Consumer Inputs Cost Vs Comfort Preferences

HEM interface enables consumer participation

Consumer Benefits

Convenience

Consumer Financial Benefits

Thermostat

Use Energy

Save Energy

Label A B C D E F G H I J K L M

Refrigerator

Use Energy

Save Energy

Label A B C D E F G H I J K L M

Water Heater

Other Devices
Variation on PAP 19

This White Paper is looking at standards gaps to support retail demand response aggregation at the residential level and possibilities of wholesale demand response aggregation at residential level.
B&P DEWG Systems and Devices Integration

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1. CAISO (California ISO) is an energy-based system for delivering information about energy to dispatchers and electric power transmitted by the ISO in North America.
2. Available through the eData system, which requires users to authenticate and is only available internally.
3. A Table Specific.
Existing Economics Work from PNNL

Transactive Cooling Thermostat Generates Demand Bid based on Customer Settings

- User’s comfort/savings setting implies limits around normal setpoint ($T_{desired}$), temp. elasticity ($k$)
- Current temperature used to generate bid price at which AC will “run”
- AMI history can be used to estimate bid quantity (AC power)
- Market sorts bids & quantities into demand curve, clears market returns clearing price
- Thermostat adjusts setpoint to reflect clearing price & temperature elasticity

* Price is normalized: $P^* = [P - mean(P)] / \sigma(P)$

Price

More Comfort

More Savings

Translates to: $k$, $T_{max}$, $T_{min}$

Indoor Temperature

Pacific Northwest National Laboratory
Existing Economics Work from PNNL

**RTP Double Auction Market – Uncongested**
- Market clears every 5-min (to match AC load cycle)
- When uncongested:
  - Quantity ($Q_{\text{clear}}$) varies with demand curve
  - Price ($P_{\text{clear}}$) is constant equal to base RTP

**RTP Double Auction Market – Congested**
- When constrained:
  - Quantity ($Q_{\text{clear}}$) is constant at rated feeder capacity
  - Price ($P_{\text{clear}}$) varies to keep load at rated capacity
Prelim High level outline for Whitepaper

Slider Interface valuation study

Intro

Economist opinion of most efficient system

Markets and ISOs  (PAP19? and B&P DEWG Systems and Devices sub-committee)

Public Utility Commissions (Regulatory and rate structures)

Aggregator’s business case

The whole home as a participant

Interface to make it all happen

Barriers to this approach

What Standard is needed? (Gaps in existing standards?)

What’s next?