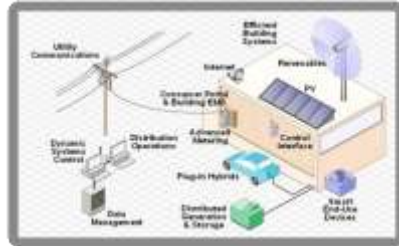




Unlocking Innovation in Information-Enabled Energy Efficiency



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MIT Energy Efficiency Strategy Project:

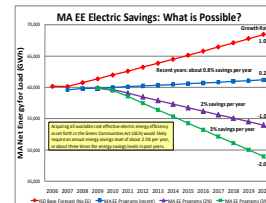


Designing an Ecosystem for Sustained Innovation in Efficiency

US Buildings consume 71% of all electricity, 55% of all natural gas

Target: 30% efficiency by 2030 with 4 Deployment options:

- EE by utilities (\$6B), carbon, DR value: *carrots*
- Codes and Standards: *sticks*
- Data and intelligence-driven: *information*
- New Business/Community Models: *innovation*



Approach: Lower consumer discount rates *change everything*.

Energy 2.0: Integrated Energy Innovation Ecosystem and Policy Framework

Connecting Systems:

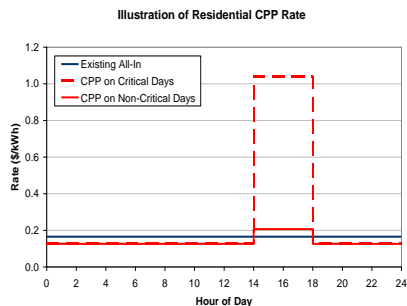
- **Disruptive Grid Innovations:**
 - Intermittent Renewables, Electric Vehicles, CHP, Microgrid, Storage
- **Utility/wholesale:**
 - AMI, dynamic pricing, demand response, efficiency-EERS, forward capacity, carbon
- **IP:**
 - “Smart buildings”, Home Networks
- **Markets/people:**
 - Data access, impactful diagnostics/format/functionality, 2.0 community/city systems.



What does the Smart Grid have to do with Energy Efficiency?

Potentially, three strategies:

- **Utility control of peak building energy use,**
- **Time-differentiated dynamic electricity pricing, and**
- **More frequent and granular energy consumption data to support operational improvements and behavior change.**



Consumer-responsive Architecture =
Providing consumers with energy diagnostics, feedback, control

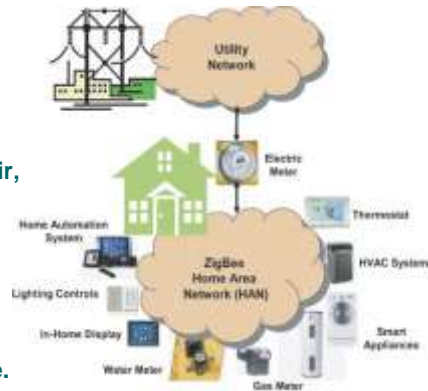
refers to systems for optimizing consumers' end-use needs (especially air conditioning, heat, hot water)

- *based on weather, schedules, and time differentiated costs.*

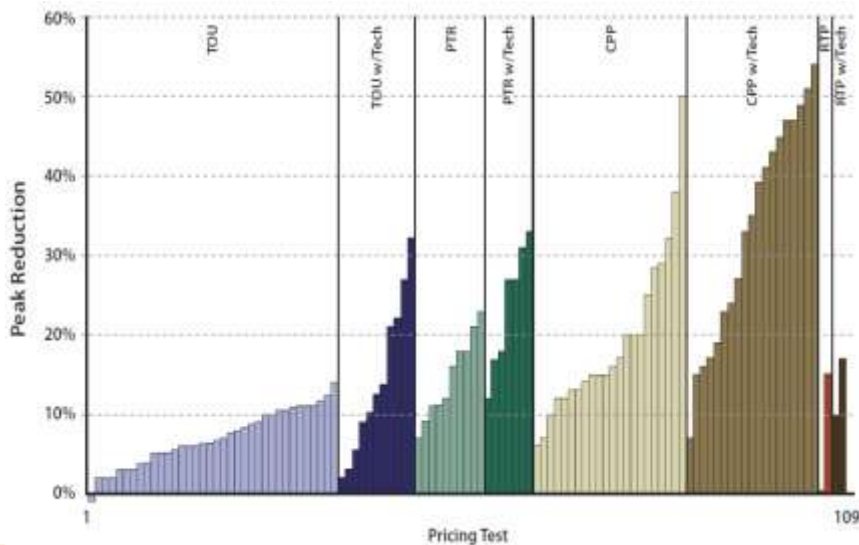
Time-differentiated rates are more fair, and some would argue inevitable.

Customer Responsive Systems work 24/7,

- providing efficiency as well as peak demand response.



2005 CA rate/technology impacts continue to be validated by other studies.



Granular Energy Data:

- energy diagnostics, feedback, control

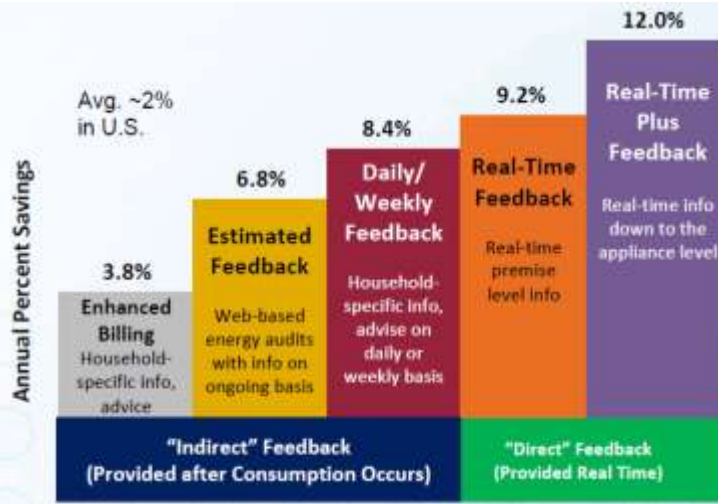
Behavior impacts of smart grid-based information options may be as high as 30%:



- Daily
- End-use
- Carbon Footprint?
- Collective Action?
- Fault-detection
- Thematic Control – *make me green*
- Control Precision
- Adaptive Control Strategies



Annual Savings from Feedback in Residential Programs (Ehrhardt-Martinez, Donnelly et al 2010)



Proposed Approach to Unlocking Efficiency Innovation: *Transparency and Democratization*



Perhaps “Green Button” is less about energy data, and more about:

Access to Efficiency, DR, and carbon mitigation measurement and rewards!

Transparency: Agreed-to methodology for interpreting energy with other publicly available info to enable:

- *Efficiency discovery (how much potential?)*
- *Efficiency measurement (how much saved?)*
- *Efficiency public credits (pass-through of regulatory benefits).*



Democratization: Policy-driven, long-term open access to savings benefits for businesses and communities.

- *Efficiency, DR, carbon mitigation open to new market innovators.*
- *Effective framework by which innovations are measured, and then rewarded based on results.*



Energy Innovation Flows from Putting “Cards Face Up”

“Sustained innovation is most likely if utilities/public policies create the enabling conditions for market-based systems”

- **Transparency:** “Green button” = “Efficiency meters”: *Making the invisible more visible.*
- **Democratization:** Enabling New Market Innovators to get: *Open easy access to credits*



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