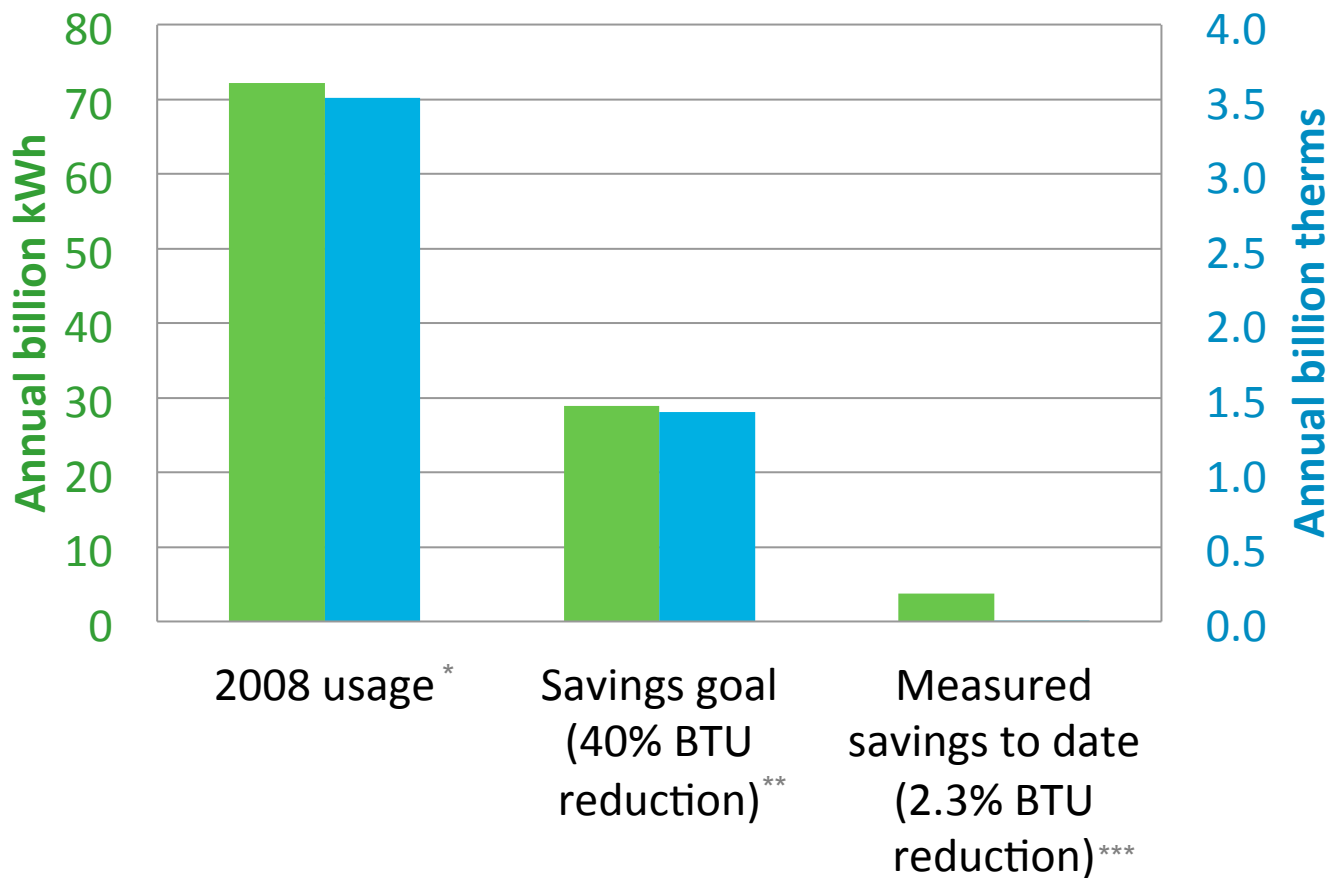


## What's missing from the current whole-house incentive program landscape?

- Behavior! Plug loads!
- While space conditioning and water heating upgrades are essential, other end-uses comprise nearly half of total energy use in California homes
- Successful feedback/behavior programs exist (e.g., in California: Opower, SMUD HER), but interventions aren't integrated with whole-house efforts

## BACKGROUND: California energy efficiency goals

*How much do we need to save in the residential sector?*

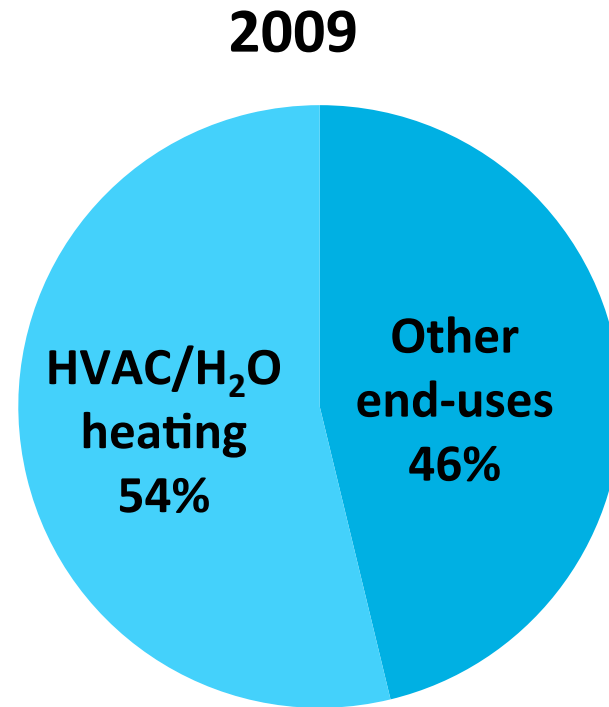
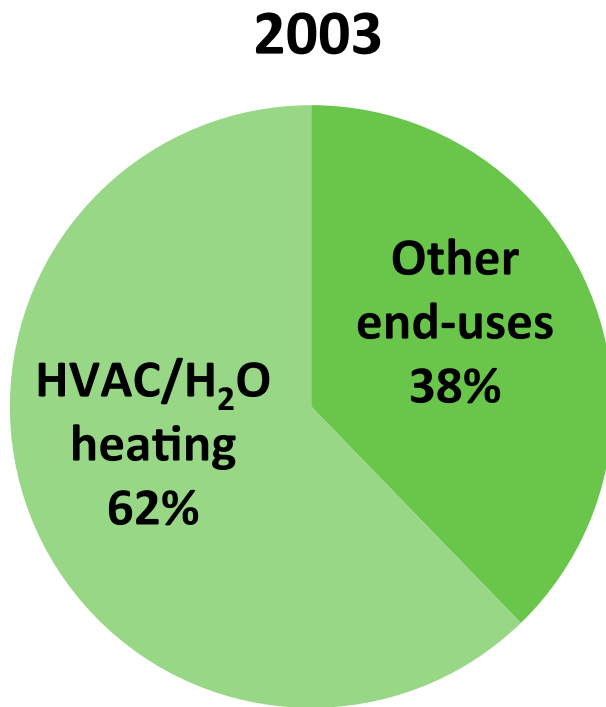


\* Source: KEMA, Residential Appliance Saturation Survey (RASS) for California, 2003 and 2009. <http://websafe.kemainc.com/rass2009/>

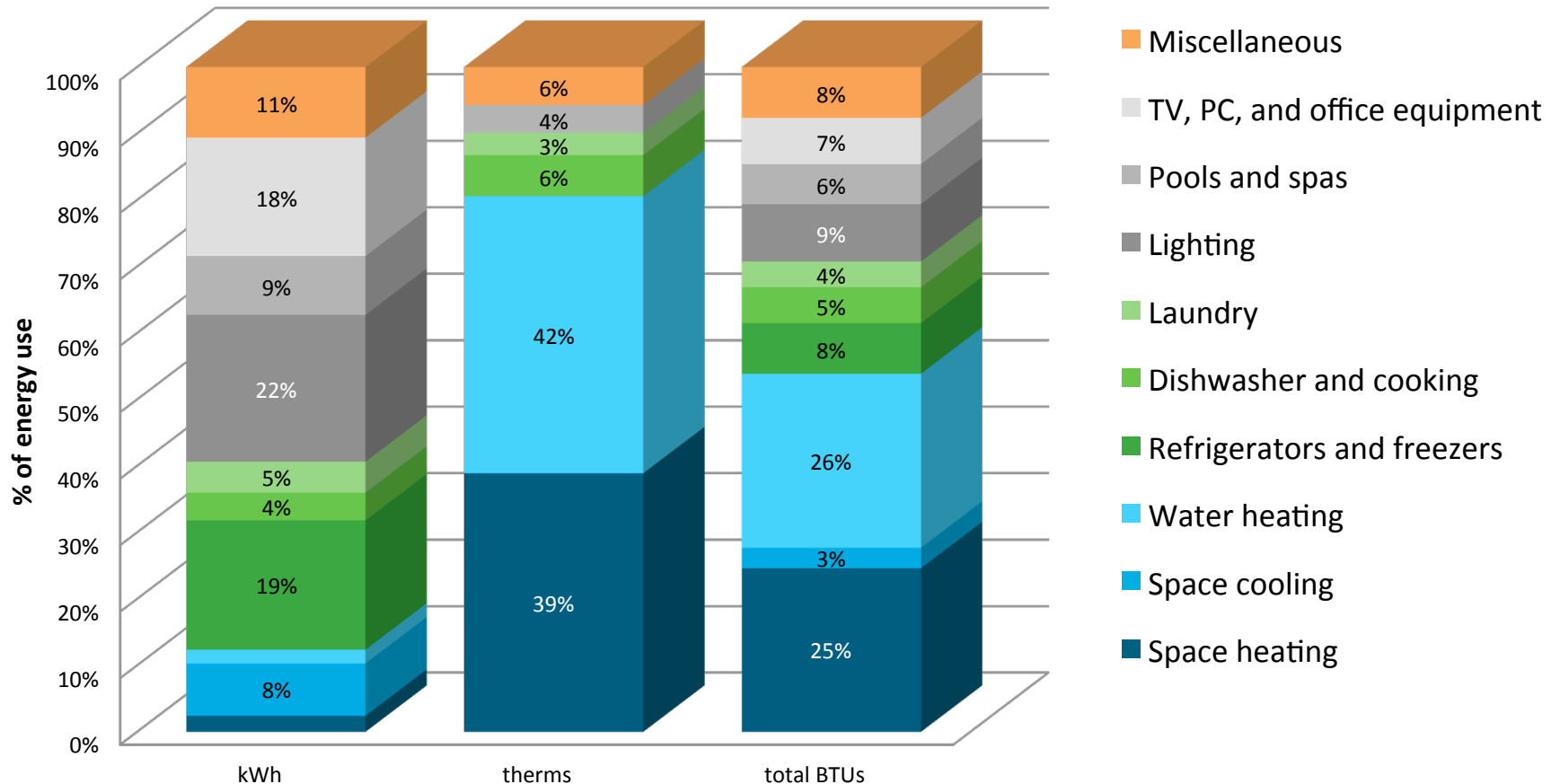
\*\* Source: *Energy Efficiency Strategic Plan* (2011) <http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/eesp/>

\*\*\* Among IOU and REN programs, Jan 2010-Aug/Sep 2013. Source: <http://eega.cpuc.ca.gov/>

## BACKGROUND: Where is energy used in California homes?



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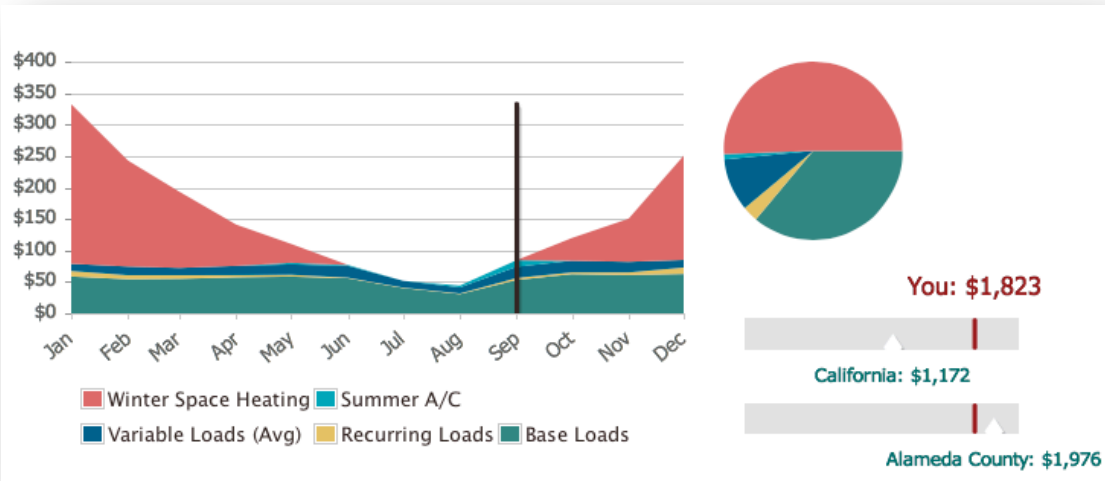




## BACKGROUND: What measures are included in current California whole-house incentive programs?

Measure	Home Upgrade	PG&E Advanced	SCE/SoCalGas Advanced	SMUD
HVAC equipment	✓	✓	✓	✓
Water heating equipment	✓	✓	✓	✓
Envelope measures	✓	✓	✓	✓
Pool pumps	✗	✗	✗	✓
Screw-in lighting	✗	✗	✗	✗
Plug loads	✗	✗	✗	✗
Thermostat settings and other behavior-based approaches	✗	✗	✗	✗

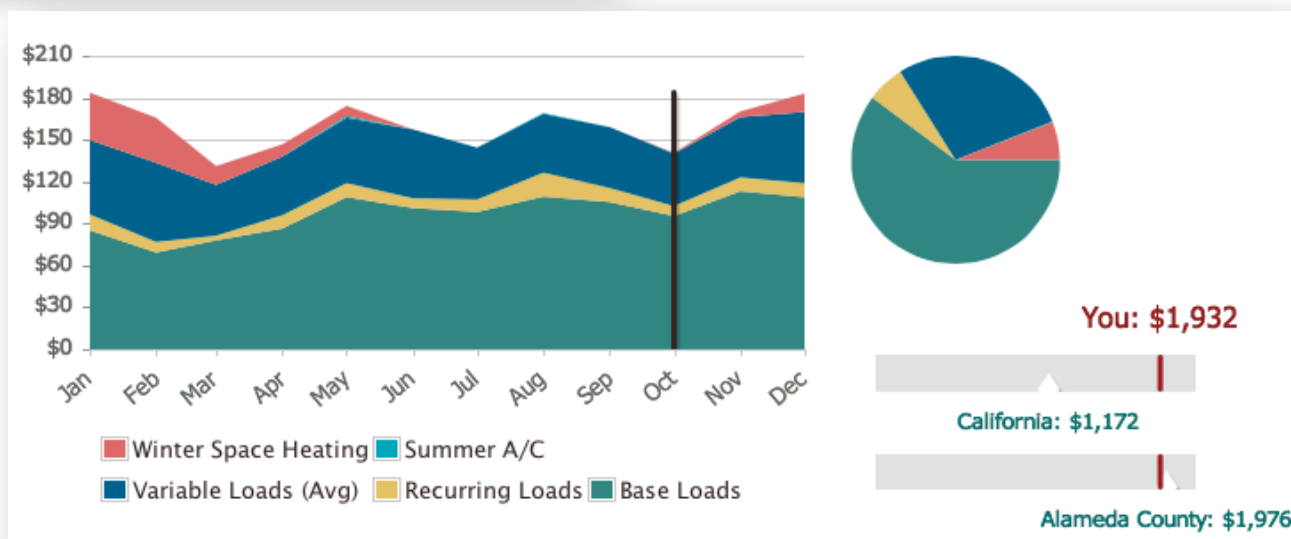
## Every home needs a unique savings plan



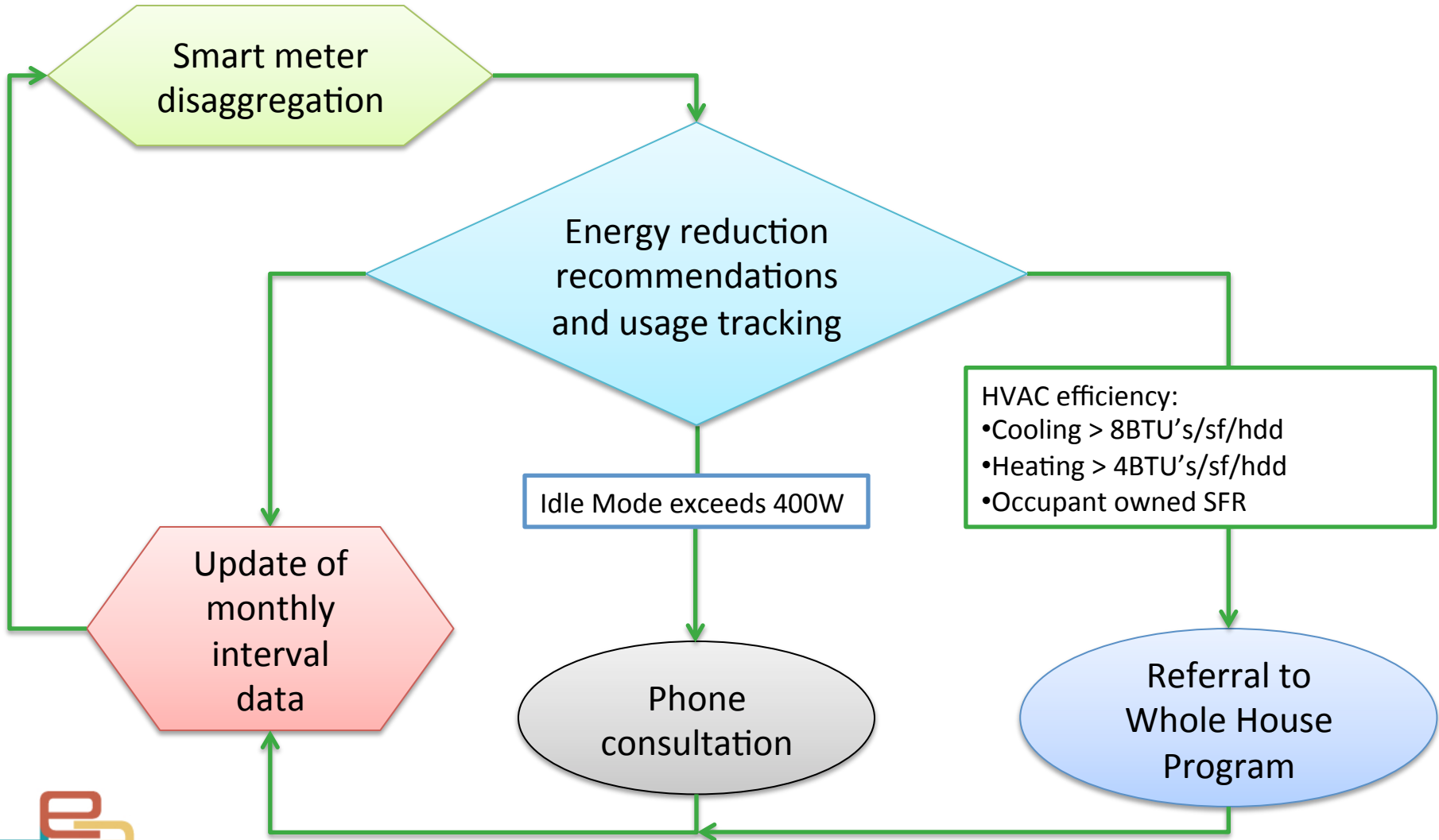
Similar annual energy bills (\$)

**BUT**

Different consumption patterns

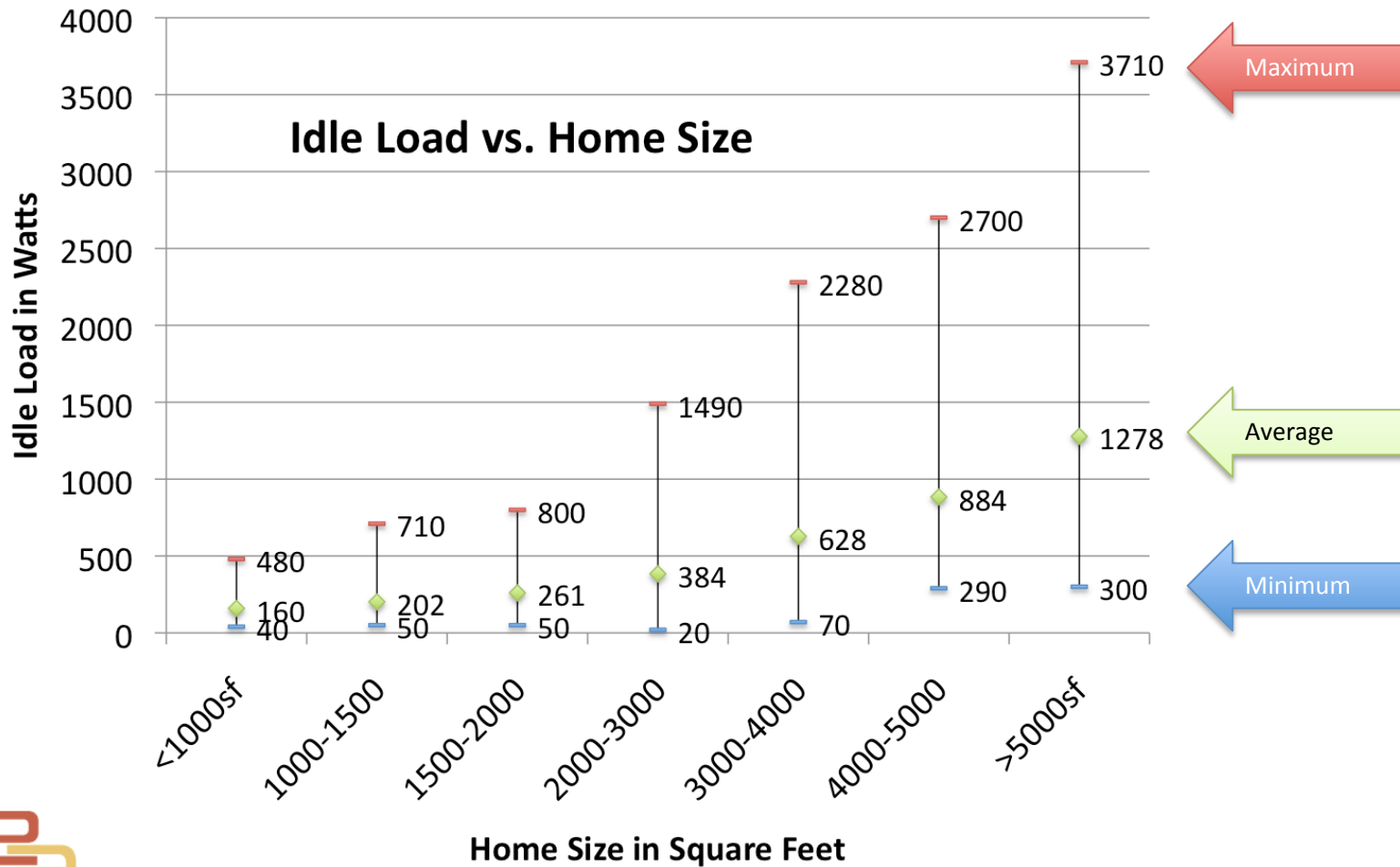


## Guide users to the best path for savings





## An example: Range of idle load by house size



## Policy and program design recommendations

### 1) Expand definition of “whole house” to include plug loads and lighting

- Include behavior feedback/recommendations among “measures”
- Behavior has greatest impact on plug loads & lighting, but operational settings on HVAC & DHW is also important
- “Behavior” includes decision to purchase efficient appliances & equipment

## Policy and program design recommendations

### 2) Sell multiple levels of upgrades under a single program umbrella

- Utilities currently operate loosely-integrated patchwork of incentive programs
- No- and low-cost behavior changes are a first and ongoing step to achieving deeper savings
- What about energy use attribution? We need to move beyond current paradigm of energy savings firewalls between programs
- Measure actual energy use via automated utility meter analysis; identify which measures contributed to what savings via disaggregation

## Policy and program design recommendations

### 3) Incentivize realized energy savings in addition to asset improvements

- Customer rebates can be tied to both physical upgrade and actual energy use reductions
- Emphasizes the importance of behavior and operational settings, contributes to sustained savings

## Policy and program design recommendations

### 4) Continue to quantify magnitude and persistence of energy savings from behavioral measures

- Build on wealth of existing studies and incorporate findings into cost-effectiveness tests
- Build and advocate for analysis techniques that allow attribution of behavioral savings within a comprehensive upgrade program



# Questions?

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