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Benefits and Costs of Energy Efficiency

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Topics

- Benefits of Energy Efficiency
- Screening Programs for Cost-Effectiveness
- Integrating Energy Efficiency into utility portfolio as a resource option

Demographics and Electric System

OVERVIEW OF VERMONT

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Vermont Characteristics

- Small, rural state
  - 9,250 square miles (24,000 square km)
  - 625,000 people
- Employment base includes dairy farming, maple syrup production, timber, skiing, solar
  - Manufacturing small, in slow decline

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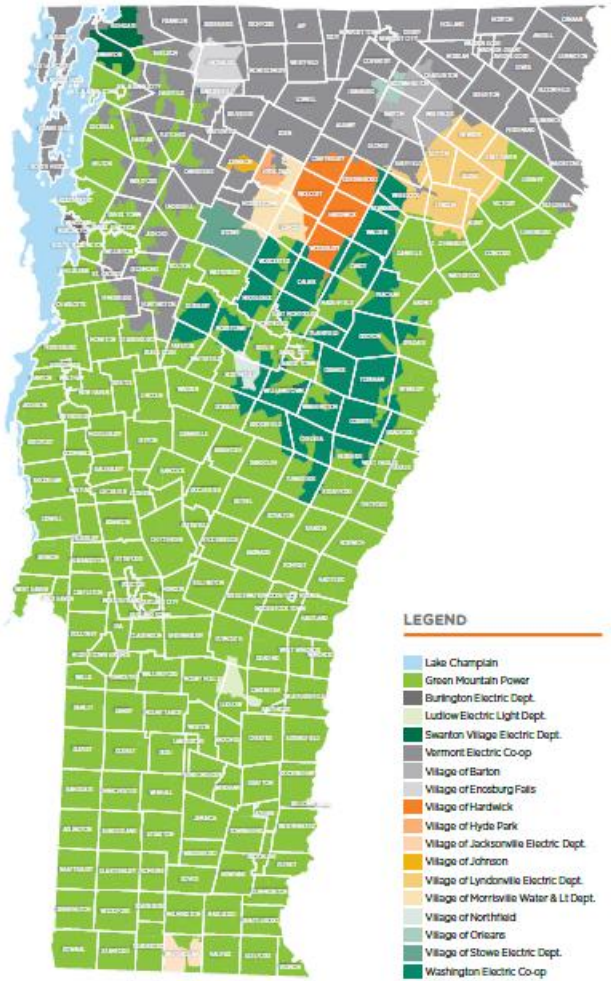
Electricity Delivery

- 17 Distribution Utilities
  - 1 Investor Owned
  - 2 Cooperatives
  - 14 Municipals
- 1 Transmission Utility owned by distribution utilities
- Vertically Integrated while rest of New England has divested
- Participates in ISO-NE competitive wholesale markets



Energy Efficiency Delivery

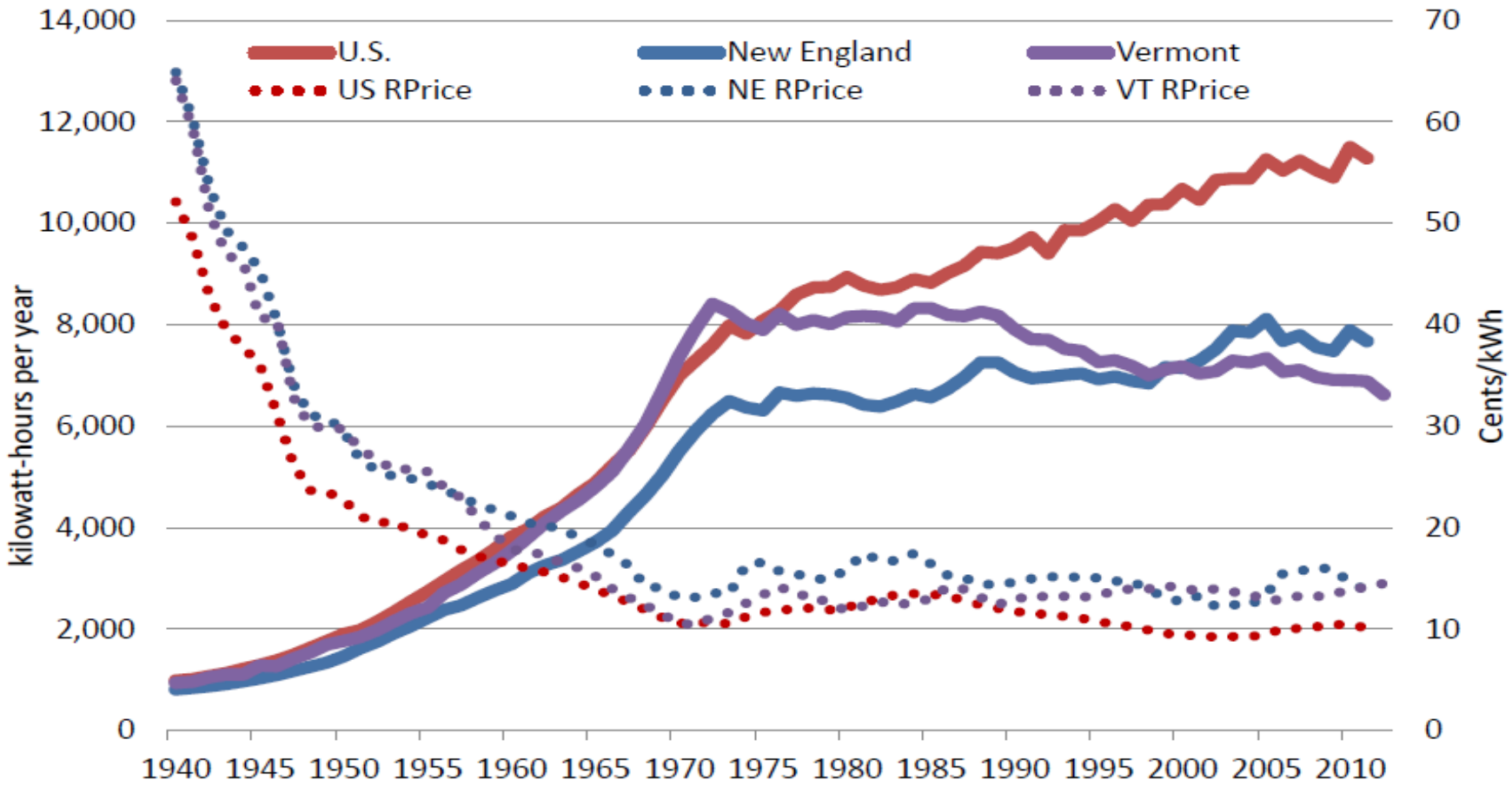
- Three “Energy Efficiency Utilities”
  - Efficiency Vermont
    - Statewide
    - Electric and some non-gas Thermal Fuels
  - Burlington Electric Department
    - Delivery in state’s largest municipality
    - Electric and some Thermal Fuels
  - Vermont Gas Systems
    - Natural Gas

Electricity Consumption

- 2013 peak ~1025 MW
- Average consumption ~7,000kWh/yr
- Northeast Electric Rates are some of highest in U.S.
  - Vermont maintains some of the lower rates in New England
  - **Average monthly bills are lower due, in part, to aggressive energy efficiency policies**

Average Retail Price Electricity - Residential		
1	Hawaii	37.81
2	Alaska	20.43
3	Connecticut	19.67
4	New York	19.49
5	Rhode Island	18.38
6	California	18.12
7	Vermont	17.87
8	Massachusetts	17.69
9	New Hampshire	17.18

Residential Rates and Consumption



Vermont Regulatory Structure

VERMONT
PUBLIC SERVICE BOARD

- Independent state agency modeled on a court
  - Not part of the State Elected Legislature
  - Not part of Governor's Administration
- Quasi-judicial
  - Supervises rates, quality of service, overall management of utilities

VERMONT
DEPARTMENT OF PUBLIC SERVICE

- Public "Ratepayer" Advocate
- Planning, Consumer Affairs
- Part of Administration

General Electric Ratesetting

- Legal Standards
  - Just and Reasonable Rates
  - Balance ratepayer and shareholder interests
  - End result that matters, not specific methodology
- Utility opportunity to recover “prudent” and “used-and-useful” costs of providing service to ratepayers, including reasonable return
- Basic principle – Does it provide benefit to ratepayers?

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BENEFITS AND COSTS OF ENERGY EFFICIENCY

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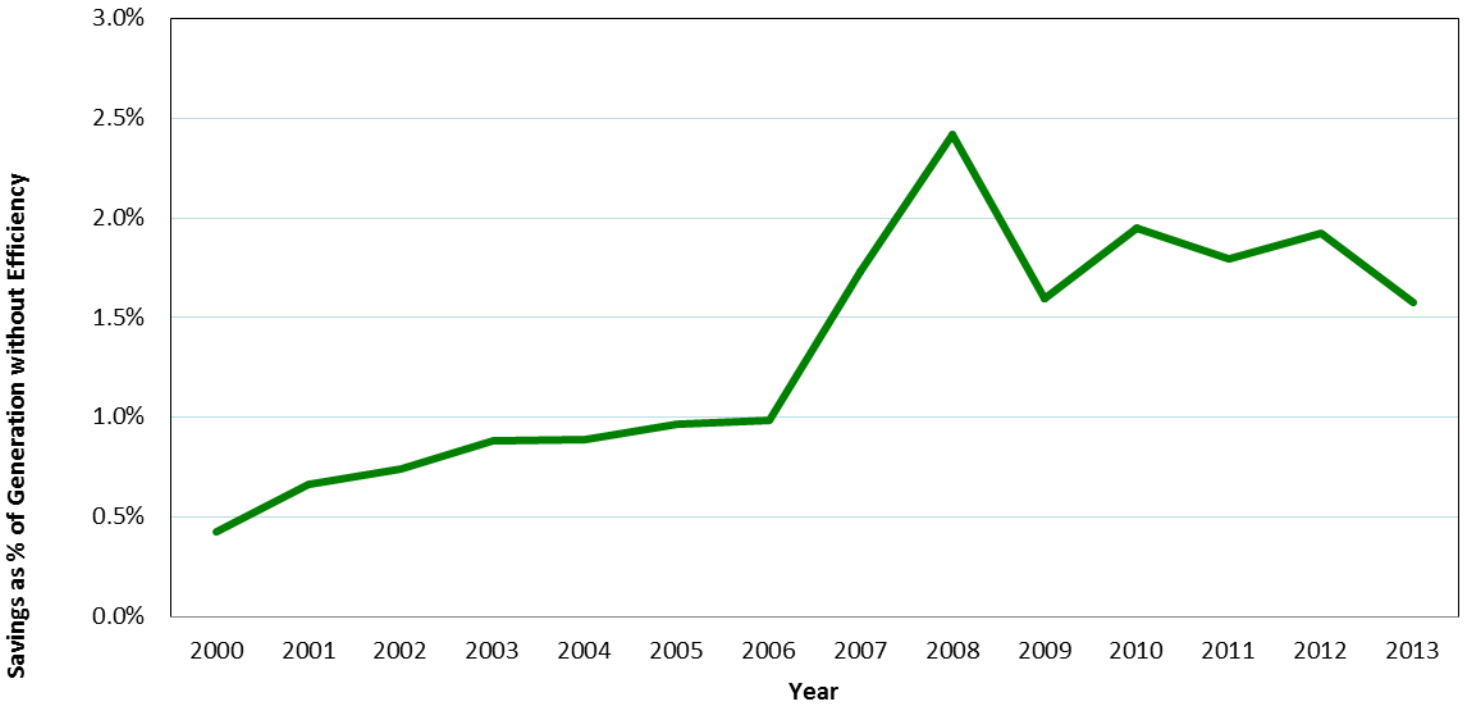
Demand Side Management – "DSM" is often used to refer to a number of different techniques to manage load

Energy Efficiency	• Selecting equipment that will perform the same work with less energy input
Demand Response	• Customers agree to respond to utility requests to reduce use during times of utility peak demand or high prices
Load Management & Conservation	• Encouraging customers to shift loads away from peak and high cost times via rate design, direct load control, or other measures

Efficiency Vermont Historic Annual EE Savings as % of VT Annual Energy Consumption



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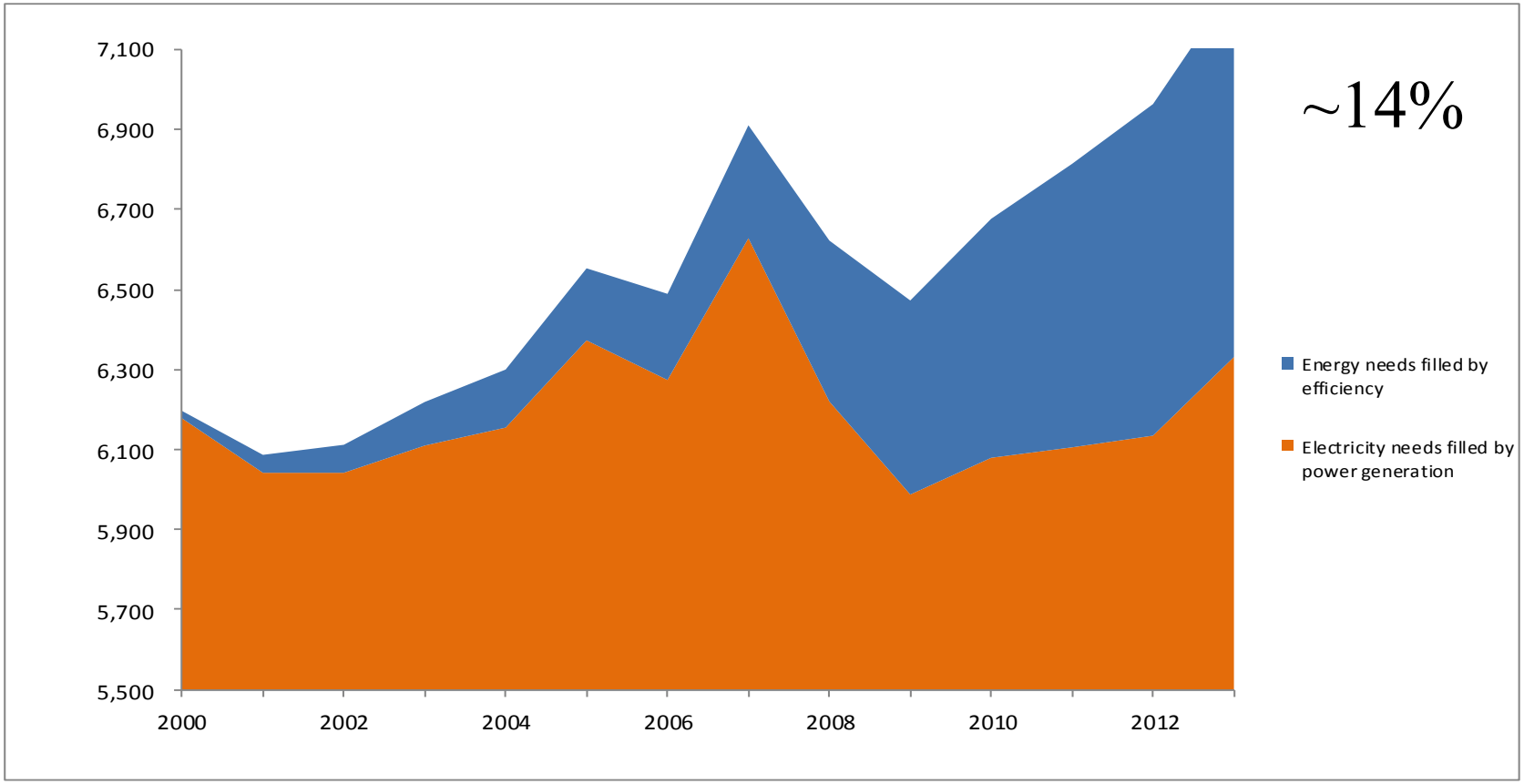
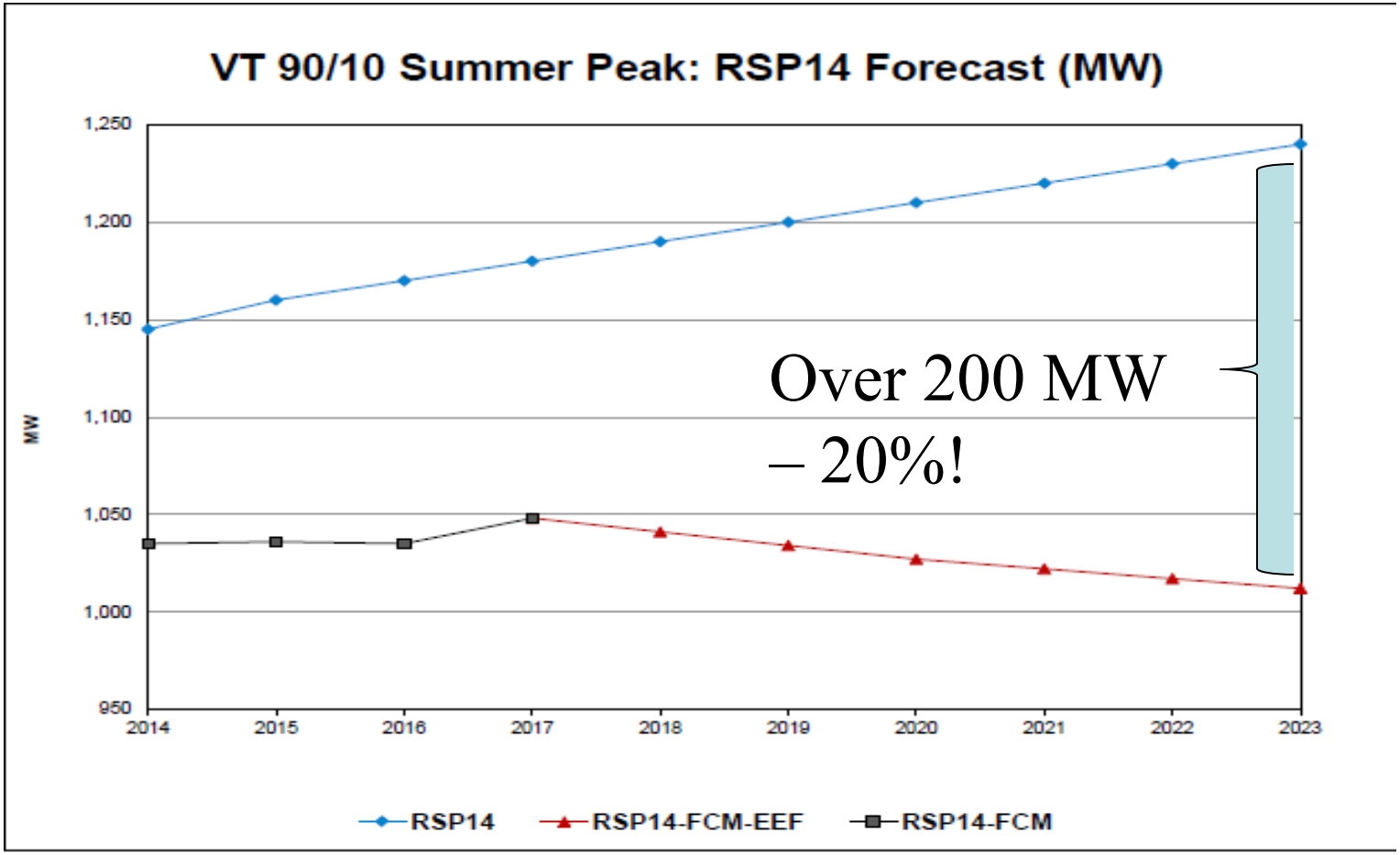
Cumulative Impact of Efficiency on Growth in Vermont Annual Electricity Supply Requirements

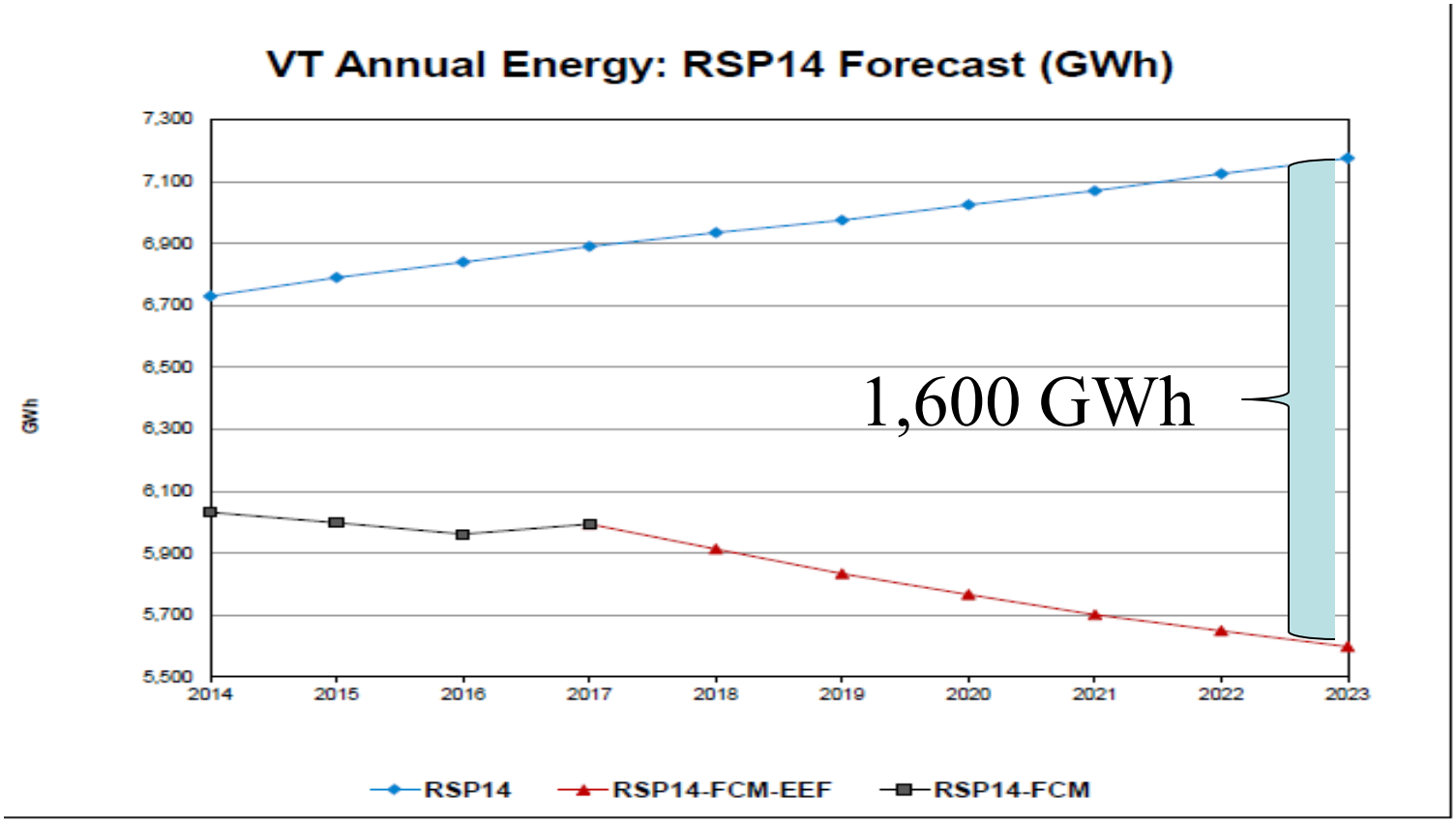


Vermont EE Forecast Peak Demand Impacts



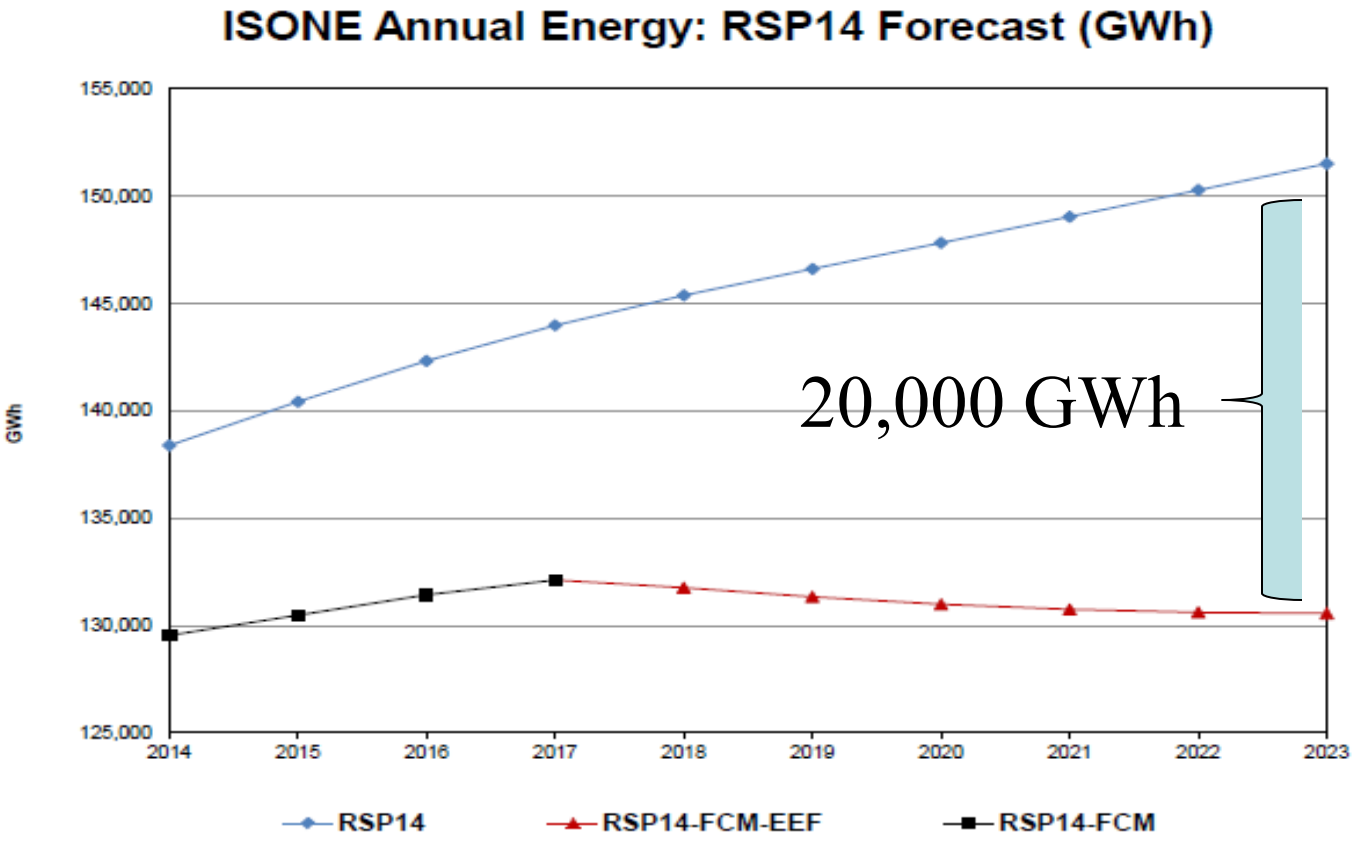
ISO-NE 2014 Final Energy Efficiency Forecast

Vermont EE Forecast Annual Energy Requirements



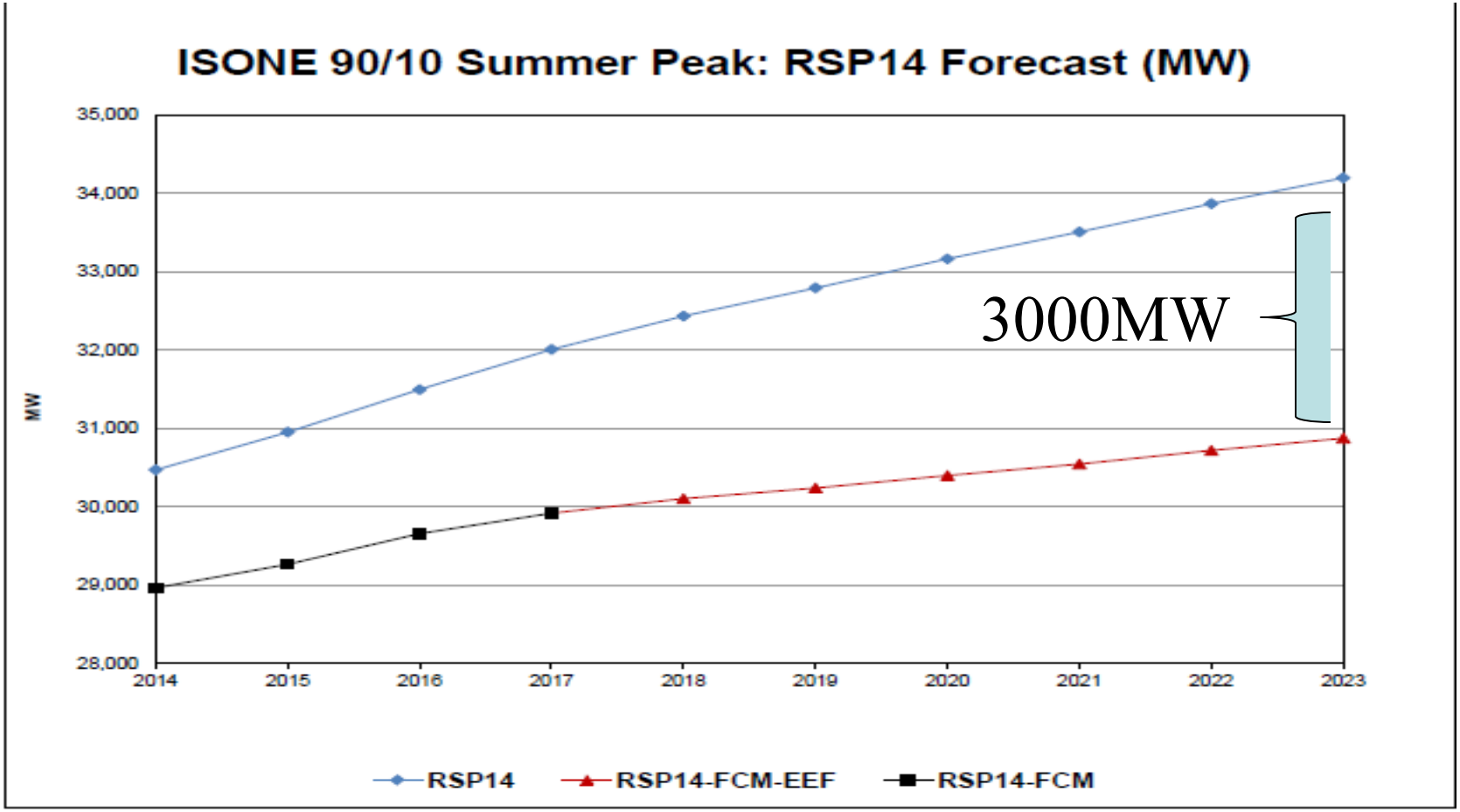
ISO-NE 2014 Final Energy Efficiency Forecast

EE Impacts on New England Energy Consumption



ISO-NE 2014 Final Energy Efficiency Forecast

Impacts of Energy Efficiency on New England Peak



ISO-NE 2014 Final Energy Efficiency Forecast

Potential Benefits/Costs of Energy Efficiency

Benefits

- Avoided Energy Costs (including losses)
- Avoided Capacity Costs
- Avoided Transmission and Distribution Infrastructure Costs
- Market Price Suppression Effects
- Avoided Cost of Compliance with Other regulations
- Non-energy Benefits
  - Participant
  - Utility
  - Societal

Costs

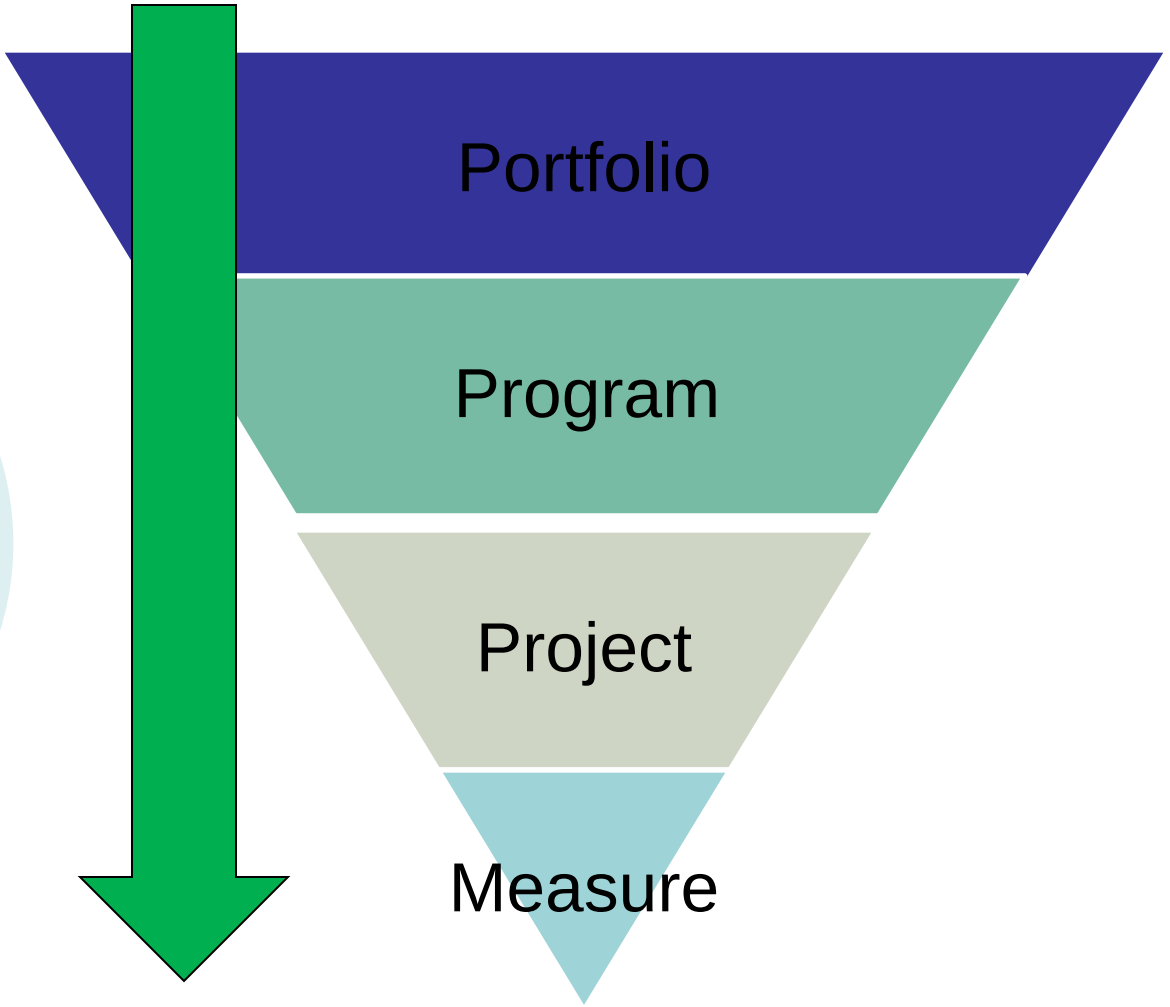
- Program Administrator Costs
- Participant or Third Party Contributions

Choice of Benefits and Costs Depends on Perspective (can use more than one)

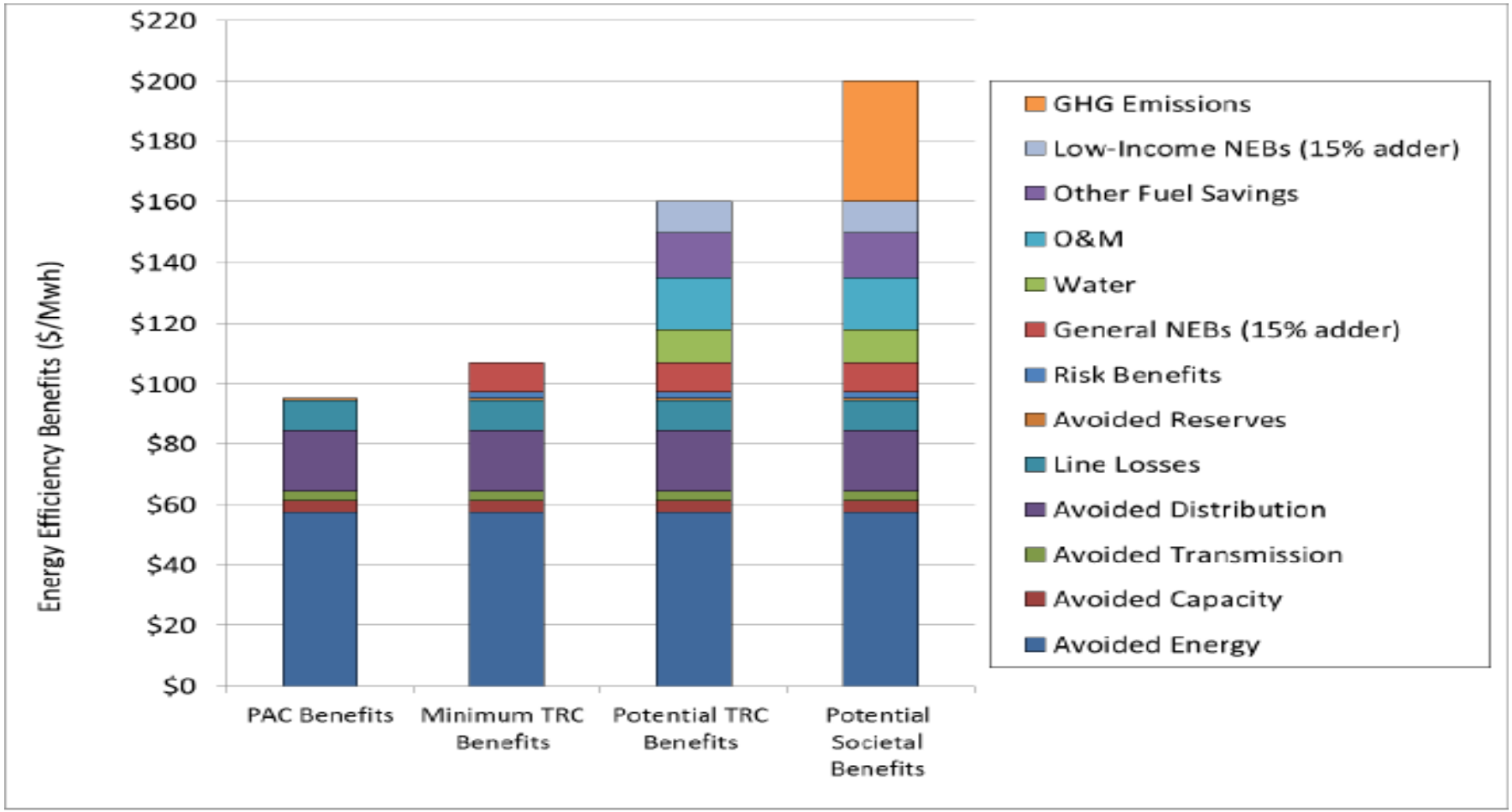
- Participant Test – b/c from perspective of program participant
- Program Administrator/Utility Test – b/c from perspective of program administrator
- Rate Impact test – b/c that affects rates (rarely used)
- Total Resource Cost Test – b/c associated with all customers, including program participants and non-participants
- Societal Cost Test – All members of society

Most states use TRC test as *primary* test for screening

Screening Hierarchy



Efficiency Vermont Portfolio Impacts (2010)



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Benefits far outweigh the costs

- Those $200/MWh of benefits in 2010 came at a cost of $40/MWh
- In 2013, benefits increased while costs remained at $42/MWh
- Even non-participants secure system-wide benefits

* Program Administrator Costs. Participant costs were negative due to large O&M savings, those savings were reflected in previous slide

Considerations for Screening DSM

- Clarify Objective of Energy Efficiency Screening
  - To identify those EE resources that are in the public interest
- Some policy goals are difficult to, or cannot be monetized
  - Emissions reductions
  - Avoiding lost opportunities
  - Maintaining efficient delivery of programs
  - Customer satisfaction with programs

Vermont's EE Policy Objectives

Energy Efficiency Resources should be treated considered equally with generation, transmission, or distribution resource.

- Resource Acquisition (traditionally primary)
- Market transformation
- Equity Considerations
  - Customer class
  - Geographic Region
- Achieve maximum societal net benefits (shifting to primary)
- Comprehensive treatment of customers
- Effective capturing of "lost opportunities"

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INCORPORATING EE INTO RESOURCE PLANNING ANALYSES

Incorporating EE into Resource Analysis

- Required in many states including Vermont as part of "least cost planning" (doesn't always happen in practice)
- Two examples of where this analysis occurred in Vermont
  - Central Vermont Transmission Constraint
  - St. Albans area distribution reliability constraint

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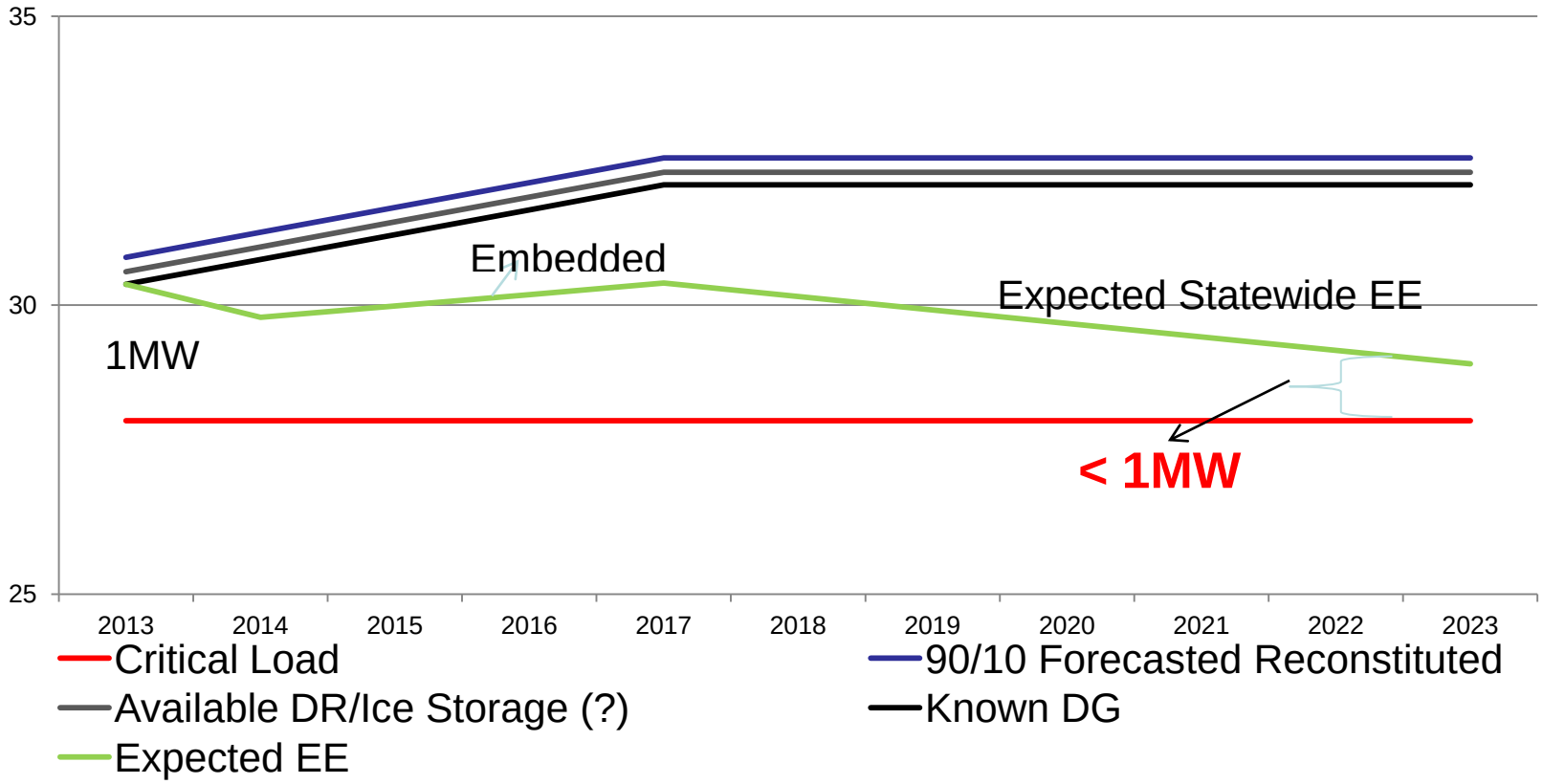
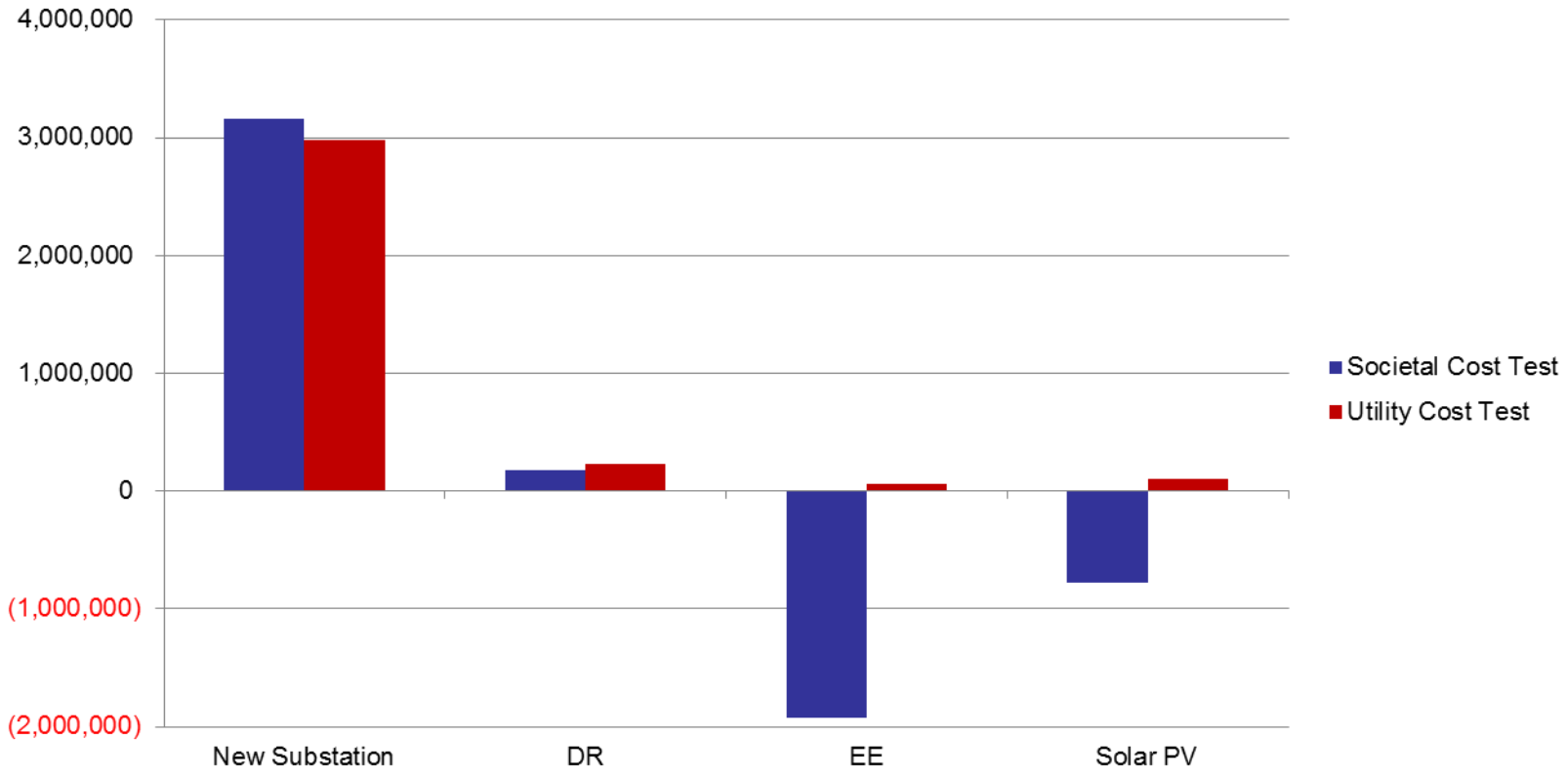
V.S.P.C
Vermont System Planning Committee

- Created after findings that $200 million transmission project could have been avoided if sufficient planning had been completed.
- Mission to ensure “full, fair, and timely consideration of alternatives”
- Utilities, Advocates, Public Stakeholders, Regulators
- EE often first option

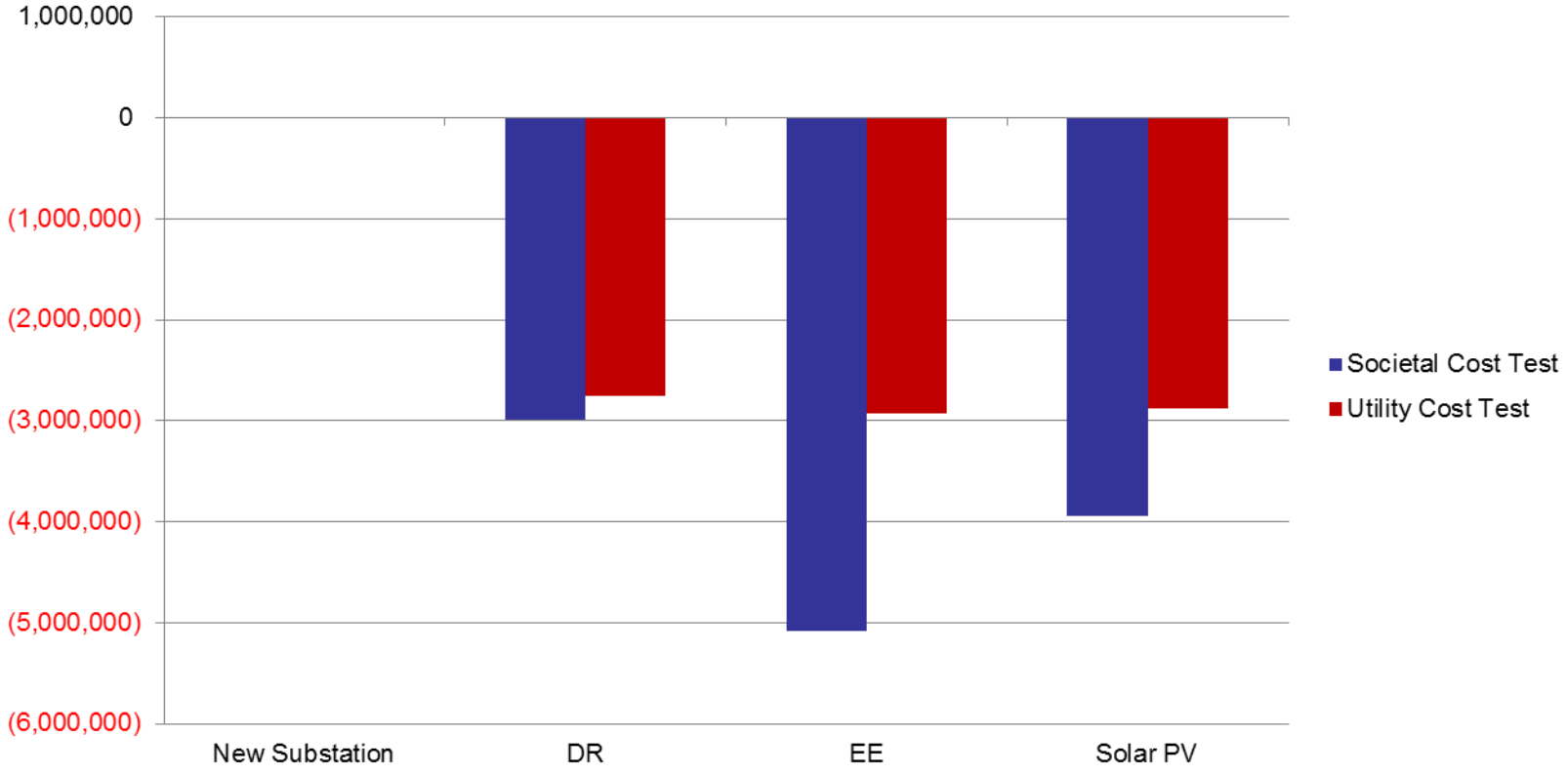
St. Albans Reliability Constraint



St. Albans NPV Costs of Resources



St. Albans Deferral Benefit Relative to Substation upgrade



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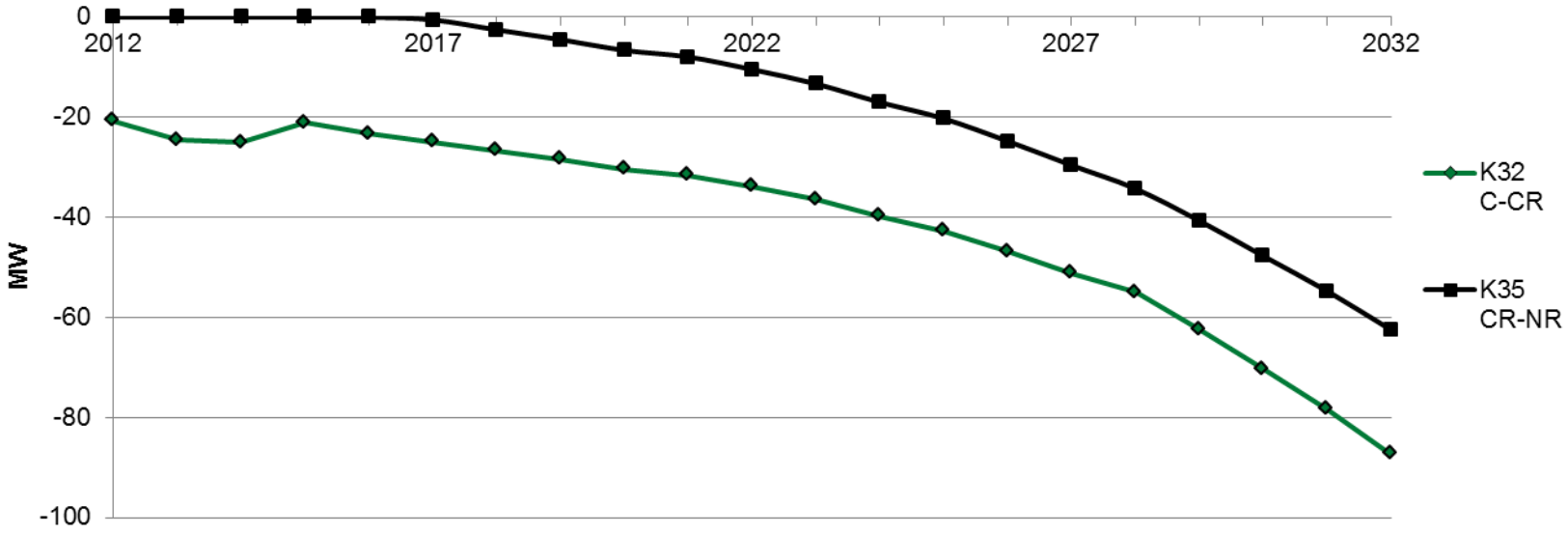
Results

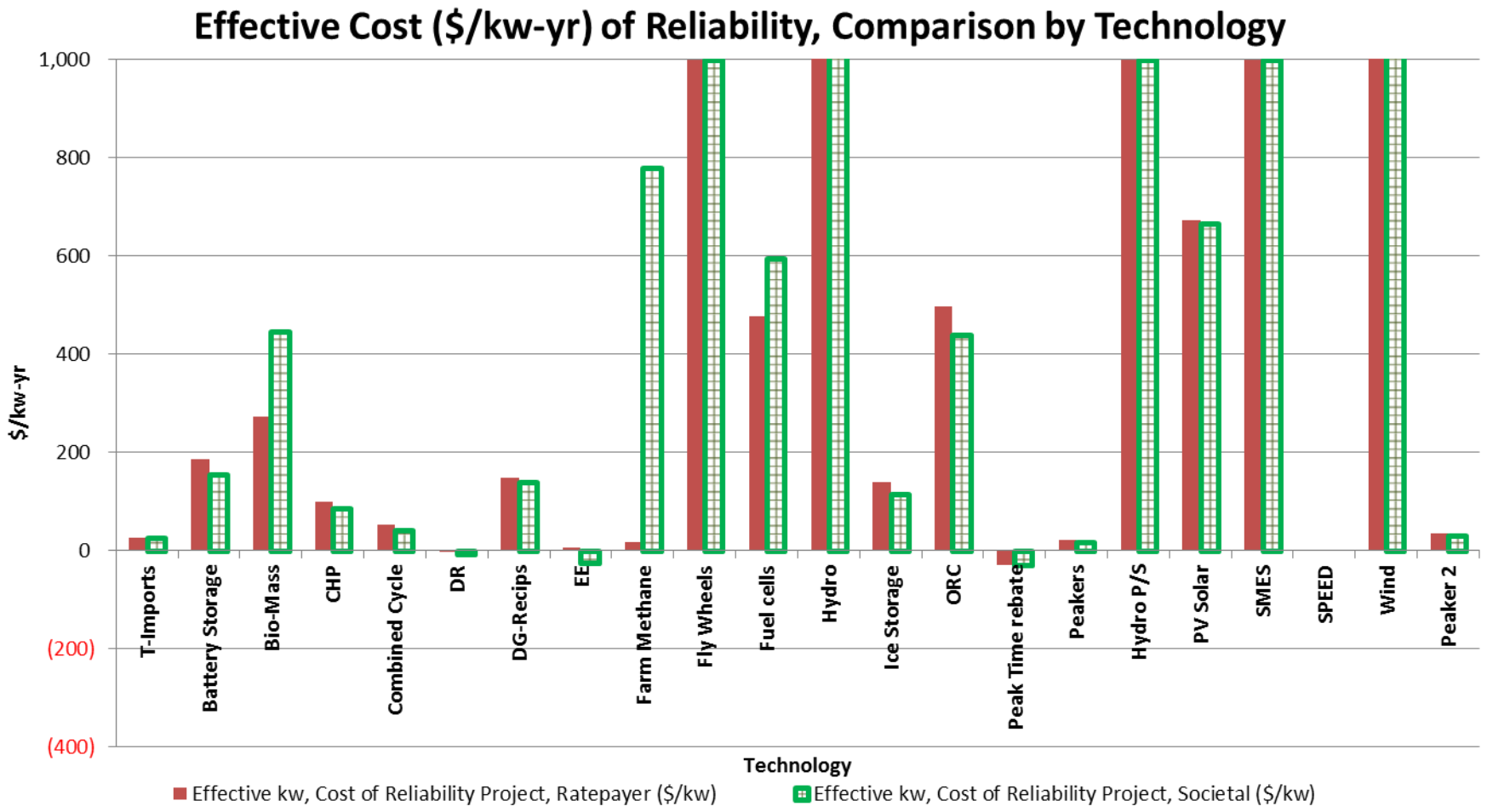
- Decisions with regard to infrastructure investment must be made amid a great deal of uncertainty
- Chose to target Energy Efficiency instead of build
- Combination of acquired savings, less new customers than predicted – no new substation needed
- St. Albans is an example that cost-effective EE can be targeted to allow more informed decisions
- “No Regrets” strategy

Applicable to a larger constraint? Central Vermont Transmission Upgrade

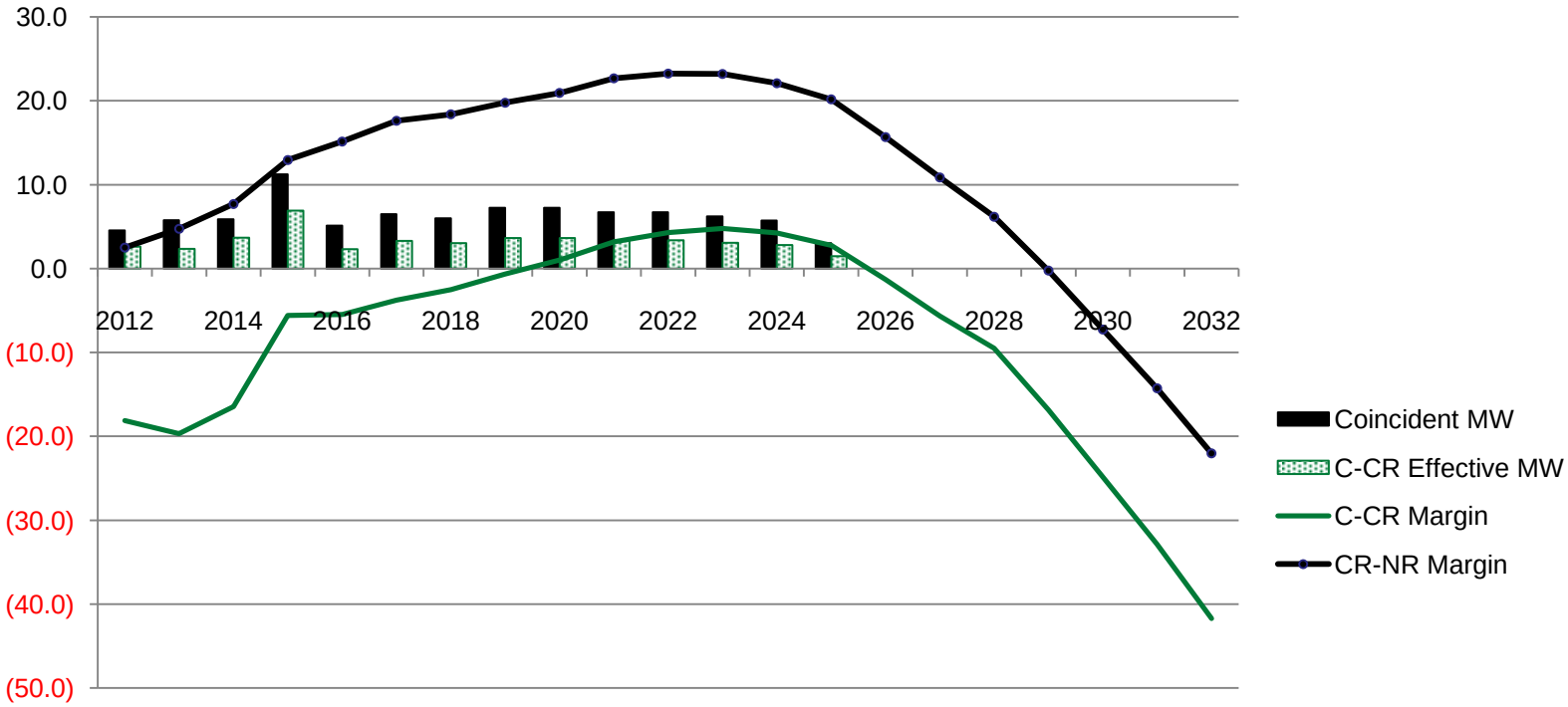


- Reliability Gap graphed as a negative margin – MW under zero are the necessary solutions

Net Cost Comparison of Resources



When EE and expected PV resources applied to gap, transmission upgrade no longer necessary



Summary

- Amount of DSM Benefits depends on how you count, but are substantial in all cases.
- Avoided Energy and Capacity Costs are only part of the equation.
- EE can be used as a tool to be deployed similar to and in combination with any other resources. It is almost always cheaper than other options.

Questions