Advancing Evaluation of Efficiency - in the Industry and the Region

May 8, 2018 – Nashua, NH

This breakfast is sponsored by:

E4 THE FUTURE

ENERGY • ECONOMY • EQUITY • ENVIRONMENT

Welcome & Overview

Elizabeth Titus, NEEP
Miles Ingram, Eversource

About NEEP

A Regional Energy Efficiency Organization

One of six REEOs funded in-part by U.S. DOE to support state and local efficiency policies and programs.

Northeast Energy Efficiency Partnerships

"Assisting the Northeast & Mid-Atlantic Region in Reducing Total Carbon Emissions 80% by 2050"

Mission

Accelerate energy efficiency as an essential part of demand-side solutions that enable a sustainable regional energy system

Vision

That the region embraces next generation energy efficiency as a core strategy to meet energy needs in a carbon-constrained world

Approach

Overcome barriers and transform markets through *Collaboration, Education, and Enterprise*

Housekeeping
and Thank You Event Sponsors

- Room logistics & silence cell phones
- Note the handouts in your folders
- Before you leave: Please complete the evaluation form – return it to NEEP table

Meeting Objective

DIVERSE TOPICS - 3 “T’s”:

- Trends
- Tools
- Technologies

GOAL FOR TODAY

Discuss opportunities and challenges for evaluation in the industry and our region

- What evaluation needs does the industry face?
- Where can collaboration help?
- How can evaluation, research and our experience help
  - Position EE in the context of DER
  - Enhance credibility and best practices

Today's Agenda

1. Overview
2. Avoided Costs in New England
3. Integrating EE with Other Resources
4. Emerging Technology: Controls

   LUNCH

5. Cost-Effectiveness and Non-energy impacts
6. Technical Reference Manuals
7. Closing Reflections

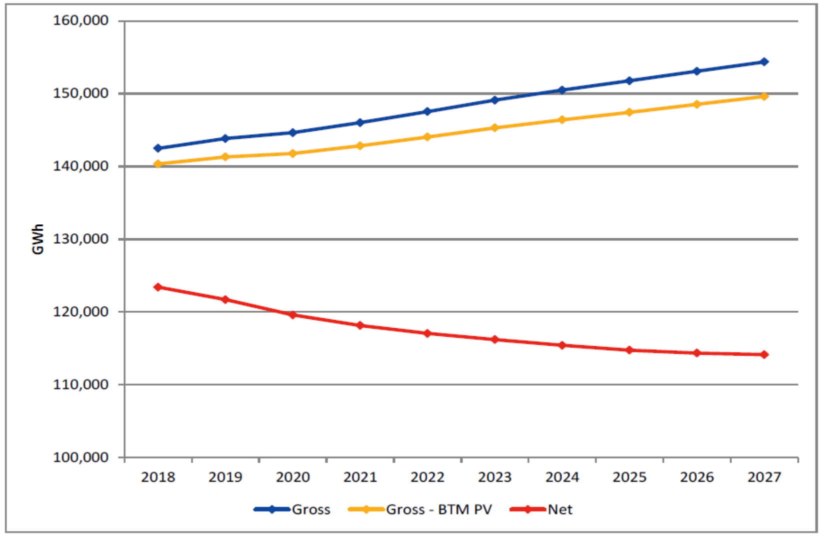
Advancing EM&V in a Changing Efficiency Landscape

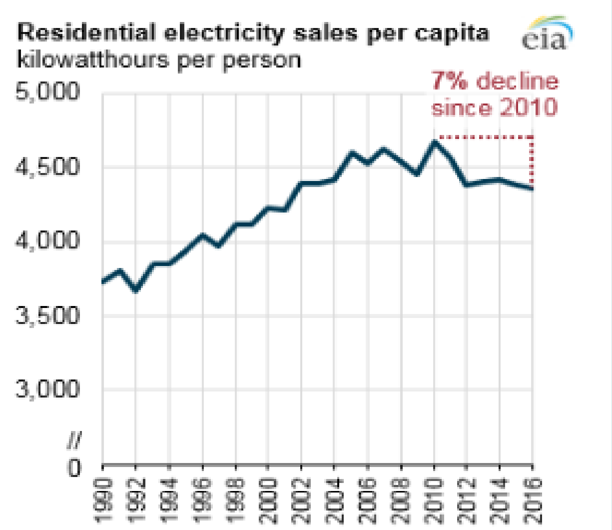
Miles Ingram, Eversource
NEEP EM&V Annual Public Meeting
May 8, 2018

The Big Picture: Success So Far

EVERSOURCE ENERGY

Draft 2018 CELT ISO-NE Energy Forecast





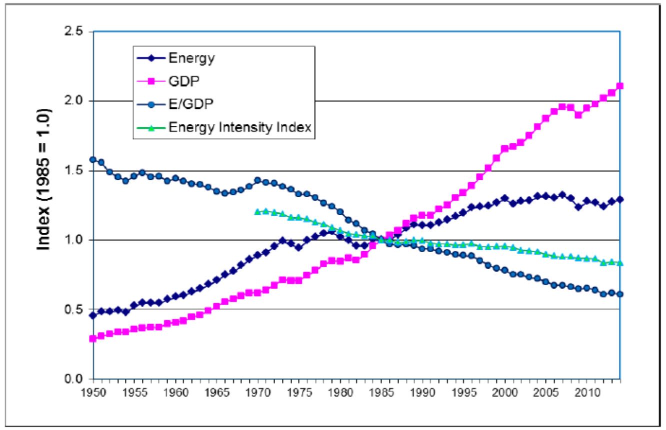
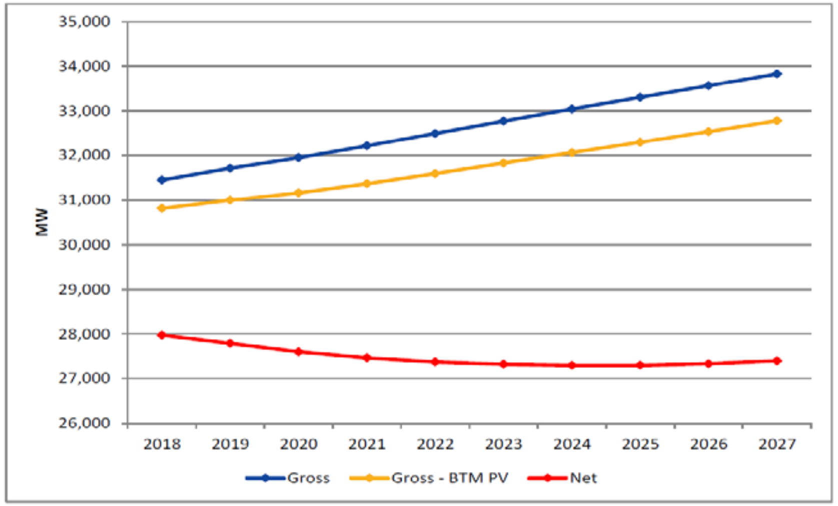


Figure S.1. Economy-wide indexes of energy intensity, economic activity, and energy use

Pacific Northwest NATIONAL LABORATORY

Draft 2018 CELT ISONE 90/10 Summer Peak Forecast




CHANGE
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CHANGE

Changes Facing Energy Efficiency Programs

- **Shifting portfolios**
  - ↓ Deemed, steady-state savings (e.g., lighting)
    Easier to predict, easier to measure
  - ↑ Behavior-based, intermittent savings (e.g., integrated controls, peak load mgmt)
    Harder to predict, harder to measure

- **New (for EE) technologies**
  - ↑ EVs/chargers, storage, demand response, energy management systems, etc.

- **Avoided costs**
  - ↓ Energy and capacity

What Do Changes Mean for EM&V Studies?

EVERSOURCE ENERGY

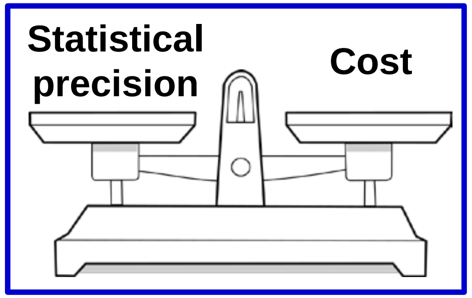
- **Shifting portfolios**
  - EM&V complexity (and costs?) may grow:
    - variance in savings for individual projects increases → sample sizes must increase to achieve desired precision and confidence levels

- **New (for EE) technologies**
  - How do we establish baselines?
  - How much will participant behavior change?

- **Avoided costs**
  - Shifting portfolios and new technologies → need more granular avoided costs for **when** (e.g., 8760 model) and **where** (e.g., distribution circuit) savings occur
  - Lower energy & capacity costs → greater need to quantify NEIs, so cost-effectiveness tests capture full value of measures

What Do Changes Mean for EM&V Stakeholders?

- **Programs may change, but EM&V must continue providing assurance to a range of stakeholders that savings are accurate**
  - TRMs → help provide transparency
  - NEI studies → must meet same high bar for rigor as studies of energy impacts
  - What's the cost of certainty?



- **Communication, collaboration, and mutual education are vital**
  - EM&V results should be objective and unambiguous, to minimize contention
  - Reports should be user-friendly for multiple audiences, without sacrificing rigor or important details → *small servings of alphabet soup and jargon salad*


nest
COOLING
75
78


TESLA


CHARGE
& DRIVE


72
ecobee

New England’s Avoided Energy Supply Cost (AESC) Study, 2018

Patrick Knight, Synapse Energy Economics

Highlights from AESC 2018

NEEP: Advancing Evaluation, Measurement, & Verification

May 8, 2018

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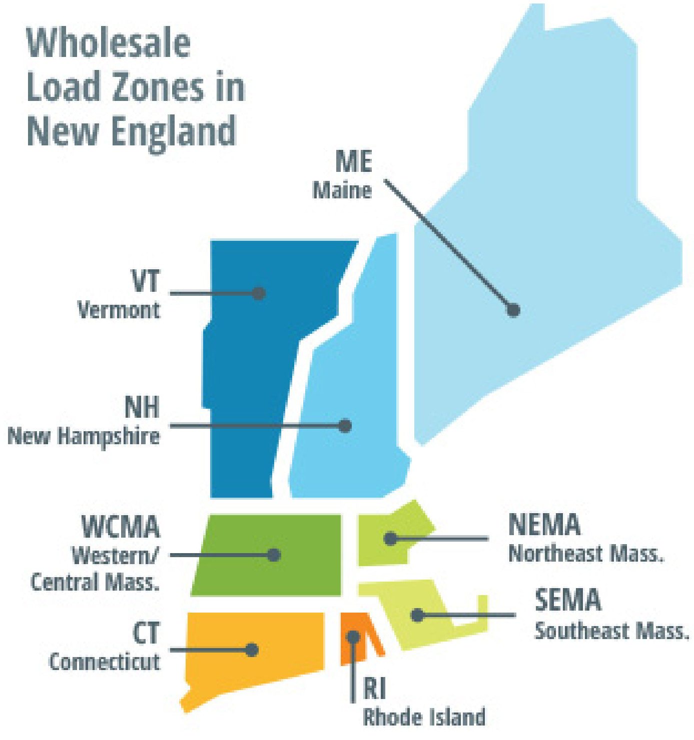
Pat Knight, Synapse Energy Economics

Synapse Energy Economics

- Founded in 1996 by CEO Bruce Biewald
- Leader for public interest and government clients in providing rigorous analysis of the electric power sector
- Staff of 30 includes experts in energy and environmental economics and environmental compliance

What is “AESC”?

- Avoided Energy Supply Components (AESC) Study
- Quantification of avoided costs for demand-side management measures for all six New England states
- DSM program administrators in all six states use the calculated avoided costs to screen future DSM measures
- Results provided for all six states (inc. subregions of CT and MA)
- Starting in 2015 study performed every three years
- Project conducted from October through March; 2018 study released on March 30th



Source: ISO New England

Collaborating on AESC

Study Sponsors

- Berkshire Gas Company
- Cape Light Compact
- Liberty Utilities
- National Grid
- Eversource
- New Hampshire Electric Co-op
- Columbia Gas
- Unitil
- United Illuminating
- Southern Connecticut Gas
- Efficiency Maine
- The State of Vermont

Other Study Group Members

- CT DEEP
- CT EE Board
- MA EEAC
- MA DOER
- MA AG
- MA LEAN
- ENE
- CLF
- NH PUC
- RI DPUC
- RI EERMC
- VT DPS
- Many others!

Project Team

- Synapse Energy Economics
  (project management and coordination, electric system modeling, fuel oil, non-embedded env. costs, sensitivities, user interface)
- Resource Insight
  (capacity cost modeling, DRIPE, T&D, reliability)
- North Side Energy
  (retail avoided natural gas costs)
- Les Deman Consulting
  (long-term natural gas forecast)
- Sustainable Energy Advantage
  (renewable portfolio standard compliance)

What is being analyzed? And how?

- Modeling a future in which *no new* energy efficiency is added after 2018—this allows us to estimate the avoided cost of any marginal MWh
- Multi-step, integrated modeling process
- Involves spreadsheet models as well as EnCompass, a utility-grade electric-sector dispatch and capacity expansion model

List of avoided costs

- Wholesale and retail energy
- Wholesale and retail capacity
- Renewable energy credit (REC)
- DRIPE
- Non-embedded environmental
- Transmission and distribution
- Reliability
- Natural gas (non-electric)
- Fuel oil and other fuels (non-electric)

What's new in AESC 2018?

Two new chapters

- T&D—Avoided costs of PTF facilities based on review of utility literature
- Reliability—Value of lost load, impact on outages, impact on generation reliability

Updates to modeling data

- New information on fuel prices
- Up-to-date information on state policies (RPS, env. regulations, etc.)
- Revised methodologies of existing costs

Hourly modeled data

- Avoided energy costs produced at 8,760 level
- Users can apply hourly load shapes of DSM measures to a "User Interface" to estimate measure-specific avoided costs

Sensitivities

- High Load—Avoided costs in a future with build out of EVs and heat pumps
- Low Load—Can be used to estimate avoided costs for storage, demand response, or distributed PV

Main Findings: Electricity Avoided Costs

- Generally lower avoided costs when comparing with AESC 2015
  - Note that a number of states are currently using the AESC 2015 Update
- Main drivers:
  - Lower projected costs of natural gas & RGGI prices
  - Revised capacity methodology related to data from recent auctions and anticipated changes to demand, supply, and market rules
  - Revised DRIPE methodologies—changes to analytical approach and inputs, as well as new commodity forecasts
  - New inputs for REC markets related to changes state renewable procurement policies
  - New categories of avoided costs (T&D, value of reliability)

ES-Table 1. Illustration of avoided electricity cost components, AESC 2018 versus AESC 2015 (WCMA), summer on-peak

	AESC 2015	AESC 2015	AESC 2018	AESC 2018, relative to AESC 2015	
	2015 cents/kWh	*2018 cents/kWh*	*2018 cents/kWh*	*2018 cents/kWh*	*% Difference*
Avoided Retail Capacity Costs	2.91	3.05	1.72	-1.33	-44%
Avoided Retail Energy Costs	6.29	6.60	4.63	-1.97	-30%
Avoided Renewable Energy Credit	0.96	1.01	0.39	-0.62	-61%
Subtotal: Capacity and Energy	**10.16**	**10.66**	**6.75**	**-3.92**	**-37%**
CO2 non-embedded	**4.88**	**5.13**	**4.36**	**-0.76**	**-15%**
T&D	**-**	**-**	**2.11**	**2.11**	**-**
Value of Reliability	**-**	**-**	**0.01**	**0.01**	**-**
Capacity DRIPE	-	-	0.91	0.91	-
Energy DRIPE	1.18	1.24	1.91	0.67	54%
Subtotal: DRIPE	**1.18**	**1.24**	**2.81**	**1.58**	**128%**
Total	**16.22**	**17.02**	**16.05**	**-0.98**	**-6%**

Geographical Variations

Avoided Energy Costs

- Constitutes almost 30 percent of total avoided cost
- Little variation in avoided energy costs by geography

	15-year levelized value for summer peak ($/kWh)
CT	$0.050
MA	$0.050
ME	$0.046
NT	$0.052
RI	$0.049
VT	$0.050

Avoided natural gas costs

- More variability due to more segmented supply
- Southern New England (SNE): costs are higher than in 2015 as a result of new cost methodology
- Northern New England (NNE): costs are lower than in 2015 (and relative to SNE) as a result of proximity to Canadian supply

	15-year levelized value for all retail end uses ($/MMBtu)
SNE	$7.40
NNE	$7.18

User Interface

- Excel workbook containing hourly load and price data for 2018-2035 for each region
- Dynamically calculates DRIPE values
  - Integrates avoided cost data for <u>all</u> electric avoided cost categories
- Users can view avoided costs according to:
  - Traditional AESC costing periods (summer and winter peak and off peak)
  - User-made costing periods (can focus on peak prices or peak loads)
- Users can modify key inputs (discount rate, distribution losses, dollar years, etc.)
- User Interfaces available for the main case, and high and low load sensitivities

Cost Interface Dashboard

Note: All values shown on this page are wholesale values.

Return to Instructions

Region	WCMA	*This is the reporting range. This specifies the geography in which the below analysis is pe*
Region abbreviation	WCMA	
State	MA	
Sensitivity	Main	*This specifies the load sensitivity being modeled. "Main" is the main AESC case, which n*
Presets	Default	*Values reported below are calculated according to the traditional AESC costing periods.*
-	*1%*	
-	*500*	
-	*All*	
Go to User Inputs		
Dollar type	2018 $	*Values can be shown either as constant 2018 dollars, or as nominal dollars.*
Additional inputs		
Wholesale Risk Premium (WRF	8.00%	*Wholesale risk premium represents the observed difference between wholesale costs anc*
Distribution Losses (DL)	8.00%	*Electrical losses due to distribution system. 8 percent is ISO New England ISO default.*
Capacity Bid into FCM (% Bid)	50.00%	*Percent of total quantity of savings entered in the FCM (i.e., one less the percentage that*
PTF losses	1.60%	*PTF losses are the pooled transmission facilities losses (i.e., the transmission facilities c*
Assumed VOLL ($/kWh)	$25.00	*Value of lost load (VOLL) describes the cost to consumers of being unable to take power*
Nominal Discount Rate	3.37%	
Inflation Rate	2.00%	
Real Discount Rate	1.34%	

	Wholesale Energy Costs						**Net ZoZ D**	
	Annual	**Winter**		**Summer**		**Other**	**Winter**	
2018 $	*Average*	*On-Peak*	*Off-Peak*	*On-Peak*	*Off-Peak*	**Costing**	*On-Peak*	*Off-Peak*
	$/kWh	*$/kWh*	*$/kWh*	*$/kWh*	*$/kWh*	*$/kWh*	*$/kWh*	*$/kWh*
2018	$0.0394	$0.0476	$0.0434	$0.0318	$0.0257	-	$0.0196	$0.0136
2019	$0.0406	$0.0484	$0.0449	$0.0317	$0.0283	-	$0.0306	$0.0212

Contact

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AESC 2018 Study: http://www.synapse-energy.com/sites/default/files/AESC-2018-17-080.pdf