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Don't Be Fooled Again with Thermostats:
Market Review, Design Considerations, and Early Findings of Savings Potential for Smart Thermostats

Presented at the 2015 ACEEE National Conference on Energy Efficiency as a Resource

September 22, 2015

DISPUTES & INVESTIGATIONS • ECONOMICS • FINANCIAL ADVISORY • MANAGEMENT CONSULTING

Table of Contents

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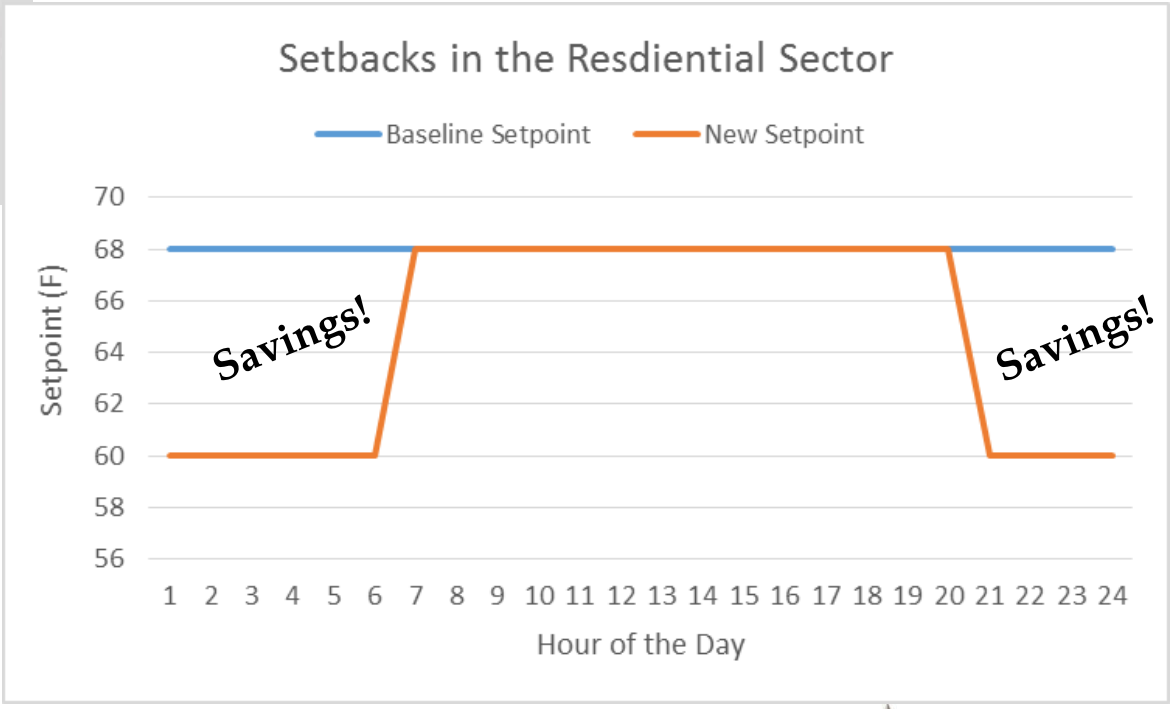
What we thought would happen…



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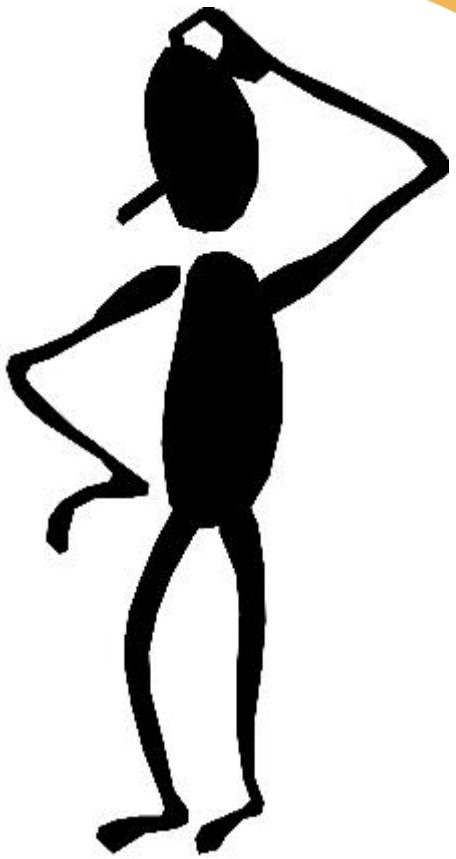
What happened…



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Vendors made it easy to program.

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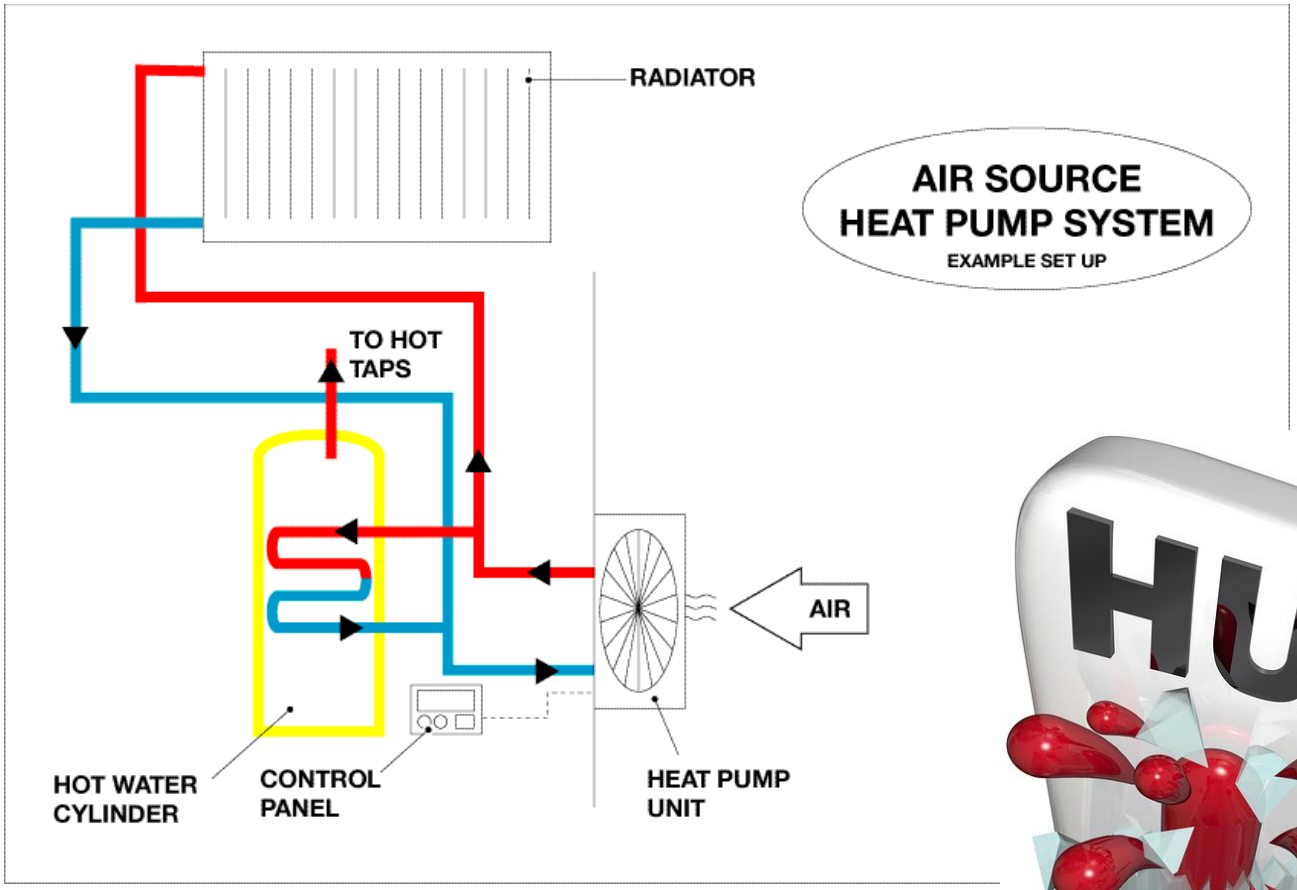
Vendors made it possible to perform HVAC diagnostics remotely.

Vendors are implementing HVAC control algorithms to save even more energy.



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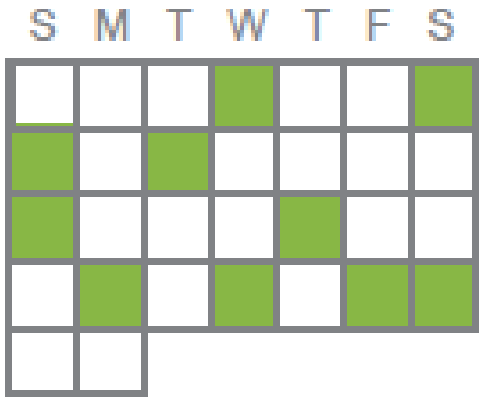
Vendors are opening up new possibilities for behavioral savings.

You earned 10 Leafs

The national average: 21 Leafs this month.

You earn a Leaf by saving energy for at least an hour a day. Learn about the Leaf ›



10 Leafs in
JOHN'S HOME

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Vendors made demand response attractive.

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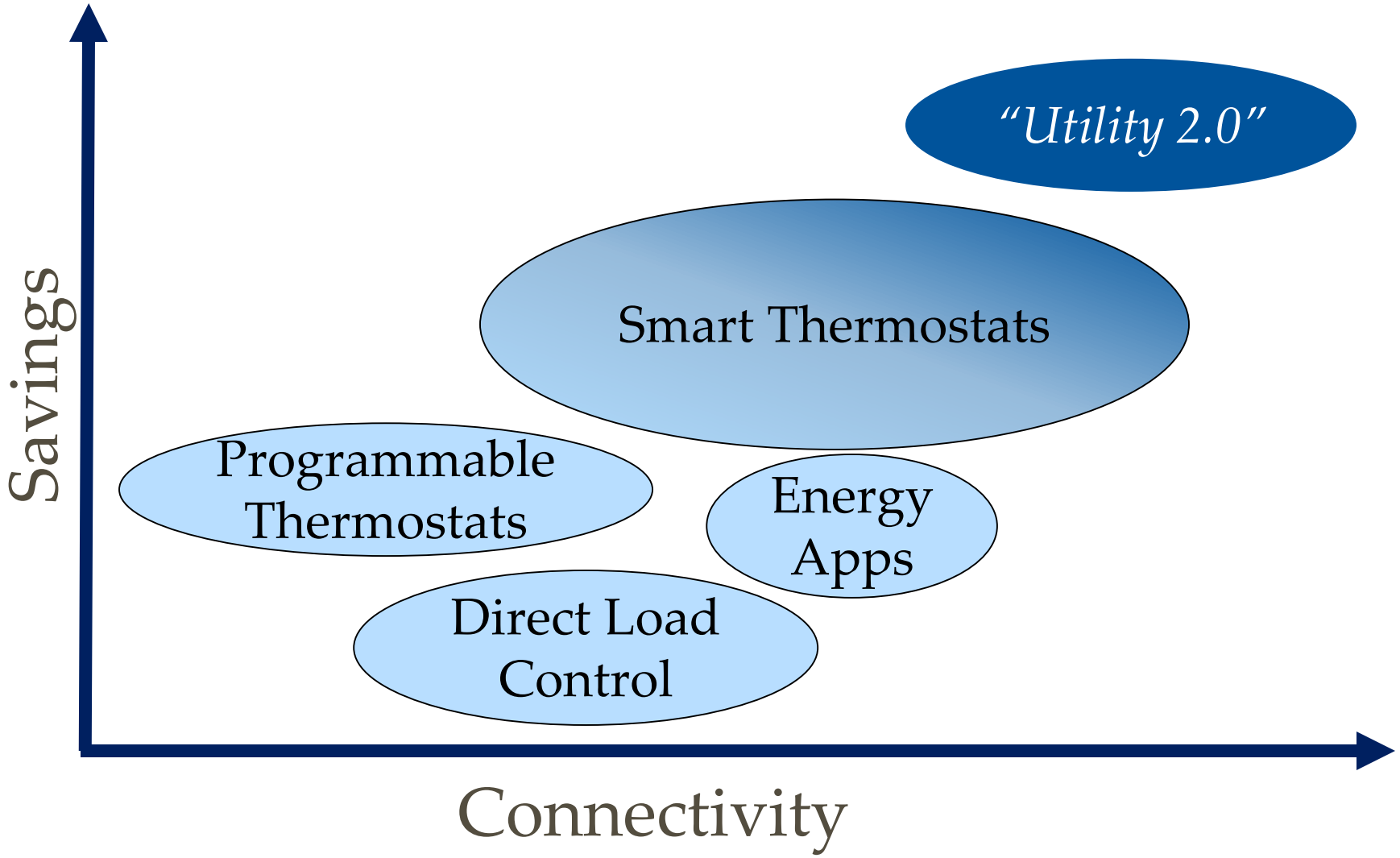
What's really probably happening…



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Thermostats can be thought of in 3 tiers.

Tier	Title	Definition
Tier I	Programmable Thermostats	• Customer programmed set points schedule
Tier II	Communicating Thermostats	<u>Tier I features, plus</u> • Remote customer access to adjust set points • Remote utility control of set points for demand response (DR)
Tier III	Analytics-Capable Thermostats	<u>Tier II features, plus</u> • Additional energy savings features through analytics • Enhanced customer engagement • Enhanced program planning and evaluation with robust customer-specific datasets

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There are several promising vendors offering Tier III solutions.

» Tier III vendors typically provide 1 of 2 types of solutions:
  a) Software that pairs with certain thermostats or
  b) A software/hardware bundle

Software-Only	Software/Hardware
comverge energy made better EnergyHub™ ECO FACTOR	ecobee Schneider Electric Honeywell 

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» **What do you want from smart thermostats:**

- Energy savings?
- Demand response?
- Customer engagement?
- A testbed for concepts from "Utility 2.0"?

Energy Savings

- We have not seen clear evidence that Tier II saves more energy than Tier I
- Tier III thermostats save more energy, but they are expensive
  - They may carry retail costs, software platform fees, annual per thermostat software fees, and labor costs

- So…
  - If you are benefit-cost constrained, you may want to look at Tier I or II
  - If you have an energy savings target, you probably want to look at Tier III

Smart thermostat energy savings are not directly comparable to savings from programmable thermostats.

	Programmable Thermostats	Smart Thermostats
Estimation Method	Energy simulation	Econometric regression billing analysis
In-Service Rate (ISR)	Additional factor (i.e., separate from % savings)	Inherently combines ISR with % savings
Baseline	As defined	Real-world
% Savings	% of heating and cooling load	Typically % of total bill

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» There are some decisions to make…

Incentive: Thermostat or Software?

- **Option1:** incentivize customers to purchase the appropriate thermostat
- **Option 2:** avoid the retail cost by incentivizing customers who already have the appropriate thermostat to participate in DR events

Customer Control?

- **Option1:** take full control over the thermostat during events
- **Option 2:** allow customers to opt-out of each event

DLC?

- Option 1 + Option 1 = ~DLC?

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Test Utility 2.0 Concepts & Evaluate Your Success Towards these Goals

Customer Engagement

- What do they want to know about energy?
- Are they excited about their energy/ thermostat app? What could get them excited?
- Are customers more engaged with their NFL app?
- What are engaged customers using the app for that other customers are not?

Use the Data

- Tailor marketing messages
- Supplement metering and survey efforts with data collected from smart thermostats

Test the Boundaries of DR

- Greater saturation
- With geographic specificity
- Targeted DR (as if the thermostat is an energy source)

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Program Design Comments

- **Benefit Cost Considerations**
  - What would the thermostats, labor time and software cost, including any monthly fees?
  - What level of product maintenance, customer support, marketing, and contractor training can the vendor provide independently from the utility?
  - Have the savings been third-party verified?
  - Are people going to start buying these thermostats without the program?
  - Programmable thermostats are a part of the baseline
  - How many customers are replacing a non-operating thermostat?

- **Service Territory**
  - What HVAC systems are compatible with which vendors, and what is the distribution of HVAC systems in your service territory? Are there additional fees for compatibility with certain HVAC systems?
  - What percentage of your customers has Wi-Fi and is willing to let the device connect through it?

Program Design Comments *continued*

» **Vendor Considerations**

- Will the thermostat be in-use and relevant 5 years from now? What other devices will it connect with?
- What impression will the device and software make on participants?
- What data will the utility and its evaluator have access to?
- Can the software be updated as new attractive features become available?

» **Delivery**

- Bring your own thermostat (BYOT) is a BIG logistical challenge
- Direct install (DI) avoids participants having non-functional equipment and complaining about the rebated product

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