Nest Thermostat Heat Pump Control Pilot

Evaluation Findings

EnergyTrust of Oregon

Nest Thermostat Overview

Nest Heat Pump Control Pilot

Installations from:
Aug. to Dec., 2013

174 Participant Homes

299 Comparison Homes

Primary Research Questions

Participant Surveys

Two web surveys:

- Mid- and post-heating season
- High response rates (>60%)

Participants were homeowners

- Older, highly educated and relatively affluent

Billing Analysis Methods

- Analyzed 113 participants and 211 comparison
- Predicted average daily electric use with panel regression model, based on monthly billing data
- Controlled for weather (HDD and CDD), home square footage and year built
- Estimated difference between groups in change of pre-to-post usage with interaction terms
- Tested various models and reference temps for best fit
- Computed annual savings from coefficients using HDDs for typical meteorological year

Characteristics of Pilot Homes

Comparison homes were very similar to participant homes when compared by:

- Home age, size, construction
- Geographic distribution
- Annual energy usage

PILOT FINDINGS

What Did Nest Replace?

75% had programmable thermostat

- 85% claimed thermostat was programmed to adjust temperature

25% had manual thermostat

- 79% claimed they adjusted temperature at least daily

6% had thermostat with lockout capability

Installation Challenges

- Equipment eligibility
  - Did not have heat pump (A/C unit)
  - Multiple heat pumps
  - Ground source
- Wi-Fi and router problems
  - Lost Wi-Fi passwords
  - Mobile Wi-Fi hotspots not sufficient
  - Nest not compatible with all routers
  - Low signal strength at thermostat

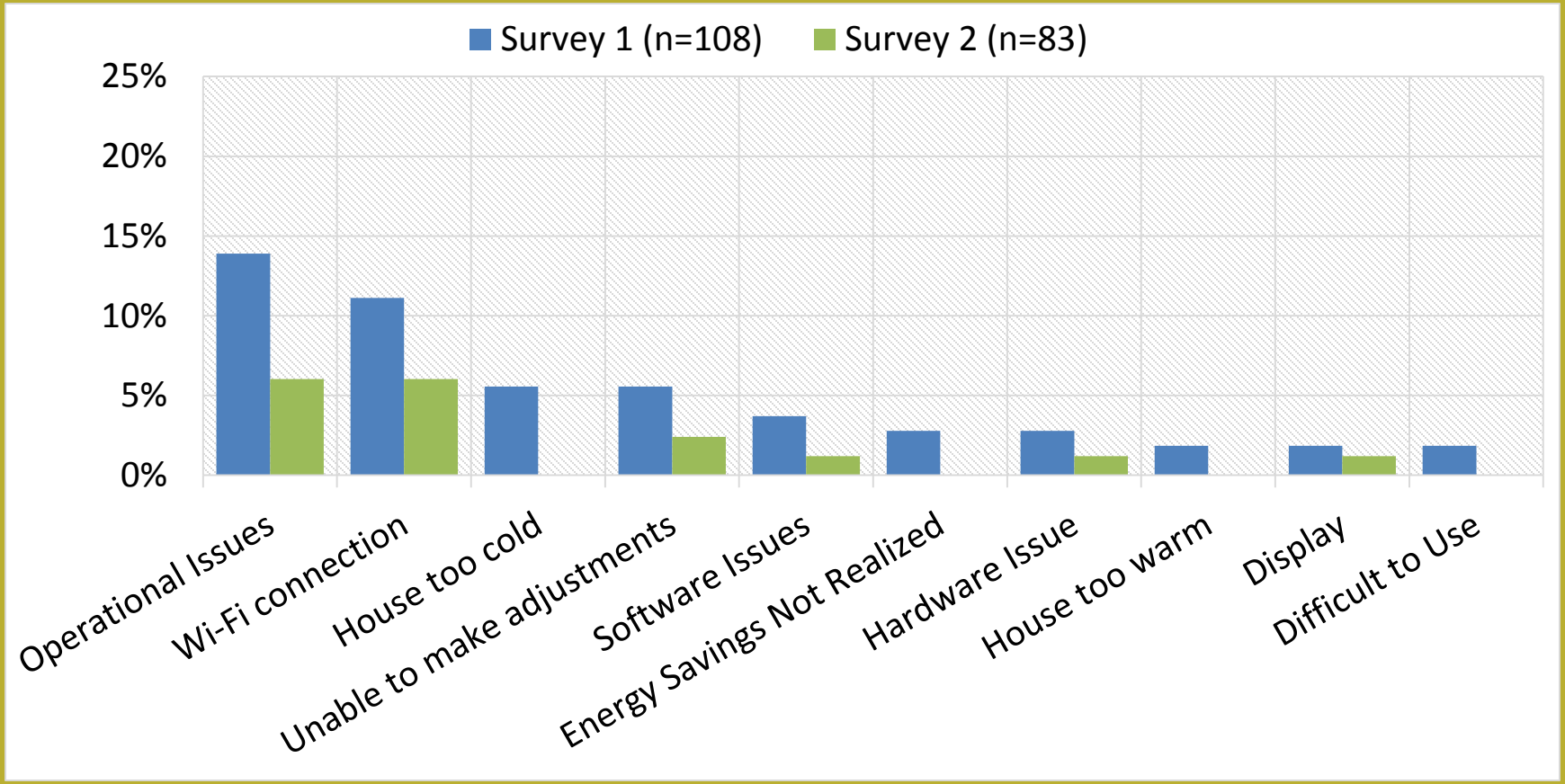
Technical Issues

- **5-7%** of sub-bases defective (1st gen)
  - 2nd gen sub-bases fixed the issue
- Wiring challenge with newer heat pumps with integrated controllers
- Elderly and non-tech savvy participants had difficulty setting Nest schedule
- Nest customer support was very helpful in overcoming technical issues

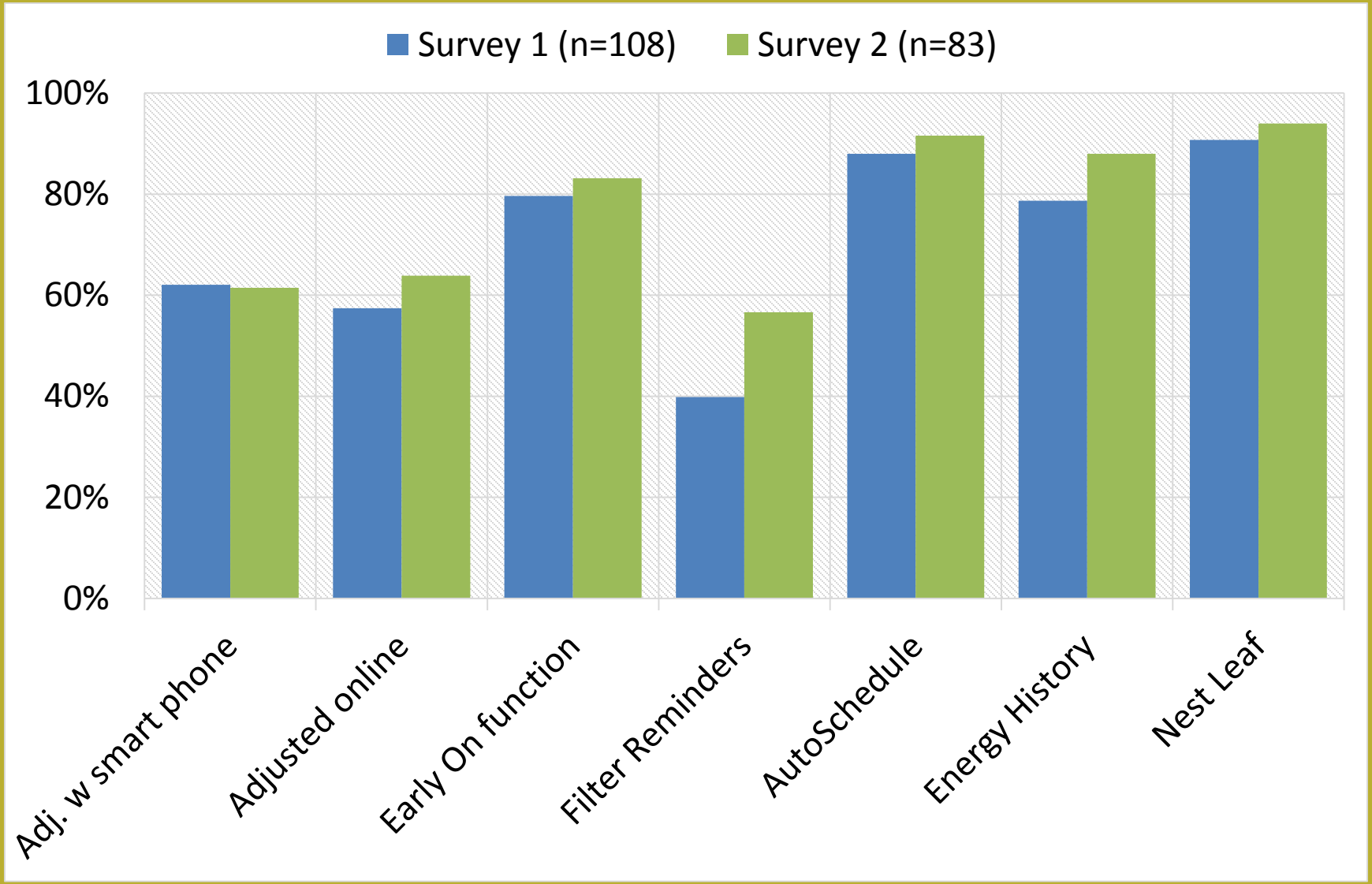
Post-Installation Problems

41% reported a problem in first survey

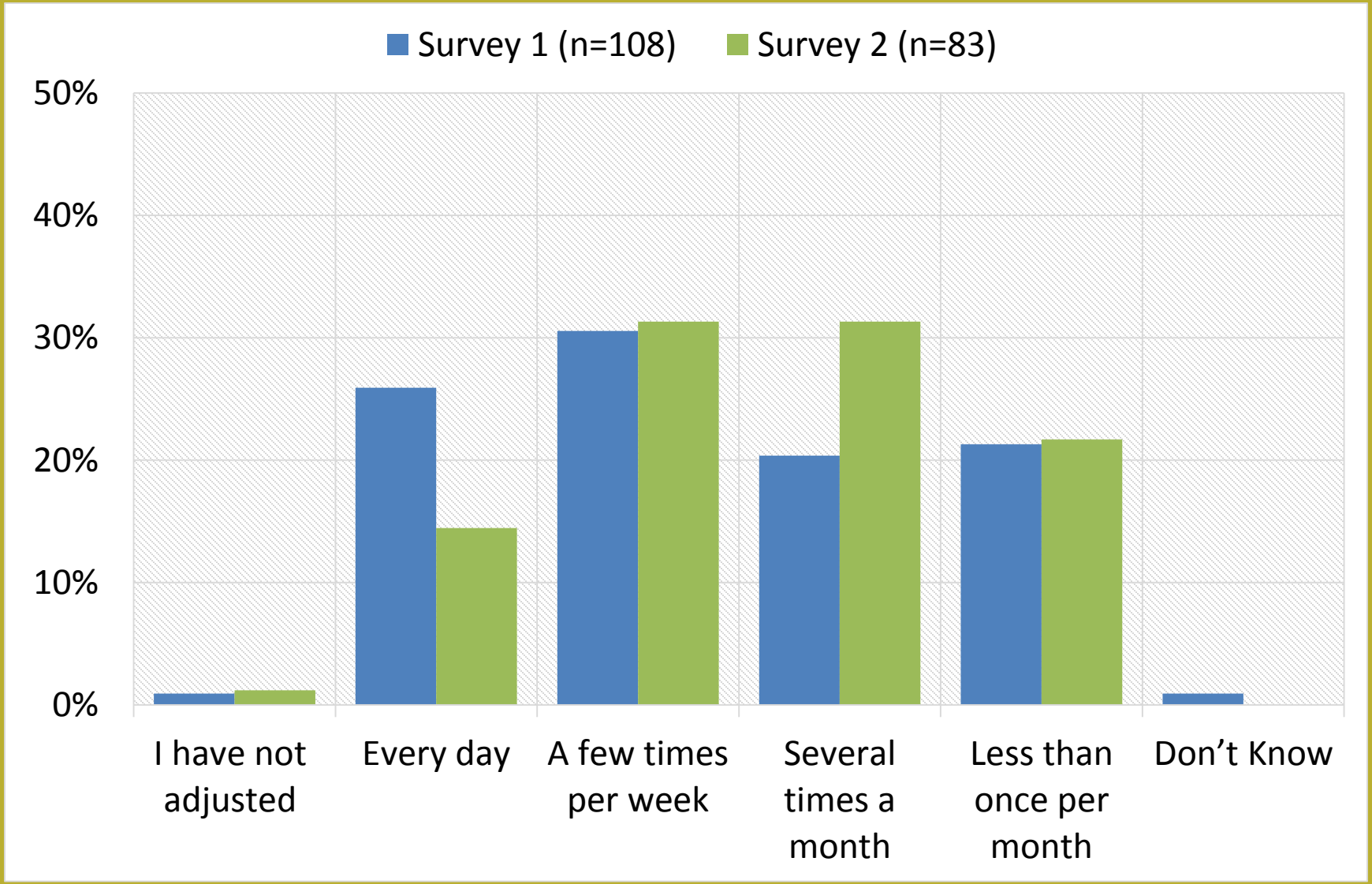
17% reported a problem in second survey



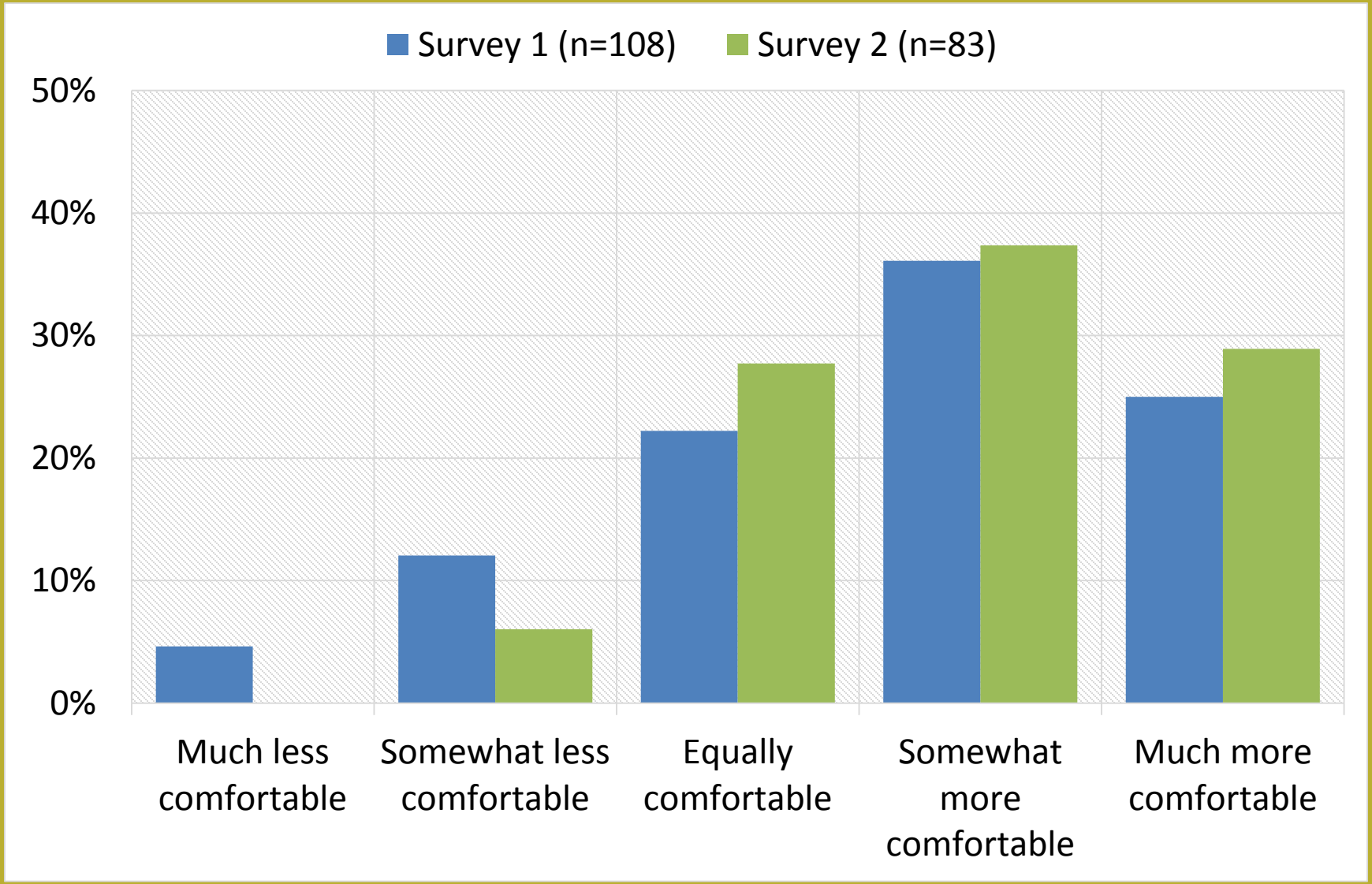
Use of Specific Features



Frequency of Thermostat Use



Home Comfort Compared to Pre-Nest



Participant Setting Changes

13% reported changing heat pump balance

- 2/3 reset to “Balance”
- Primarily changed due to cold house

20% reported turning Auto Away off

- Primarily changed because Auto Away was triggered when people were at home

Satisfaction with and Value of Nest

93% said that Nest was easy to use

89% were satisfied with Nest (4 or 5)

62% thought Nest was worth full retail price

- 34% said this even if no energy savings

- Lowering bills and savings energy were primary reasons for participating

ENERGY SAVINGS

Electric Savings Results

780 kWh / year electric savings (+/- 465)

4.7% total electric load savings

12% heating load savings

Just heating savings – no cooling season data

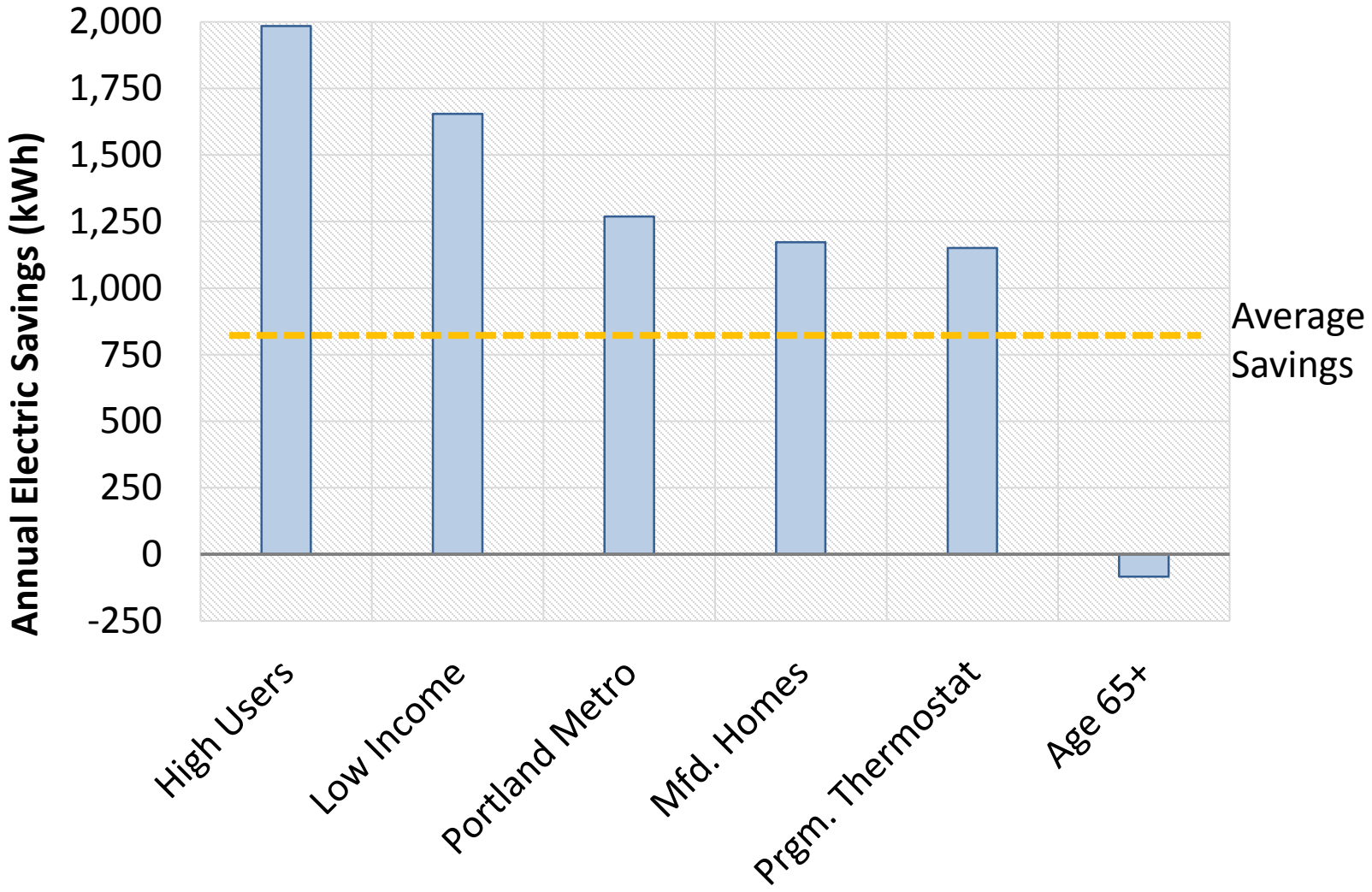
Nest Heat Pump Balance Data

Backup heat runtime with Max Savings was **half** compared to other settings

7.7% use of backup with Max Savings

15.4% use of backup with other settings

Savings by Subgroup



Conclusions

- Many installation and technical issues encountered at first, but resolved
- Significant heating savings for heat pumps
  - Preliminary – need full year of follow up
  - Valid for direct-install only, not self-install
  - Varied by subgroup
- Participants were highly satisfied with Nest
  - Primary driver: Energy savings

Recommendations

- Nest is a viable energy saving technology that can be rolled out on a larger scale
- Analysis results can serve as deemed savings for Nest with heat pumps
- Provide troubleshooting guide and support to participants to address most common issues
- Subgroup findings could be used to better target customers
- Recruit customers by emphasizing energy savings and home comfort
- Some technical issues could have been identified in advance

Next Steps for Energy Trust

- Moving forward with expanding incentives and promoting Nest for heat pump homes
- Considering different delivery and verification methods (contractor vs. self-install)
- Target tech savvy population, high users, lower income and manufactured homes
- Moving forward with an advanced thermostat pilot for gas furnaces that will include Nest

Find the full report online at:
energytrust.org/reports

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