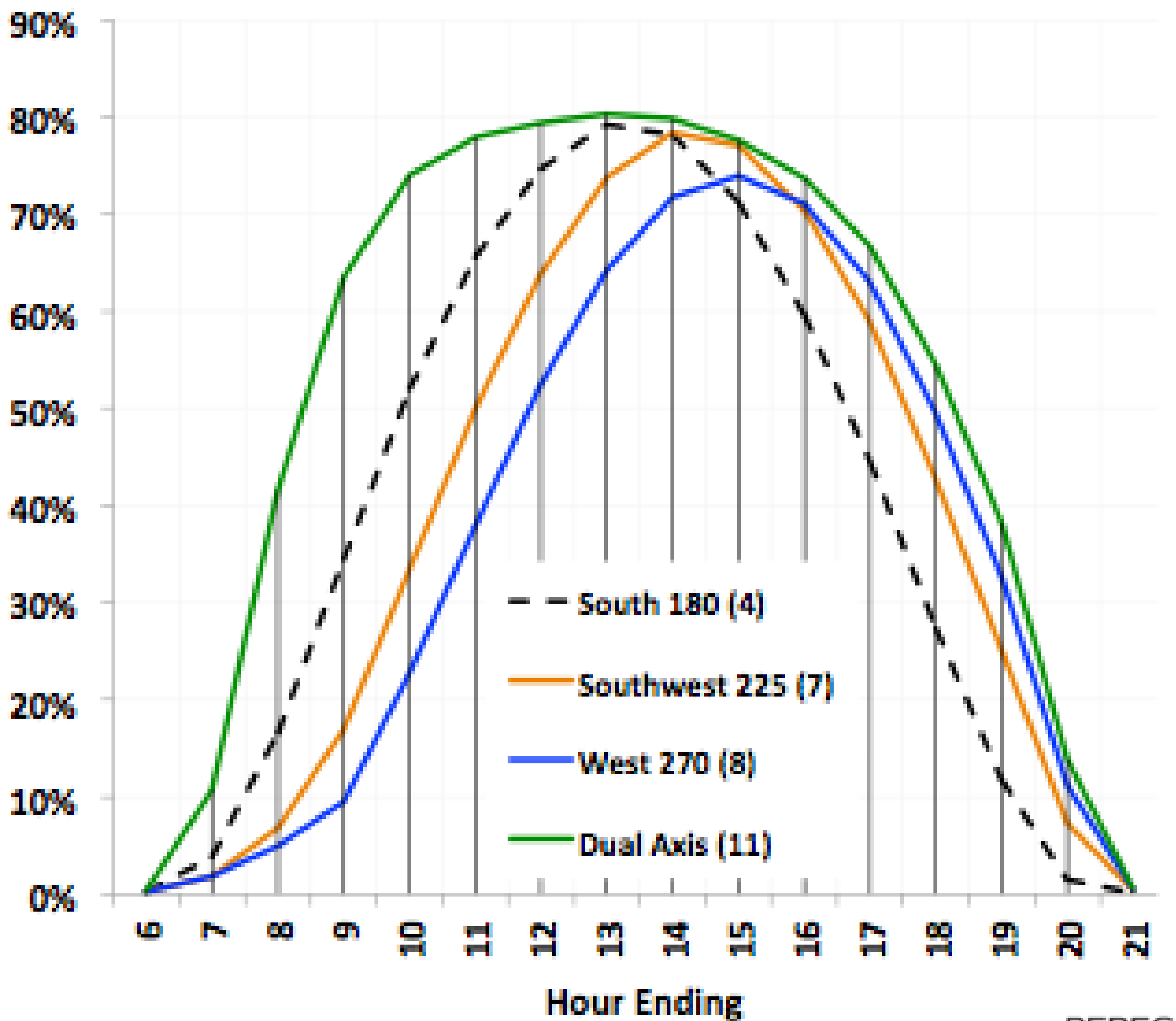


Figure 4: Output of Solar Configurations on July 22, 2011



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Granular Analysis of System Components Relative to Peak Demand

- Energy and Capacity Value of Distributed Generation Depends on Load Profiles, Meteorological Data, Deployment location, and Technology Configuration
- Reality Check: Is it Cost-Effective and are there countervailing reliability risks??

2011 2012

Figure 10: Energy and Capacity Parameters for PV in Pilot Area

	Energy Savings					Capacity Savings				
	Gross Annual kWh	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %	Summer Coincident (%)	Winter Coincident (%)	Annual Median (%)	Trans. Coincident (%)	Distribution Coincident DCP-N (%)
1 Flat	1,240	36.5%	18.9%	30.7%	13.9%	40.2%	2.3%	24.3%	37.3%	34.4%
4 South 180	1,463	40.2%	20.8%	27.0%	12.1%	42.6%	3.0%	24.4%	34.4%	26.1%
7 SW 225	1,371	39.4%	20.1%	27.9%	12.5%	51.4%	4.4%	33.7%	49.6%	47.7%
8 West 270	1,154	37.0%	18.8%	30.4%	13.8%	54.3%	4.7%	34.7%	54.8%	55.4%
9 1-Axis	1,805	39.6%	21.0%	27.0%	12.5%	57.6%	4.9%	36.6%	57.7%	57.9%
11 2-Axis	1,841	39.5%	20.9%	27.0%	12.6%	59.0%	5.0%	38.4%	60.1%	61.2%

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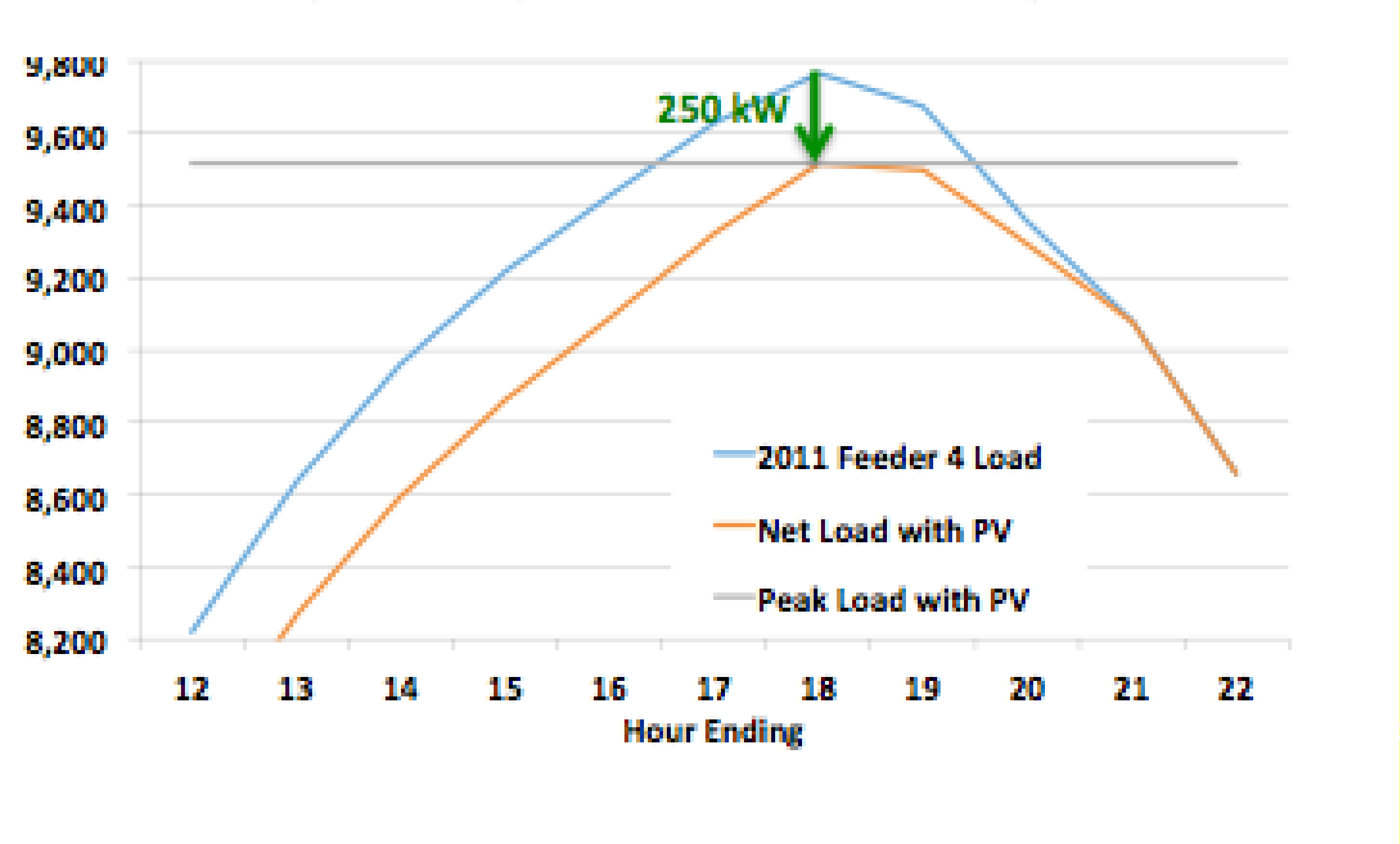
Maximize Planned Investments of Solar to Achieve More Efficient Outcomes



QUESTIONS?