2018 NEEP Summit
*EE By The Sea: Oceans of Opportunity*
October 1-3 / Middletown, RI

# Session 2B: Metrics, Cost-Effectiveness and Data for Advanced Efficiency


Moderator: Rich Sedano, RAP
Paul Hibbard, the Analysis Group
Bruce Biewald, Synapse Energy Economics
Pasi Miettinen, Sagewell

# Cost-Effectiveness:
# Broadening the Value Stack

## 2018 Northeast Energy Efficiency Partnerships Summit

October 2, 2018

Bruce Biewald

# On Quantifying Impacts

if you can’t measure it, you can’t manage it

Deming, W. Edwards. 1994. *The New Economics for Industry, Government, Education*. Cambridge, Massachusetts: MIT Press, p35.

# On Quantifying Impacts

“It is wrong to suppose that

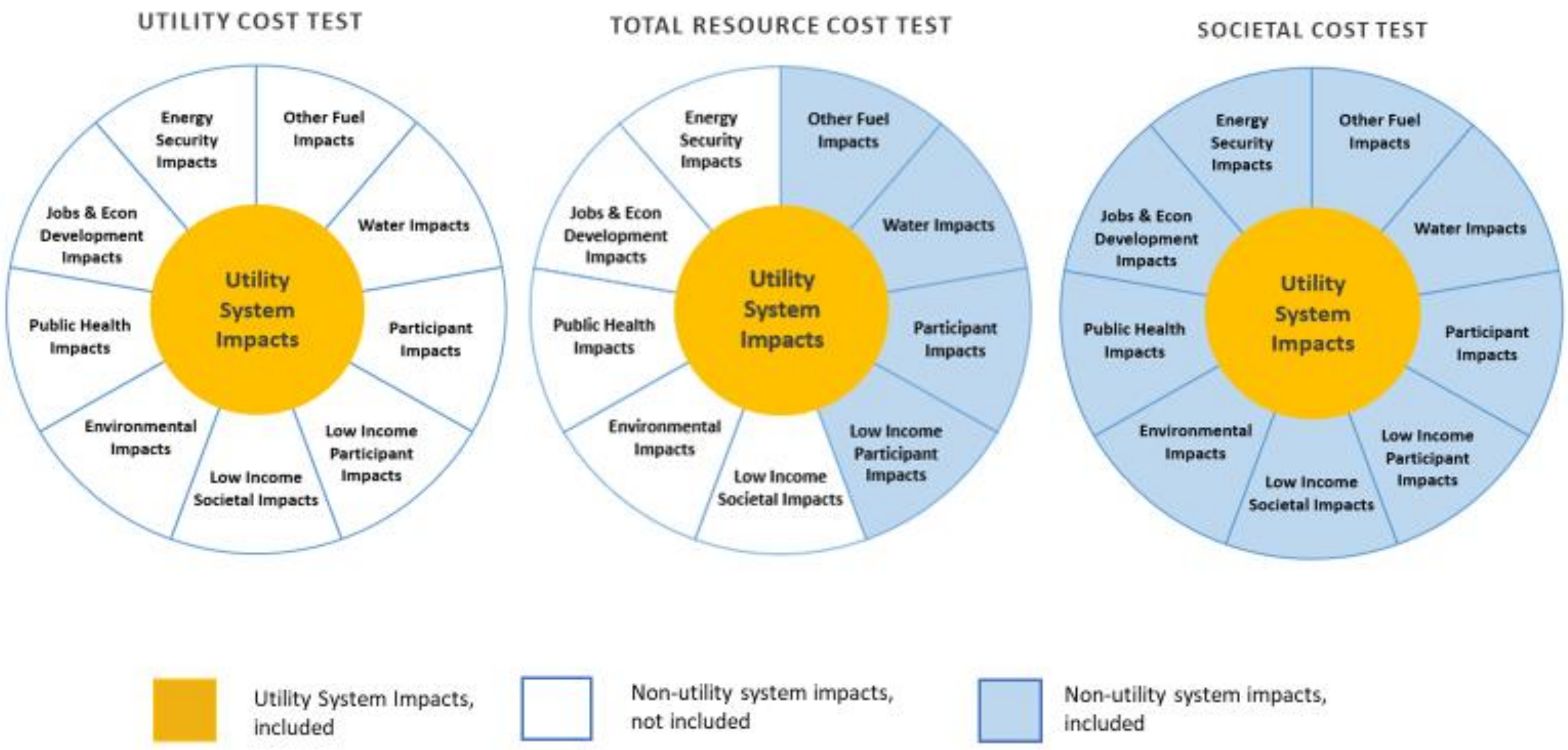
if you can’t measure it, you can’t manage it

—a costly myth.”

Deming, W. Edwards. 1994. *The New Economics for Industry, Government, Education*. Cambridge, Massachusetts: MIT Press, p35.

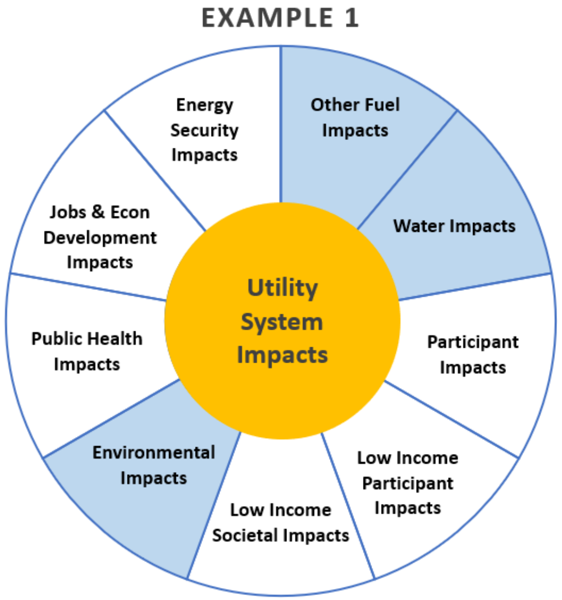
  

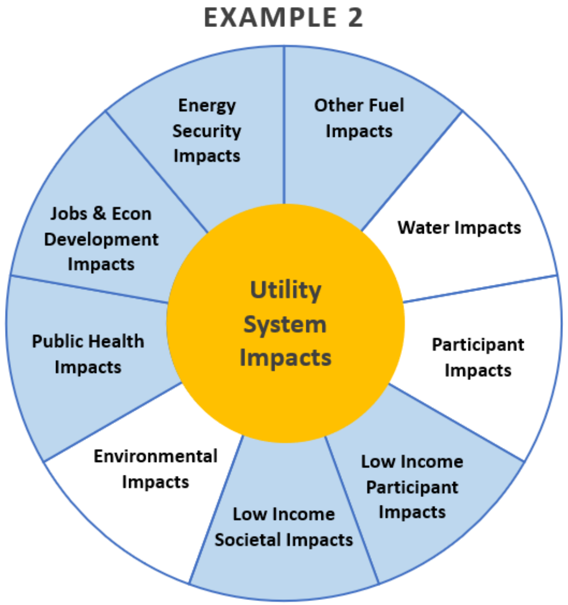
# Traditional Cost-Effectiveness Tests

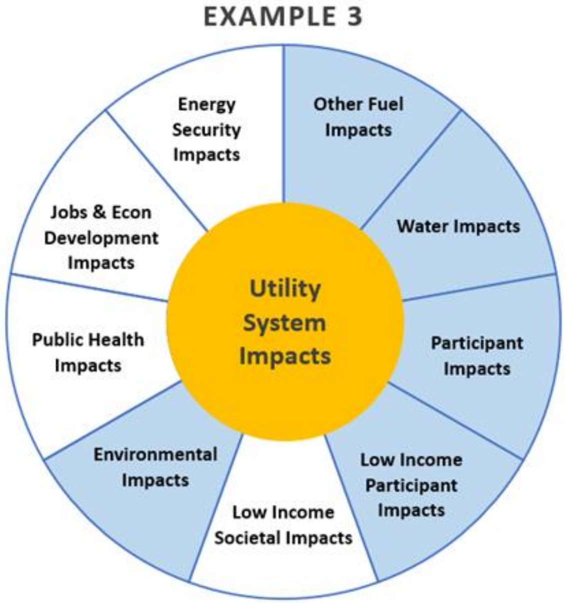


# National Standard Practice Manual: Multiple Options for Tests

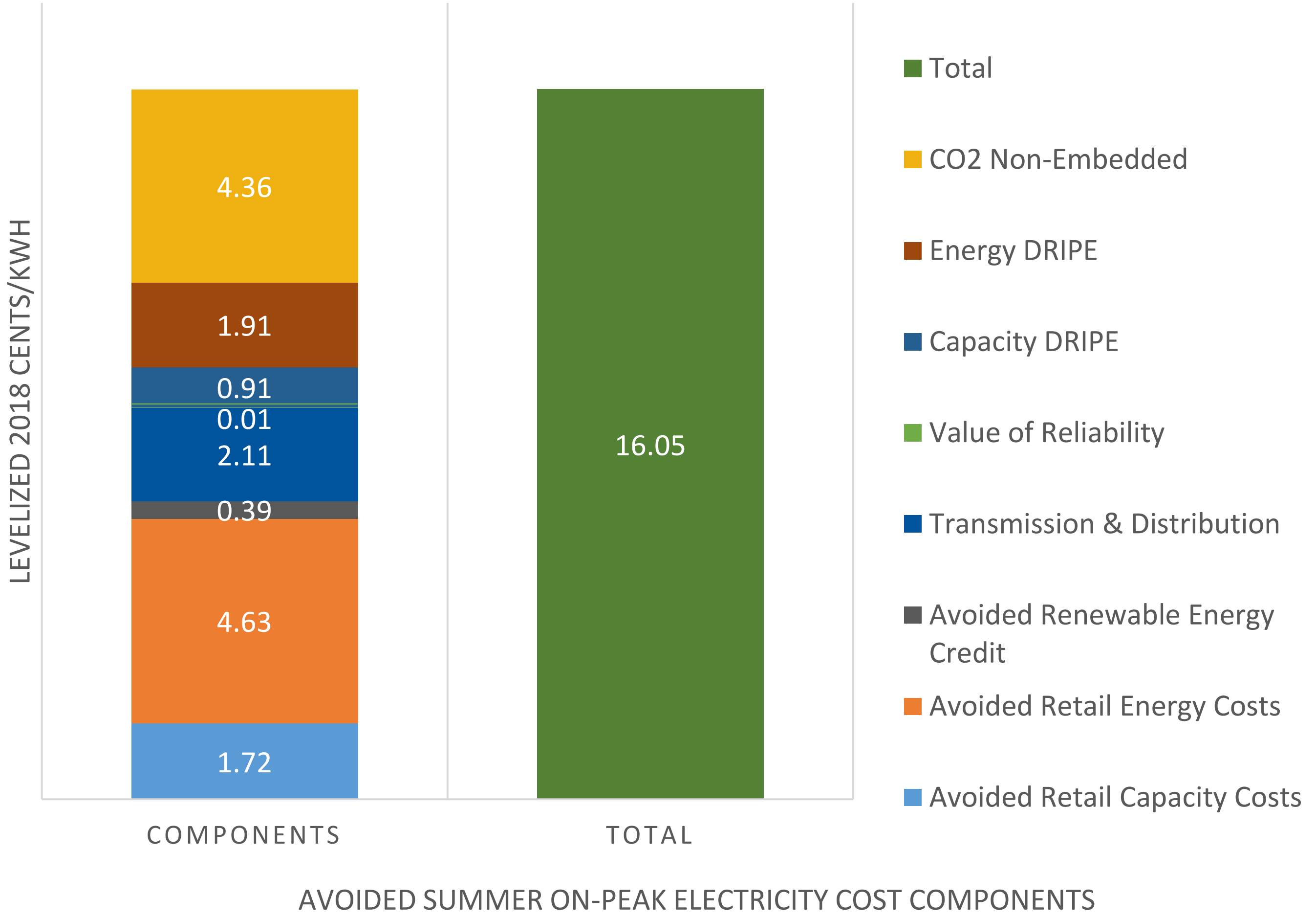
States are not limited to the three traditional tests.
As long as their test adheres to the NSPM principles.
Particularly about meeting policy goals.



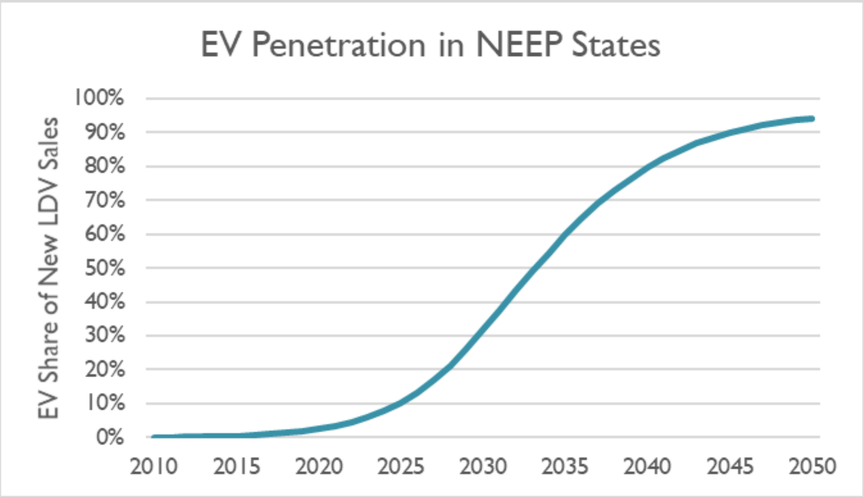
# 2018 Avoided Energy Supply Costs New England

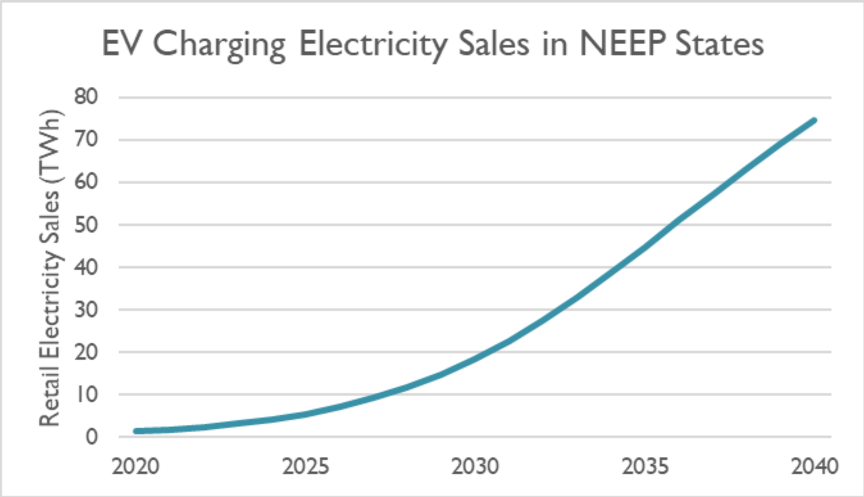


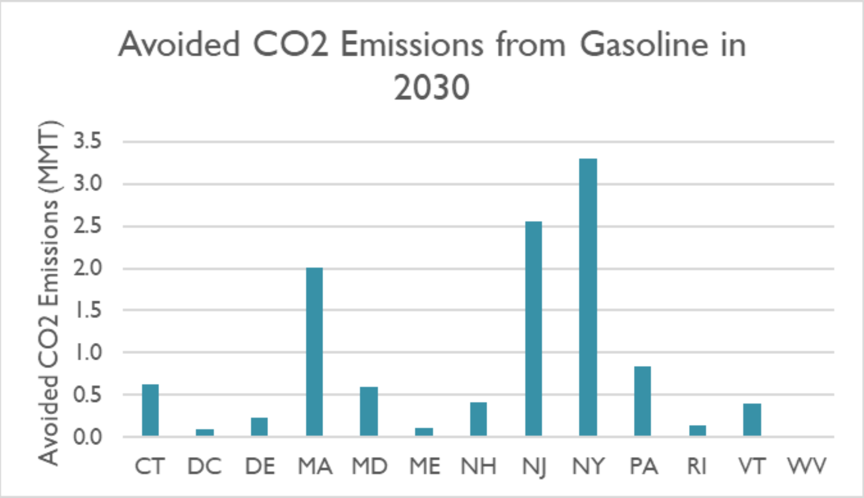

*Source: Knight, P. et al. 2018. Avoided Energy Supply Costs in New England: 2018 Report. Synapse Energy Economics for Avoided-Energy-Supply-Component (AESC) Study Group. ES Table 1.*

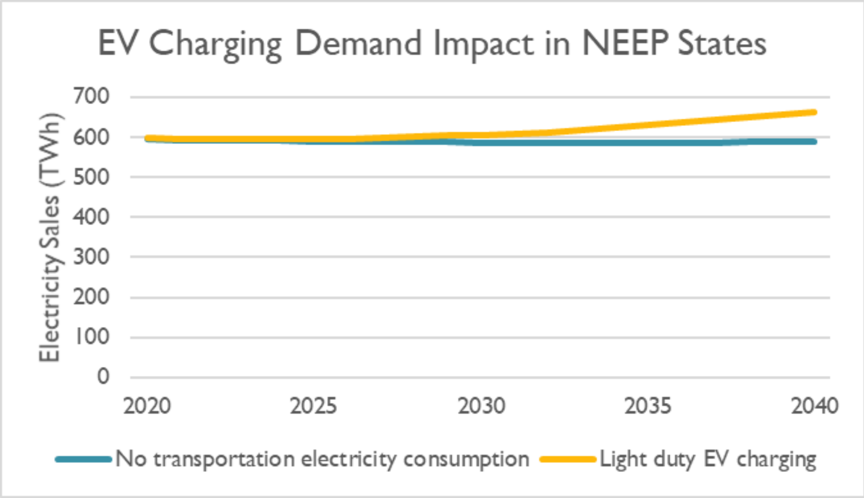
  

# EV-REDI Tool Scenario for NEEP States



# Useful Resources

Avoided Energy Supply Costs in New England: 2018 Report: Knight, P., Chang, M., White, D., Peluso, N., Ackerman, F., Hall, J., Chernick, P., Harper, S., Geller, S., Griffiths, B., Deman, L., Rosenkranz, J., Gifford, J., Yuen, P.Y., Snook, E., Shoesmith, J. 2018. *Avoided Energy Supply Costs in New England: 2018 Report.* Synapse Energy Economics for Avoided-Energy-Supply-Component (AESC) Study Group.

National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources: Woolf, T., C. Neme, M. Kushler, S. R. Schiller, T. Eckman. 2017. *National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources*. Edition 1, Spring 2017. Prepared by the National Efficiency Screening Project.

Locational and Temporal Values of Energy Efficiency and other DERs to Transmission and Distribution Systems: Hall, J., J. Kallay, A. Napoleon, K. Takahashi, M. Whited. 2018. *Locational and Temporal Values of Energy Efficiency and other DERs to Transmission and Distribution Systems*. Synapse Energy Economics. Presented at 2018 ACEEE Summer Study on Energy Efficiency in Buildings.

Aiming Higher: Realizing the Full Potential of Cost-Effective Energy Efficiency in New York: Woolf, T., A. Napoleon, P. Luckow, W. Ong, K. Takahashi. 2016. *Aiming Higher: Realizing the Full Potential of Cost-Effective Energy Efficiency in New York.* Synapse Energy Economics for Natural Resources Defense Council, E4TheFuture, CLEAResult, Lime Energy, Association for Energy Affordability, and Alliance for Clean Energy New York.

Ackerman, F., 2017. *Worst-Case Economics: Extreme Events in Climate and Finance*. London: Anthem Press.

# Future of M&V

# AMI Meters, Energy Efficiency & Electrification

**NEEP Summit**
**October 2, 2018**

sagewell[SM]
Energy Analytics

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# Disclaimer:

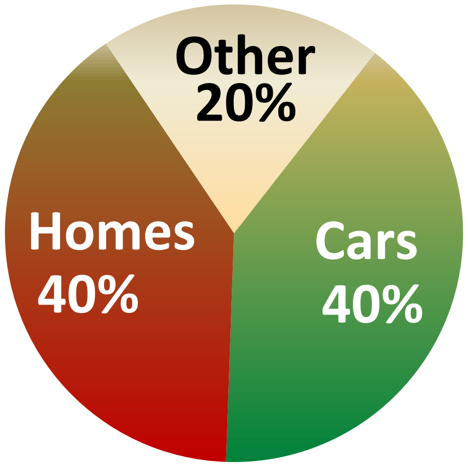
## Intended to start a thoughtful dialogue

### - Following analysis needs community input and feedback

# A Key Energy Efficiency Program Goal and Justification: $CO_2$ reduction

sagewell Energy Analytics

- 80% $CO_2$ reduction goals by 2050
- Largest residential EE program results come from suburbs
- Sources of (suburban) emissions:



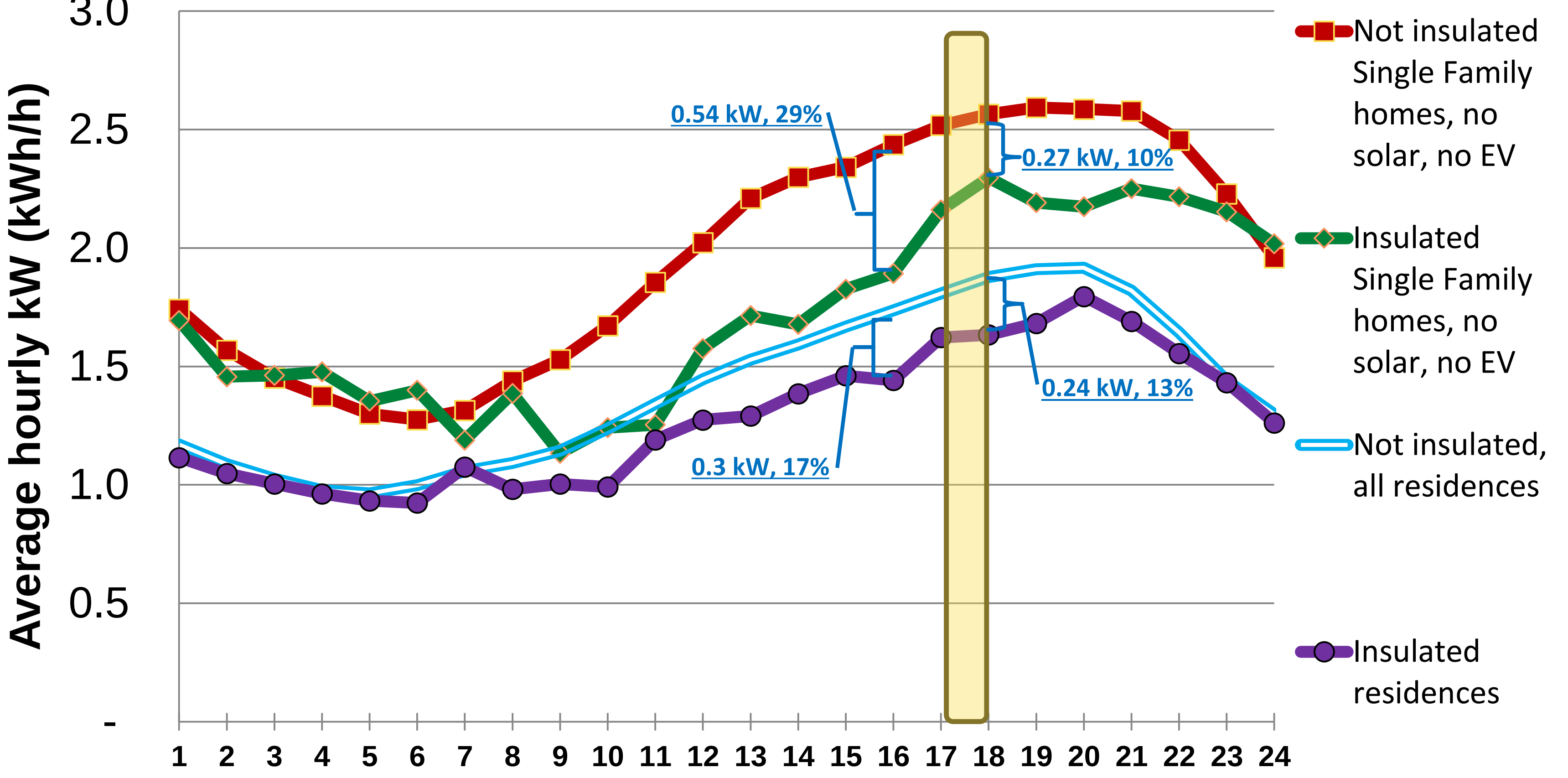

- If electrify all homes & cars – can reduce their emissions by almost half – at current NE generation mix
- Electrification can achieve (almost all) emissions goals if grid is 100% renewable. Can EE?

# What does AMI meter data analysis tell us about EE programs?

sagewell[SM] Energy Analytics

## Peak reduction from insulation (2018 peak day)

(Mid-sized residences 1,500 sft to 3,000 sft)




- **Typical peak reduction observed in AMI data: 0.1 kW to 0.3 kW, or 5% to 15%**

**Mass Save® Reported Electric Program Peak Reduction**

- Mass Save® Reported peak reduction: 0.83 kW
- 3,257 kW/ 3,914 participants = 0.83 kW
- **Mass Save® reports 46% <u>avg.</u> peak reduction?**

Q1 2018 Electric & Gas Summary Report

*Prior to 2016, benefits were only reported in Q2 and Q4. Benefits in the other quarters are shown as zero.

| As of Q1 2018 | Participants | Total Expenditures | Annual MWh Savings | Lifetime MWh Savings | Summer Capacity (kW) |
|---|---|---|---|---|---|
| Electric | | | | | |
| Actual | 2,176,665 | $ 94,266,072 | 259,496 | 2,090,469 | 37,234 |
| ⊟ Residential | 2,162,768 | $ 50,001,276 | 168,639 | 1,008,729 | 24,080 |
| ⊟ Residential Whole House | 1,190,759 | $ 28,411,856 | 43,858 | 202,946 | 7,074 |
| Residential New Construction | 880 | $ 2,194,187 | 3,078 | 31,645 | 523 |
| Residential Multi-Family Retrofit | 3,734 | $ 858,863 | 595 | 6,338 | 48 |
| Residential Home Energy Services - Measures | 3,914 | $ 19,065,323 | 19,152 | 143,929 | 3,257 |

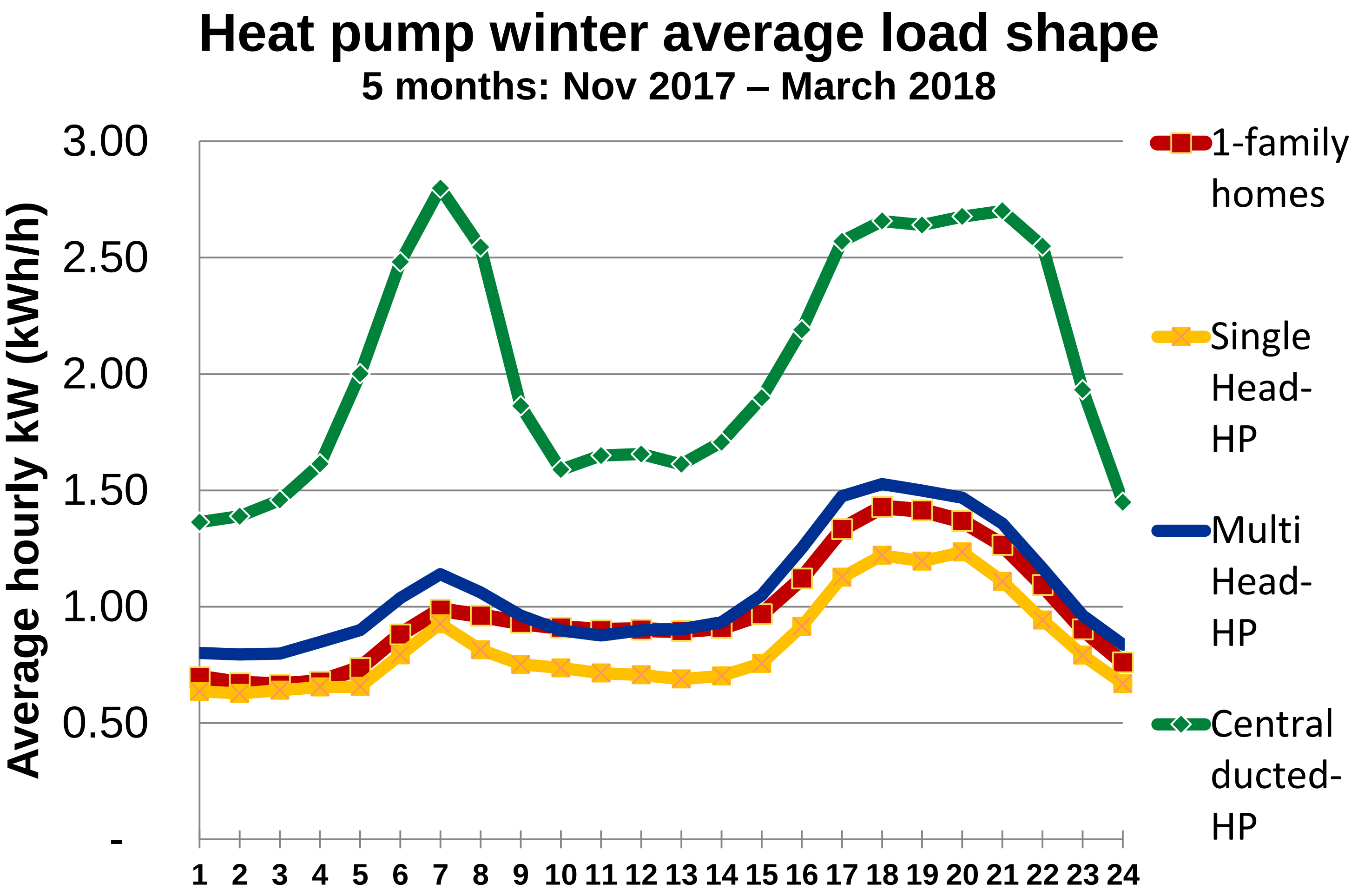
Source: Masssavedata.com

**10 year weatherization energy impact:**

- **Homes audited annually: 4%**
- **% of homes that weatherize: 33%**
- **Annual energy savings: 30%??**
- **10 yr savings= 10x 4%x 33%x 30%= <u>4%?</u>**

Data from **Sagewell SageSight**[SM] AMI meter data analytics software and Sagewell's AMI meter data library
2018 summer peak, Aug 29, 2018, hour ending 6pm. Peak day temp 96 degrees, peak hour temp 90 degrees

# If we electrify home heating, what technology should we use?




Data from **Sagewell SageSight**SM AMI meter data analytics software and Sagewell's AMI meter data library

- Not all heat pumps are worth the same environmentally or economically
- Ductless heat pumps are typically not used for heating
- Ducted heat pumps use about 4,000 kWh/yr more than average home
  - Reduce C02 by 30% to 50% over natural gas and oil
- Focus on over 600,000 furnaces in MA

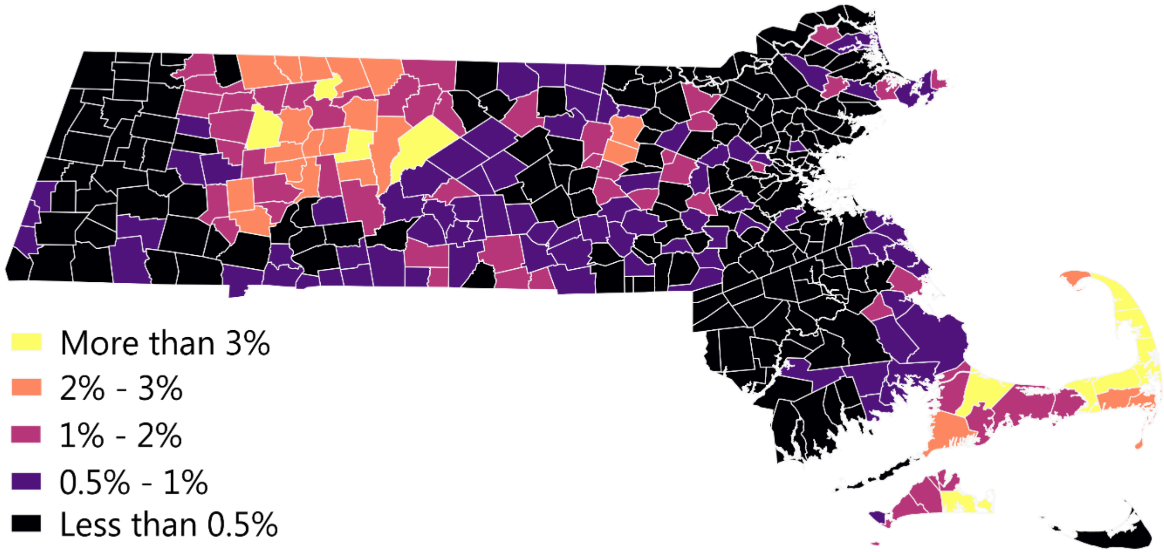
SAGESIGHT ANALYTICS

# Heat pump trends

## MA Heat pump sales Q4 2014 – Q3 2017


- **40% annual growth in the last two years**
- 2018: ~7,500 installations/ yr (w/ available data)
    - 2.5% to 3% annual heating & cooling system sales
- **Total sales likely double ~15,000 customers/yr**
    - **5-6% annual heating/cooling system sales**
- Overall market: over 200,000 heating & cooling system replacements/ yr
- **Less than 10% of units sales are heat pumps**

## MA Residential Heat Pump Market share




Excludes municipal utilities

- **Heat pump operating costs are LOWER than natural gas**
- Heat pumps will gain market share

# EE Program costs vs. alternatives

Residential Electric EE Program costs in MA:

- $309 million in 2017
  - $218 million in customer incentives
- Customers pay $140/yr per household
- Current spending on “Residential Home Energy Services – Measures” can be as high as $6,600 per home

Alternative heat pump program (for discussion purposes only):

- Assume 10% admin costs
- $280 million program incentive spending
- Whole home heat pump hardware wholesale cost: $5,000
  - Use upstream rebates ONLY
- Could provide 56,000 homes free whole home heat pump hardware each year (& remove fossil fuel system)
- For example, could replace all furnaces in the state “in 10 yrs”
- 600,000 central ducted heat pumps * 4,000 kWh/yr * 15 c/kWh margin = $360 MM of annual contribution margin
- Assume 50% savings to residential customers: 1.2 c/kWh electric rate reduction
  - Other half to industry as incentives?
- Each central ducted heat pump reduces heating $CO_2$ emissions by 30% to 50%  - and will get cleaner as the grid gets cleaner

Data source: MassSaveData.om

# Further analysis needed

Final thoughts

- Comparing effectiveness between multiple programs (e.g. EE vs. heat pumps) vs. within a single program is helpful
  - Electric vehicle marketing is also a high impact program candidate
- Electrification offers multiple wins: lower emissions, lower electric rates to customers, higher returns to utility shareholders
- Additional AMI meter data analysis and further validation needed
  - Possible analysis outcomes:
    - Do nothing. EE Programs are working well against electrification
    - Re-engineer efficiency programs to make them more effective
    - Reallocate portion of EE program funding to electrification
    - #EEexit
- States and utilities with AMI meter data can do this analysis
  - Sagewell can offer its anonymous AMI meter database to states or utilities without AMI meters
- Should we publish a white paper on this topic?

# The End