Future of Utilities

(Radical)

Changes in Utility Economics

Insights & Implications from AMI Meter Data Analysis

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sagewell℠
Energy Analytics

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Sagewell Introduction

- Smart meter data analytics software provider
- Strategic electrification analysis
- Utility customer sizes: from 10,000 to 4 million meters
- Based in Boston, MA
  - Employees in Michigan, North Carolina, New York and California

Awards

Energy Innovator of the Year
Braintree Electric Light Department - 2018
For Sagewell's use of AMI meter data in *Bring Your Own Charger*® (BYOC) program and in strategic electrification programs

"Game Changer Company" Award - Sagewell
By The Boston Globe for innovation in energy markets

Associate member of the year
Sagewell - 2017
AMI data analytics and use of data to grow strategic electrification program at public power utilities

Leading by Example Award
Belmont Light
For Sagewell's Innovative use of AMI meter data to drive strategic electrification programs (heat pumps and EVs) and energy efficiency programs

Principles behind analysis

- First and foremost –a business analysis
- First evaluate actual economics without any regulatory adjustments/ distortions
- Then review regulatory frameworks and their impact on “actual” economics

The punchline from AMI meter analysis

- Extraordinary alignment of interests from electrification
  - Environmental (significant emissions reductions)
  - Utility shareholder economics (higher earnings)
  - Customer economics (lower rates)
- Significant implications for
  - Utility programs
  - Regulations & regulatory strategies (for both utilities and regulators)
  - Investments
  - Mergers & Acquisitions
- AMI meter data binds all storylines together

Evolution of customer analysis

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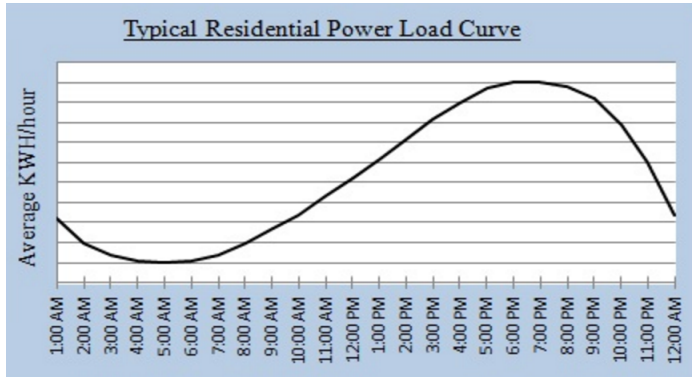
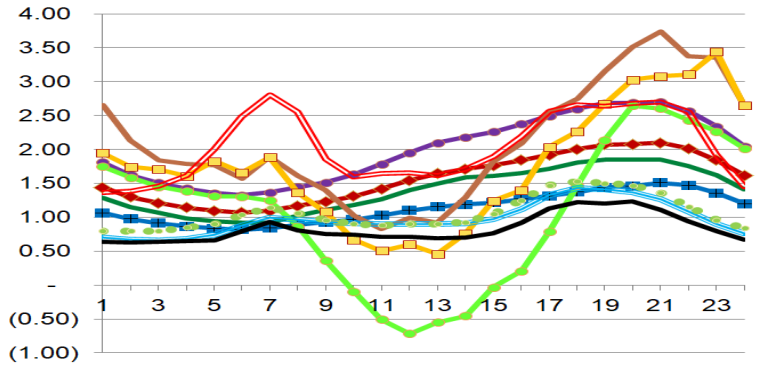
Past

1- load shape per class



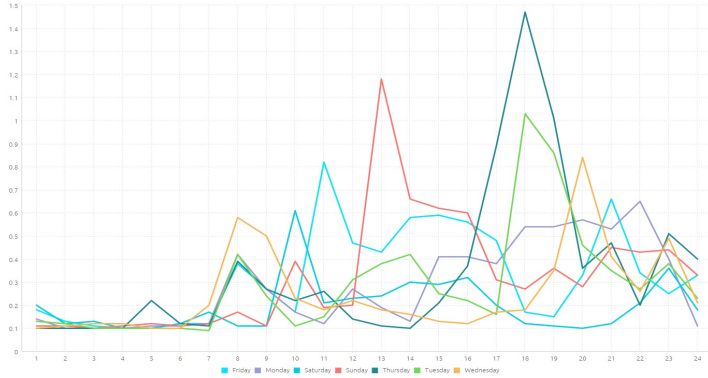
Near Past

Hundreds of load shapes per class



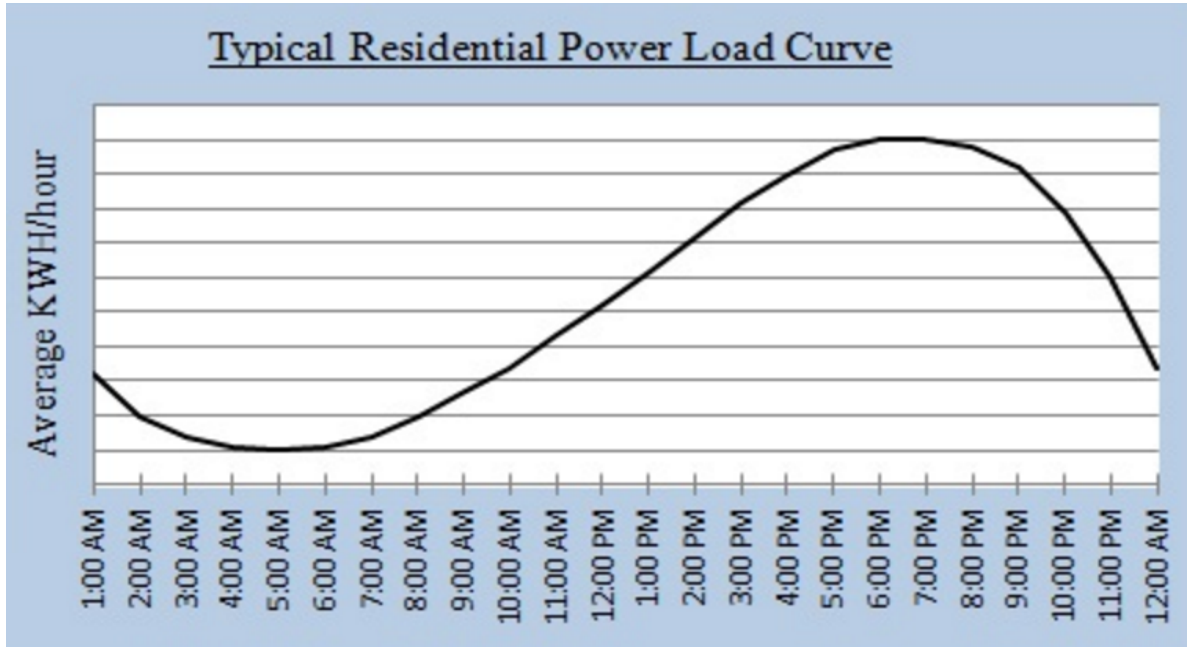
Present

Individual customer analysis



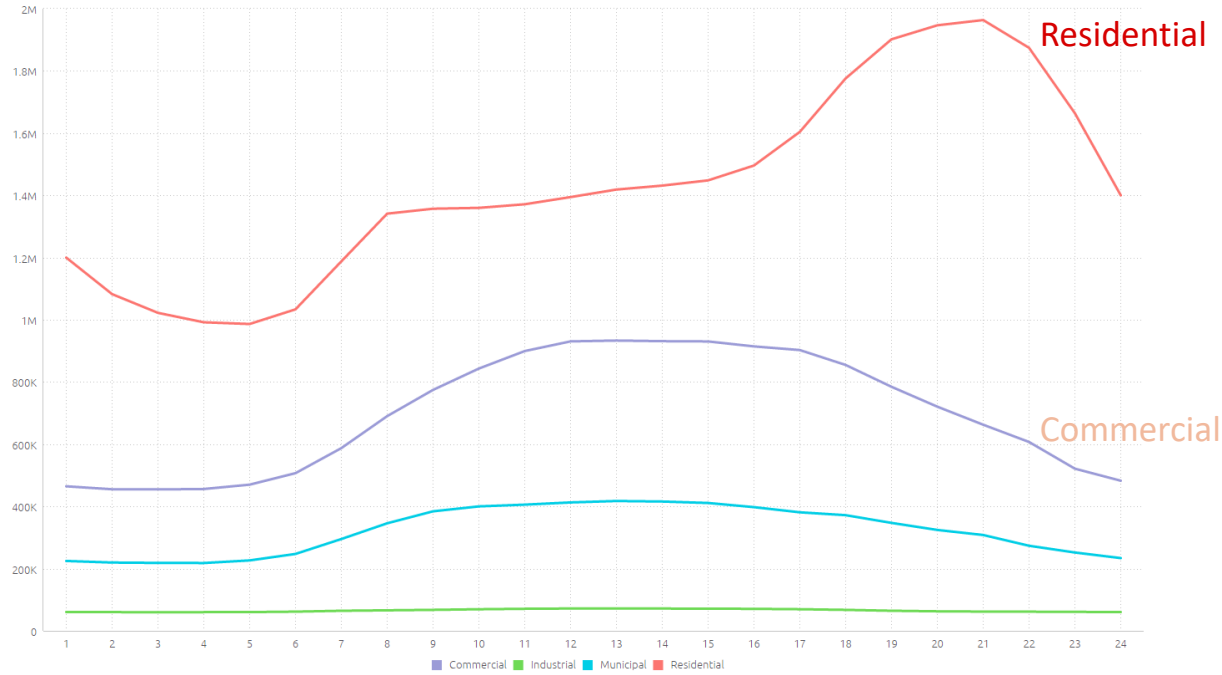
Modeled vs. actual load shapes by customer class

Reference load shape



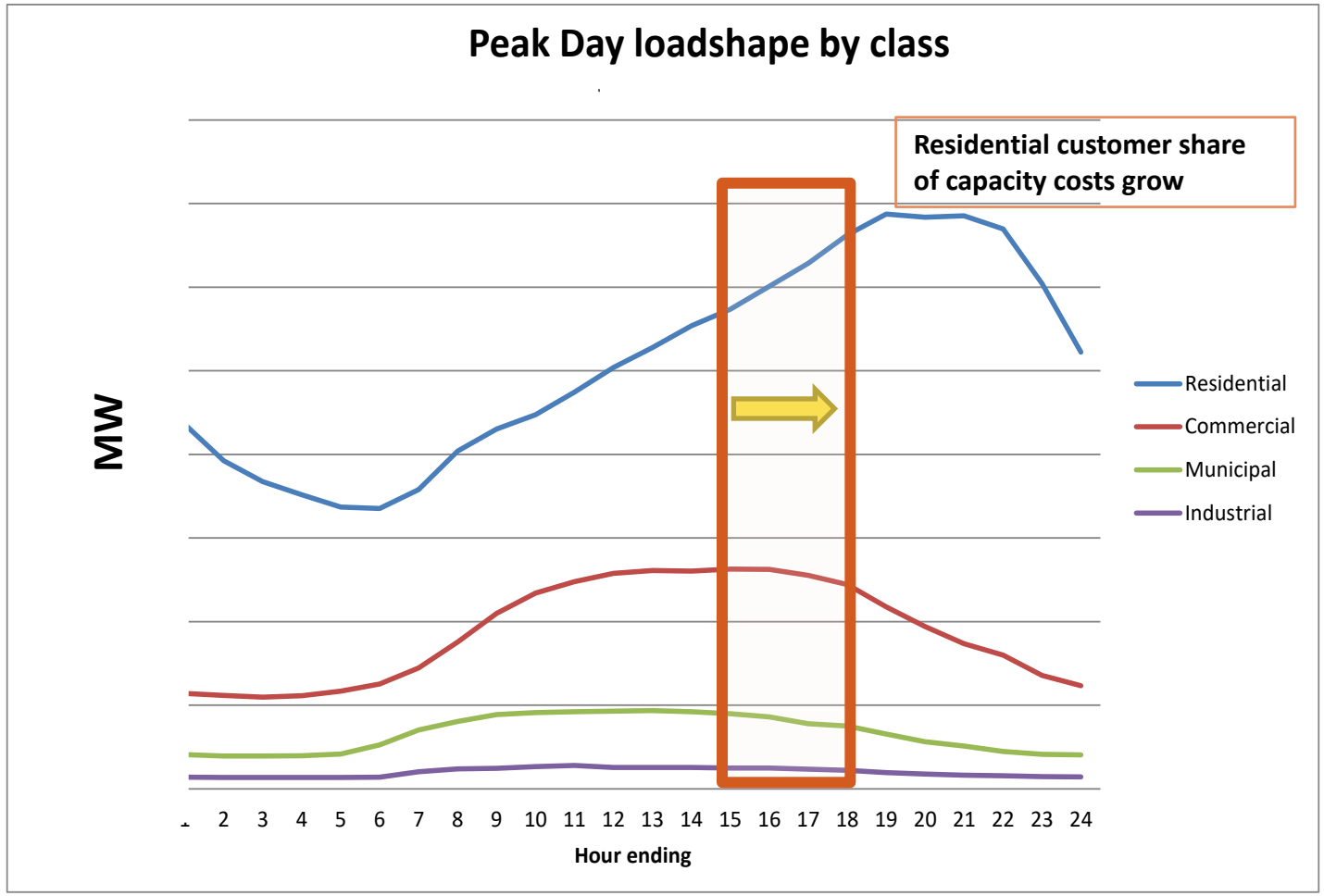
vs.

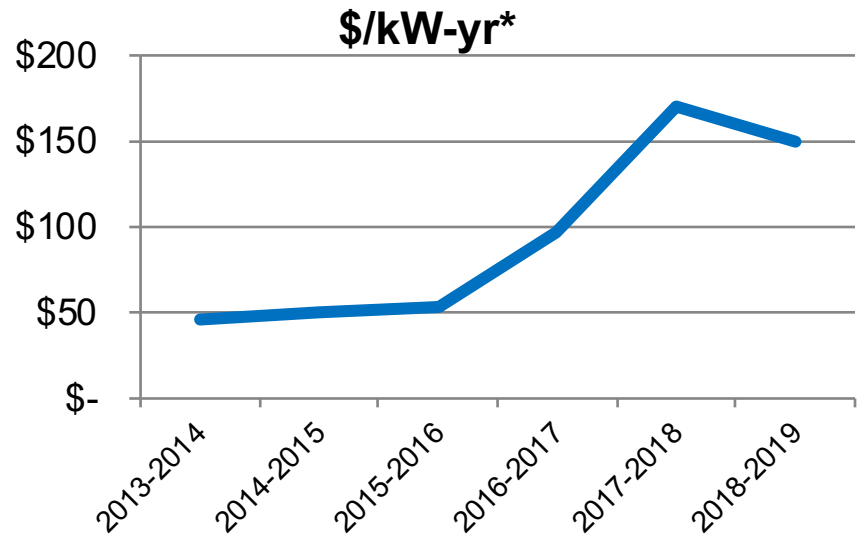
Actual peak day load shape



Data from Sagewell SageSight[SM] AMI meter data analytics software

Who is on peak – when peak shifts? Combine with cost shifts. MA Example.





- $500 million increase in capacity costs in 2 yrs
- LMP energy costs fell to 3.5 c/kWh
- **1 peak capacity hour costs more than energy for the rest of the year**
- Upends distribution utility economics
- **Customers that were profitable three years ago are no longer**

Analytics software scale – changing customer analysis

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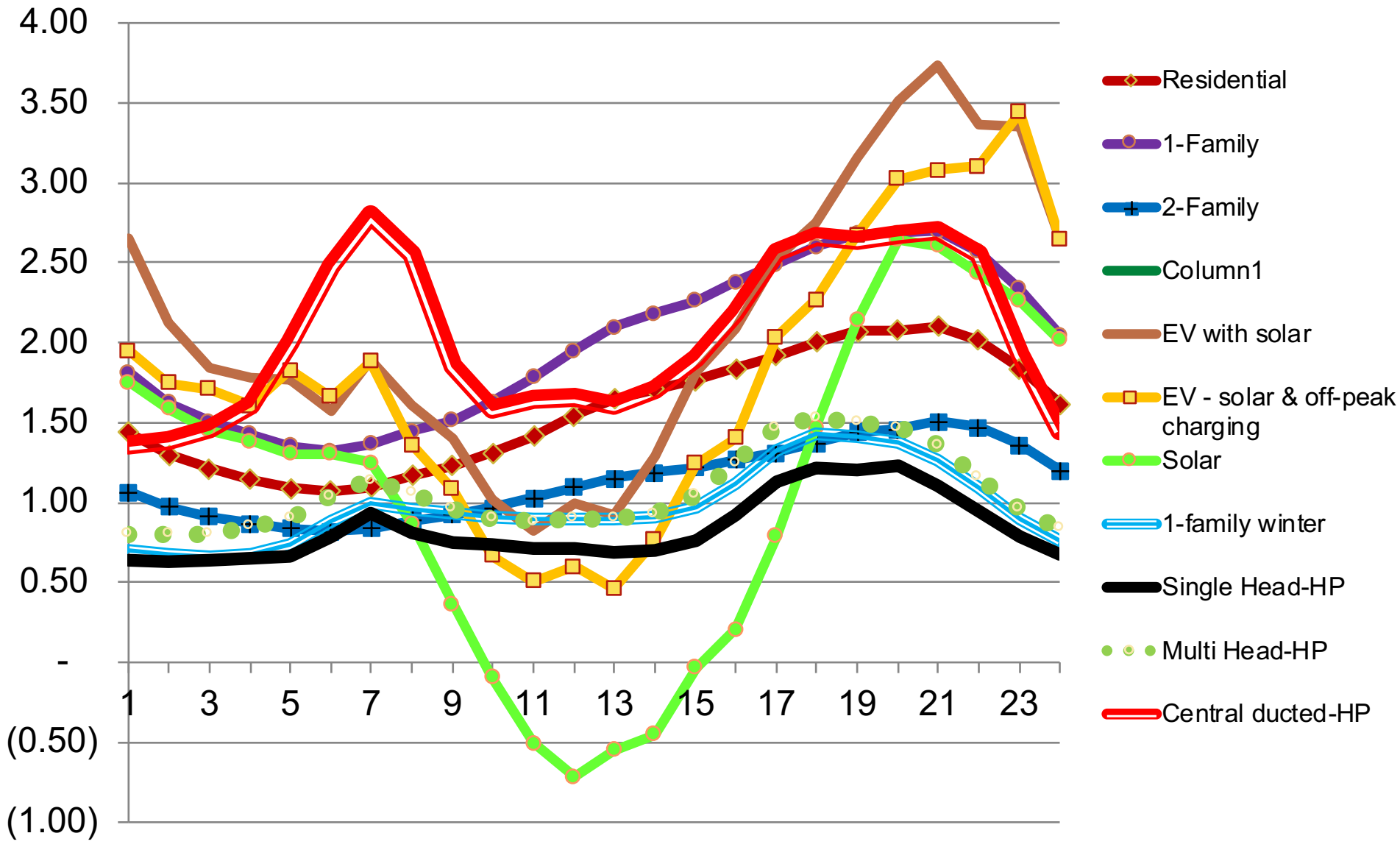
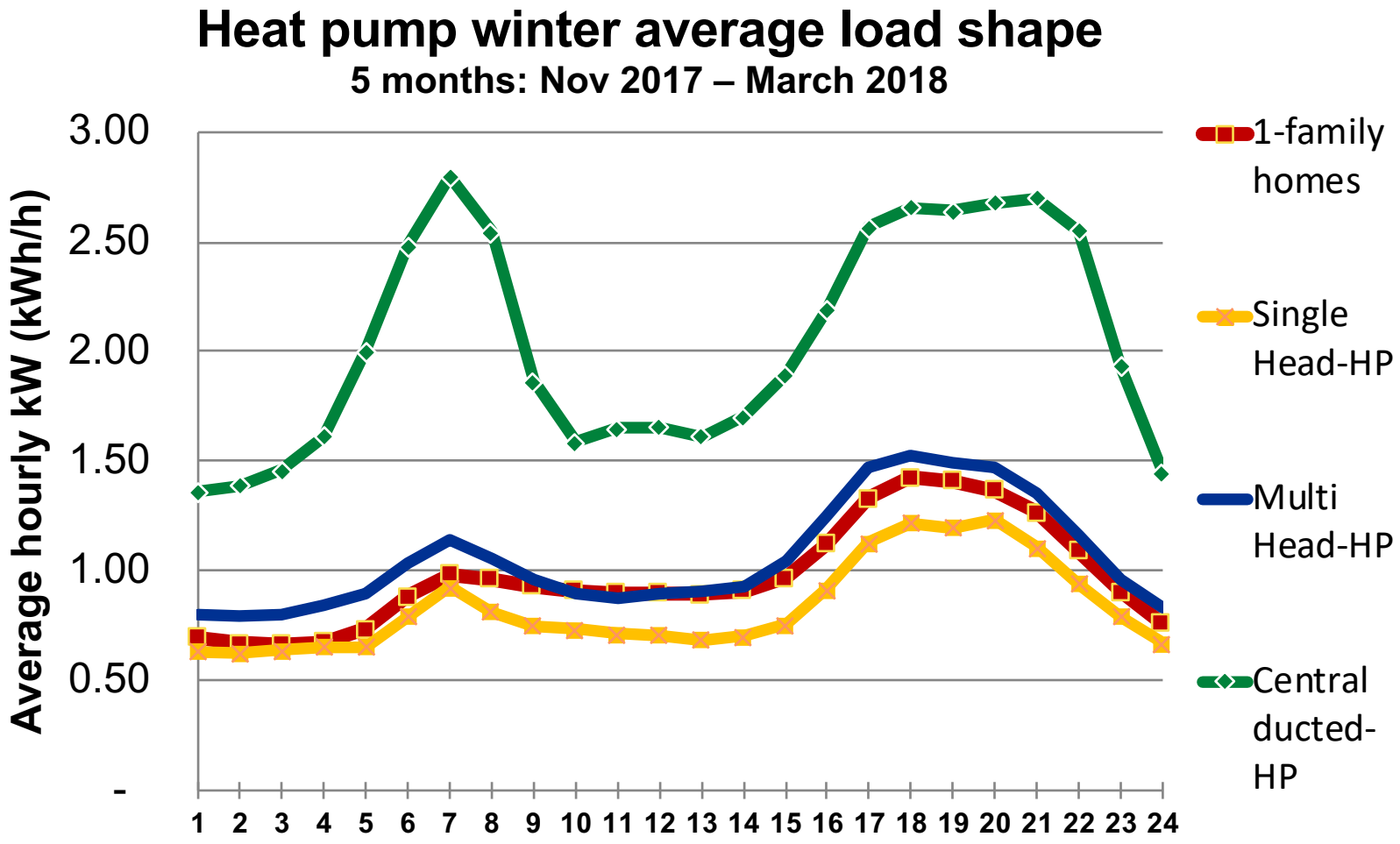
- Example utility with 2 million meters
  - Collects 60 data points/hour /meter
  - 1 **T**rillion data points a year
- Traditional databases and “big data” solutions cannot handle the volume

Hundreds of residential sub-class load shapes



- Does a residential customer "class" even exist?
- Sagewell models over 200 residential "sub classes"
- **Load shapes vary substantially by utility**
- Big business changes coming

Not all technologies are worth the same



- Not all heat pumps are worth the same environmentally or economically
  - Neither are all Electric vehicles!
- Data suggests Ductless heat pumps are typically not used for heating
  - Not displacing fossil fuels
- Ducted heat pumps use about 4,000 kWh/yr more than average home (in climate zone IV)
  - **Reduce C02 by 30% to 50% over natural gas, propane and oil**
- Heat pumps operate down to -17F
- Heat pumps already cost less to operate than natural gas, propane and oil in large parts of the country

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

Individual customer energy use is volatile:

One customer, one week

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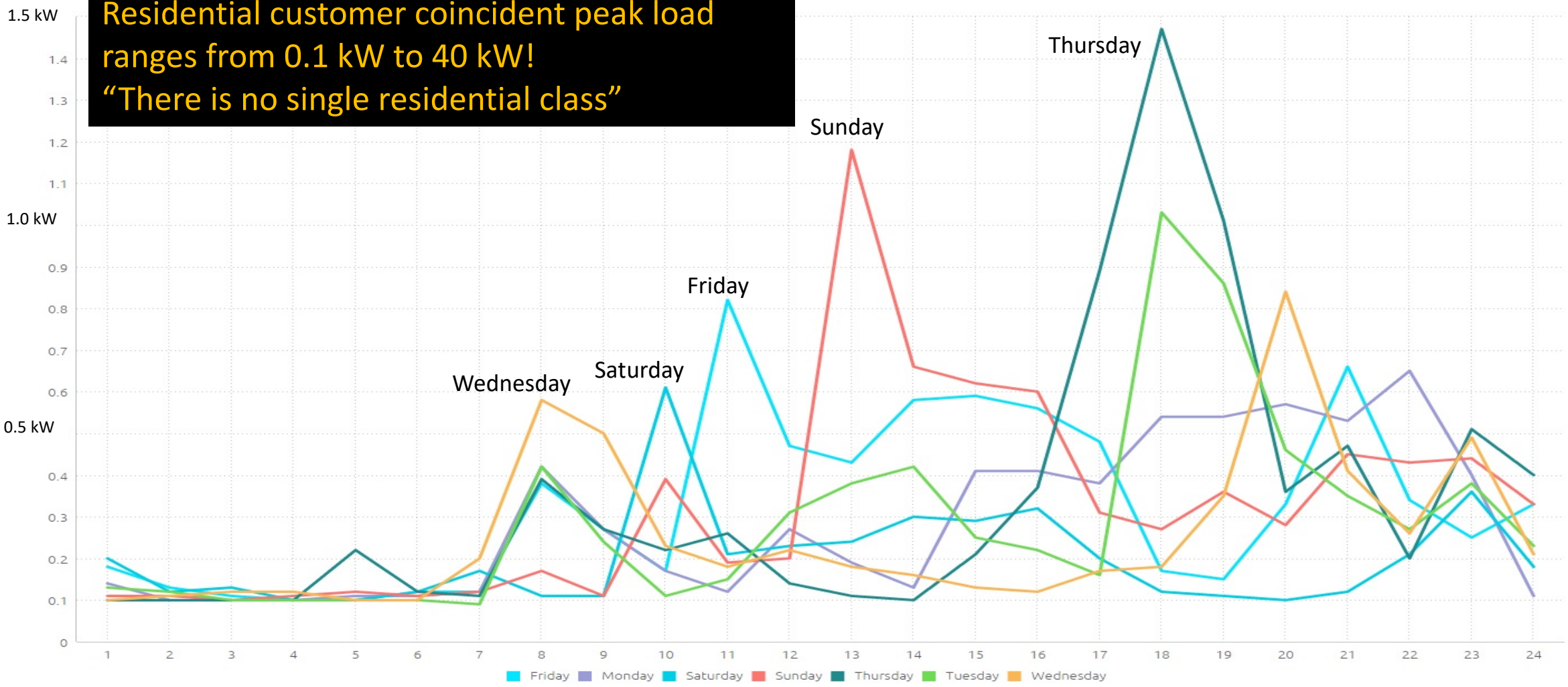
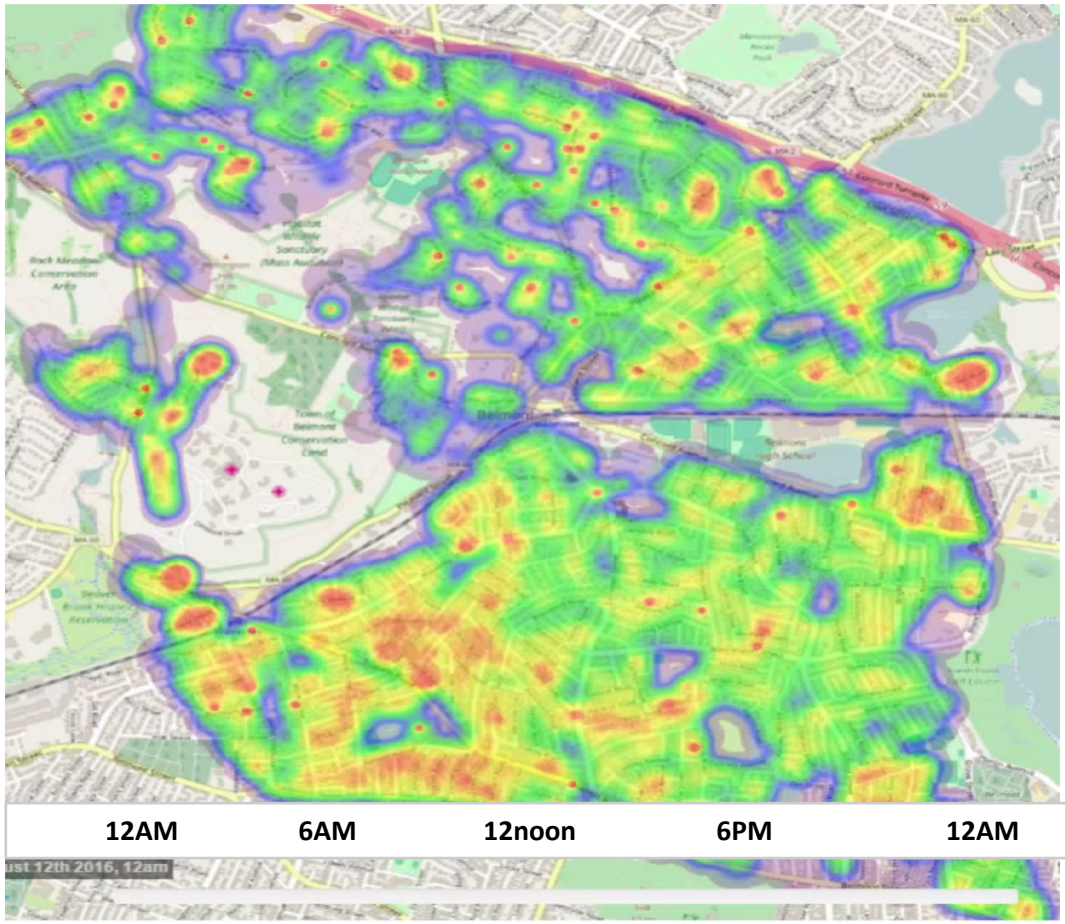
Residential customer coincident peak load ranges from 0.1 kW to 40 kW!
"There is no single residential class"



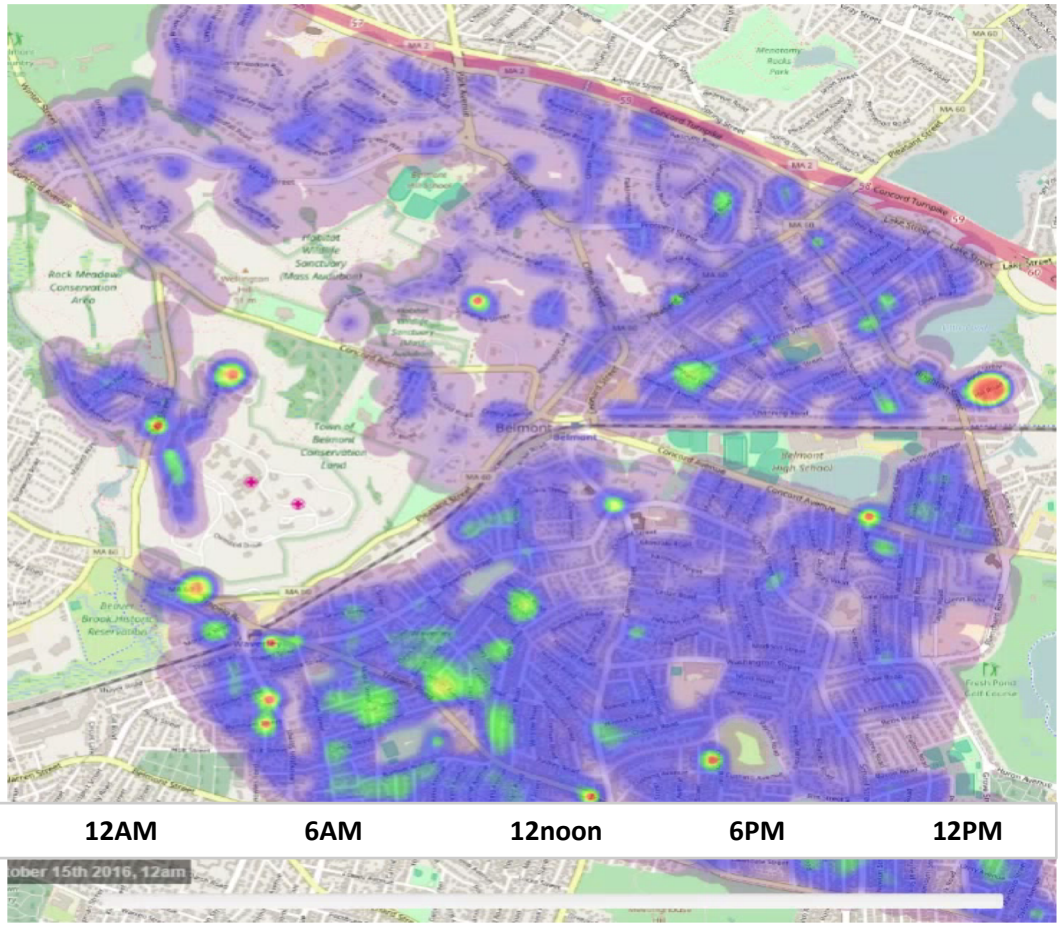
Graph from Sagewell SageSight[SM] AMI meter data analytics software

Residential peak load reduction – a game of “Whack-a-Mole”

Summer peak



Fall Saturday



Animation from Sagewell SageSight℠ AMI meter data analytics software

Bottom-up vs. top-down customer analysis

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- Top-down cost allocation is not necessary any more
- Top-down cost allocation could actually be stopped
- “Bottom up” analysis results in different conclusions from “top down” analysis
- Alternative: calculate contribution margin by the customer, by the hour
  - Figure out how much each customer actually contributes towards fixed cost

Redefine financial analysis

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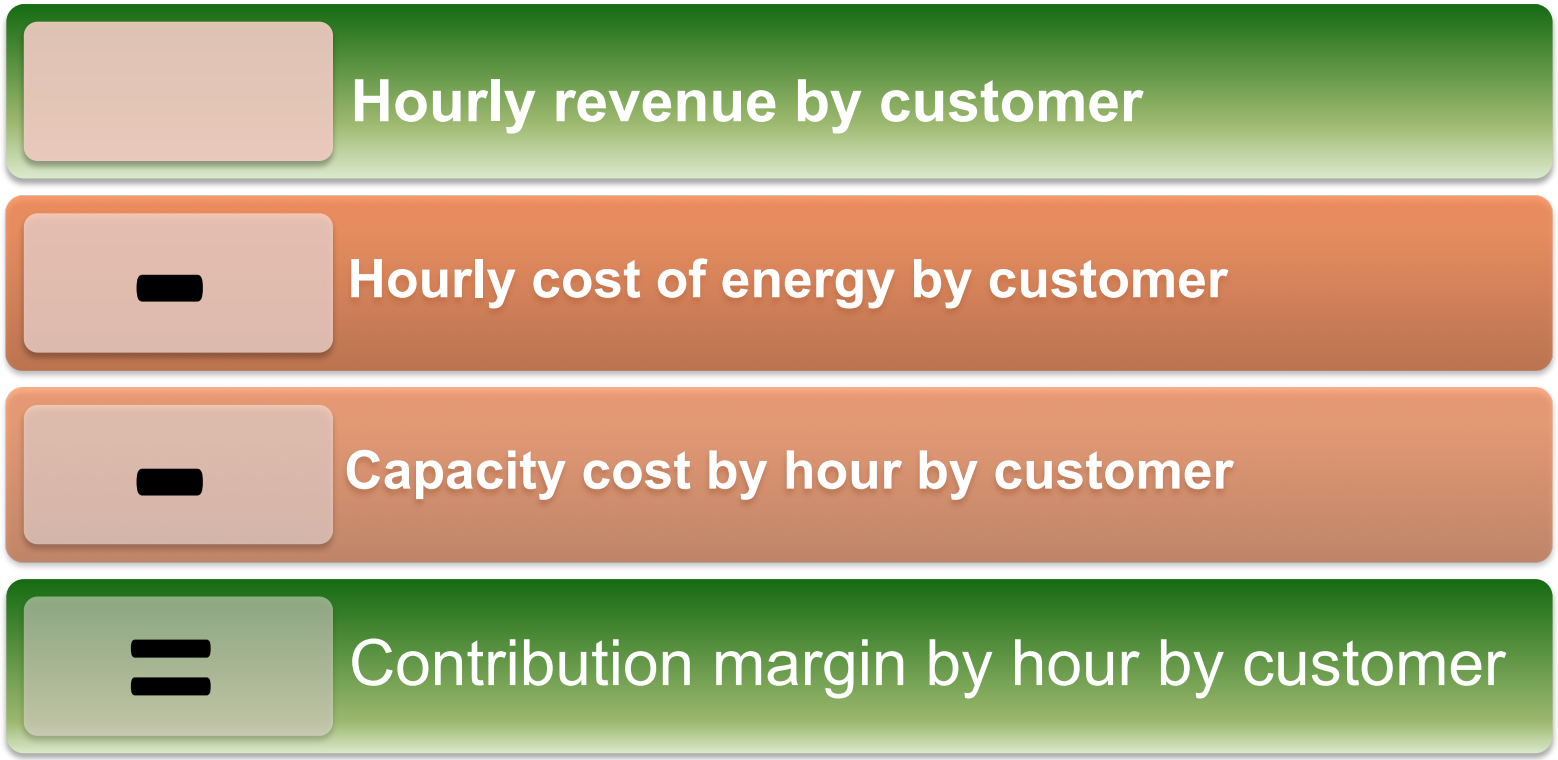
Contribution margin:

"Variable margin contributing towards fixed costs"



Calculates hourly profitability for each customer

Heat pump contribution margin calculation example

- Central ducted heat pumps increase sales by 4,000 kWh
  - 2,000 kWh to 15,000 kWh range
  - Energy sales margin = 16 c/kWh
    - →4,000 kWh x 16 c/kWh = $640/ year
  - Monthly transmission and annual system capacity cost = ~$250
  - Contribution margin = $640-$250 = $390/year
  - Delivers incremental margin with little incremental network costs
- Doubles customer margins of an average home

- However, margins range from $200 to $1,500 per year!
- Target customer prioritization matters

Margin analysis examples

- Case study:
- Heat pump contribution margin: $350/yr
- 1.3 million potential customers in the territory
- $455/yr million in potential contribution margin

- Also, electric vehicles represent another $540 million/yr in margin
- Together: 1 Billion of potential new contribution margin
  - Would flow directly to net income (but for regulated earnings constraints)
- Can invest significant sums in marketing and customer acquisition

Heat pump trends

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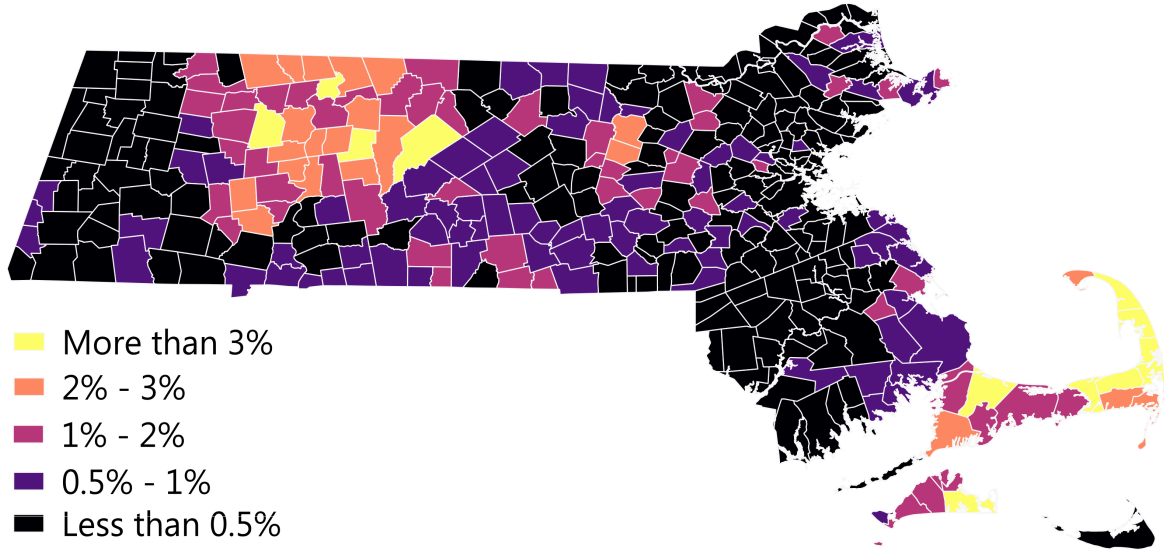
MA Heat pump sales Q4 2014 – Q3 2017

- **40% annual growth in the last two years**
- **Still: less than 10% of units sales are heat pumps**

MA Residential Heat Pump Market share



Excludes municipal utilities

- **Heat pump operating costs are competitive**
- Heat pumps will gain market share

Implications

- Economics of distribution utilities are changing rapidly
  - But electricity pricing strategies and product marketing is not keeping up with changes
  - Favorable economics and environmental benefits can be significantly accelerated
- Who will capture the changes in the energy value chain?
  - Utility customers in the form of lower rates?
  - Utility shareholders?
  - Both?
  - Other? LBO firms?
- Results in:
  - Significant changes in utility programs (e.g. electrification over energy efficiency)
  - Significant changes in regulations & regulatory strategies (for both utilities and regulators)
  - Investments by utilities
  - Mergers & Acquisitions

Final thoughts

- Every utility is unique; can't always apply AMI meter data analysis lessons from other utilities
- Benefits are best captured by those who analyze their own meter data
- Extraordinary alignment of interests from electrification
  - Environmental benefits (significant emissions reductions)
  - Utility shareholder economics (growth & higher earnings)
  - Customer economics (lower electric rates)