



# *Springing Forward!*





# *Springing Forward!* Collaborative Research on Smart Thermostat Savings Potential

**Moderator:** Jim Perich-Anderson, Evaluation, PSE

**Panelists:** Keshmira McVey, BPA

Phil Kelsven, BPA

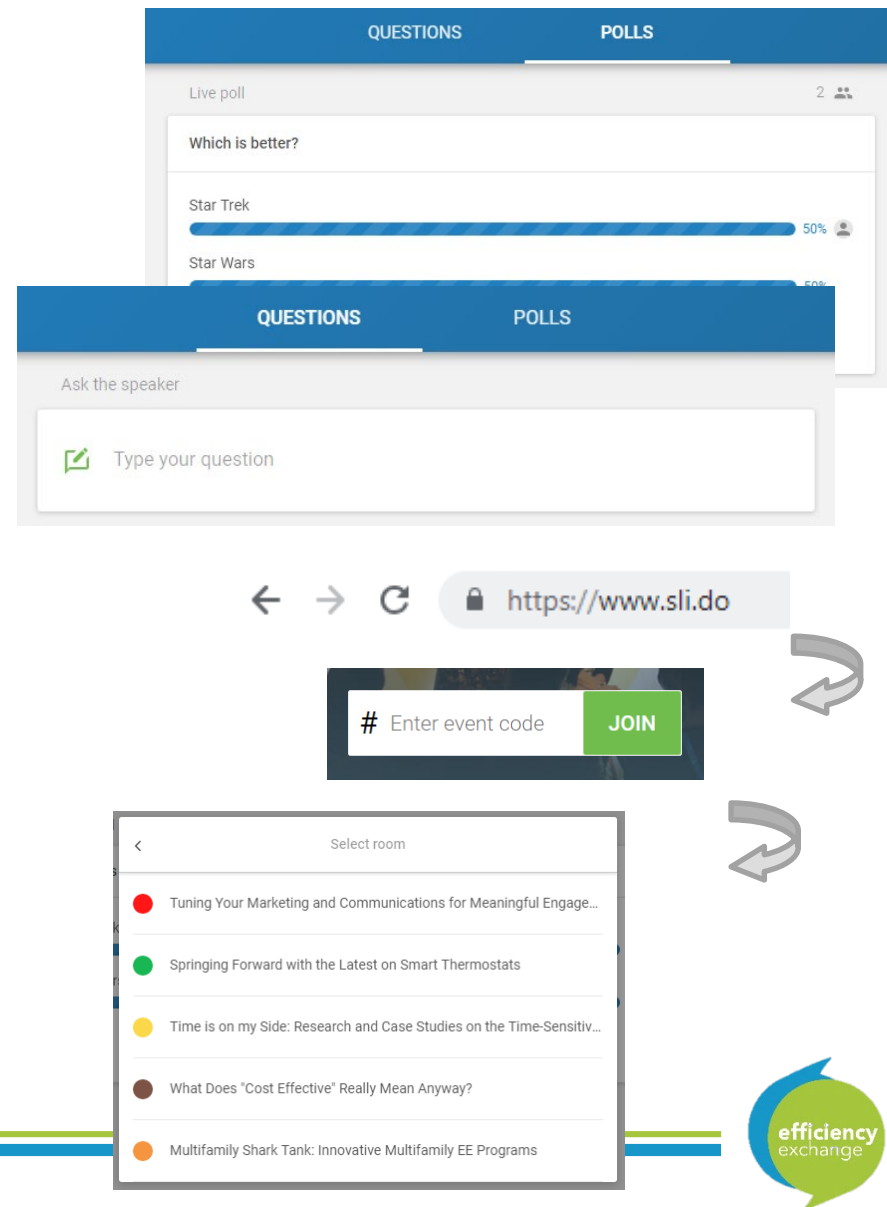
Dan Rubado, Energy Trust of Oregon

Clint Stewart, Residential Programs, PSE



# This panel will be moderated using Slido

- What does this mean?
  - Panelists may poll or survey the audience
  - Questions can be asked at anytime from your laptop or mobile device
- How?
  - Visit the website “Sli.do” from your browser on your laptop or mobile device
  - Enter event code: **Y676**
  - Select **Springing Forward** from the room list at the top of your screen

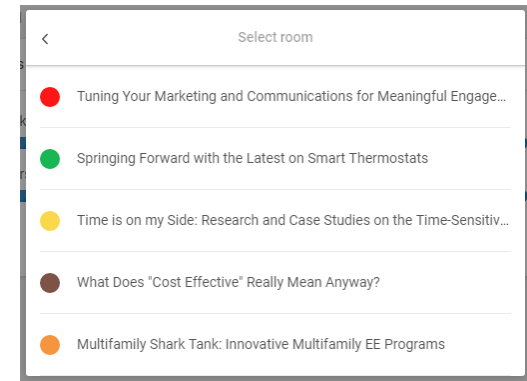
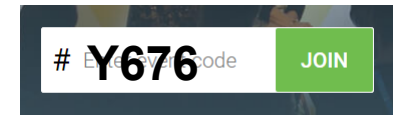
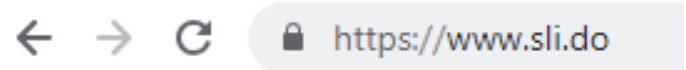




# Audience Survey

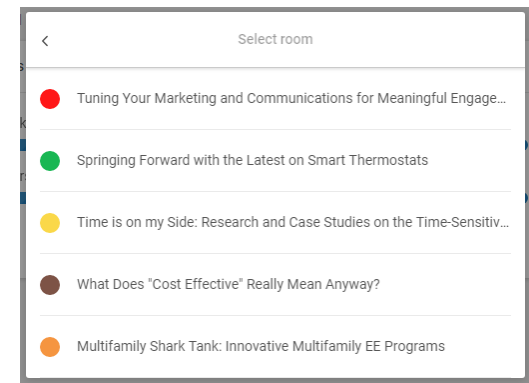
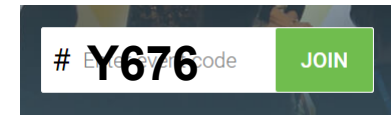
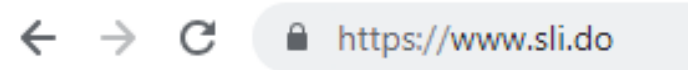
# Audience Survey Part I

1. What are your roles (official and unofficial) related to energy efficiency?
2. What kind of Smart Thermostat do you have at home?
3. What do you hope to learn about Smart Thermostat technologies today?



# Audience Survey Part 2

1. What do you consider to be the top three benefits of Smart Thermostats?
2. What do you consider to be top three drawbacks to Smart Thermostats?





# Audience Survey

1. What do you consider to be the top three benefits of Smart Thermostats?
2. What do you consider to be top three drawbacks to Smart Thermostats?



# Market Transformation in the PNW

<https://www.youtube.com/watch?v=Pt29gIMtTSo>

Keshmira McVey, Program Manager Emerging  
Technologies  
Bonneville Power Administration







# Smart Thermostats – A Technical Overview

Phillip Kelsven, Energy Efficiency Planner,  
Bonneville Power Administration



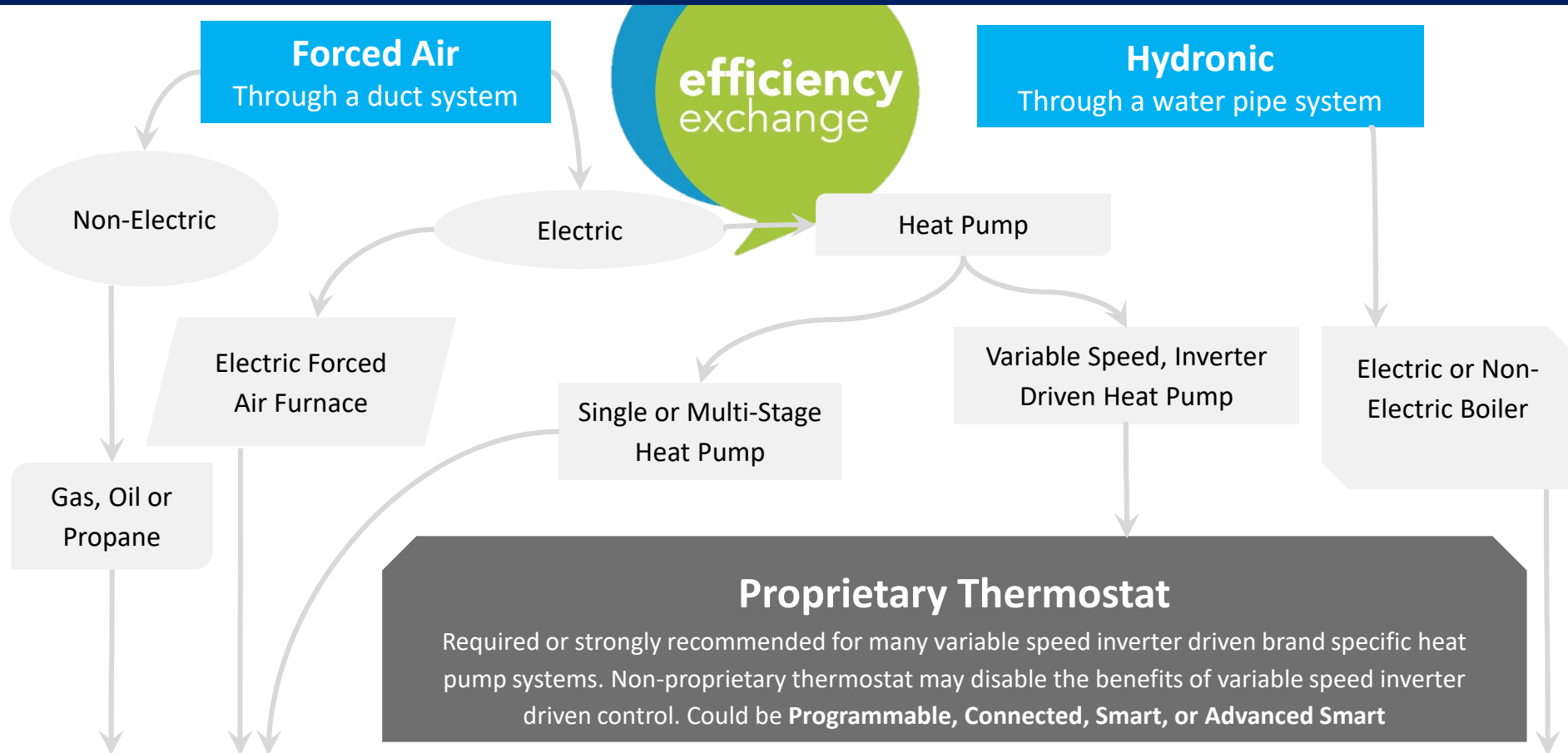
# Agenda

- Thermostat applications and features
- A primer on heat pump controls
- Delivery Channels
- Opportunities and Barriers

# Help! Features and Applications

- There are a lot of choices in the market for thermostats, how to make sense of it all?
- HVAC system determines a path to available products
- Features desired determine a path to available products

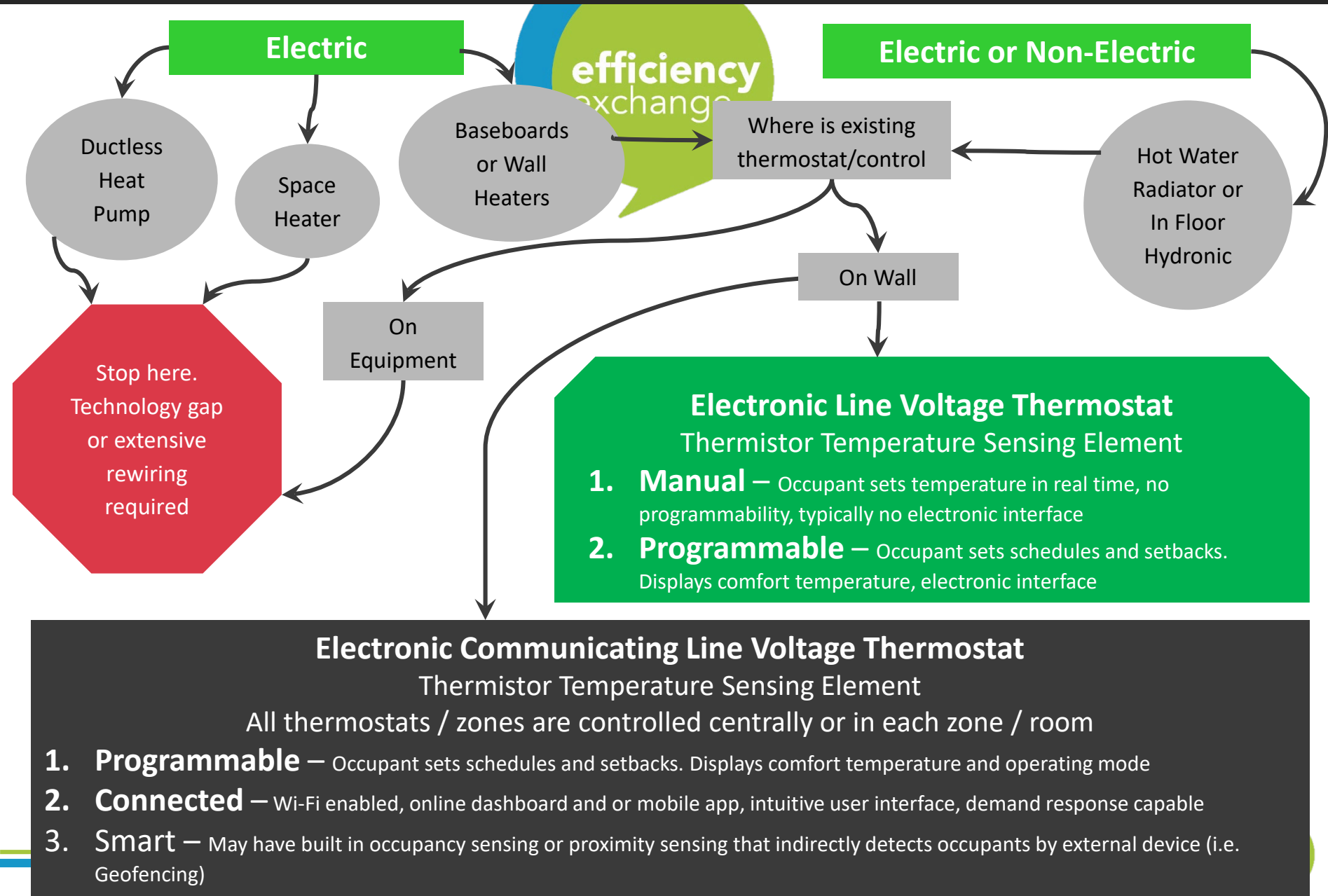
# Central Heating/Cooling System — Duct or pipe distribution from central source and control



## Thermostat — 4 Categories

1. **Programmable** — Occupant sets schedules and setbacks. Displays comfort temperature and operating mode
2. **Connected** — Wi-Fi enabled, online dashboard and or mobile app, intuitive user interface, demand response capable
3. **Smart** — Proximity sensing that indirectly detects occupants by external device (i.e. Geofencing) and adjusts temperatures based on occupant preferences
4. **Advanced Smart** — Occupancy sensing that directly detects occupants by internal sensor, heat pump optimization, learning algorithms, research-proven savings

# Zonal Heating /Cooling System — Multiple sources each with its own control



# Heat Pumps

- A special application of smarter thermostats
- Control of energy intensive auxiliary resistance heat
- Energy Star will soon have a % auxiliary run time criteria for connected thermostat certification
- Inverter driven variable speed air source heat pumps may require the manufacturers proprietary thermostat

# Delivery Channels

- Traditional rebate, send us the form and receipt
- Midstream retail
- Midstream retail with coupon
- Midstream HVAC contractor
- Direct Install
- Utility online store
- Manufacturer / Utility online store

# Opportunities and Barriers

- **Opportunities** to increase adoption and savings
  - Retail
  - Manufacturer Data
  - Demand Response ready
  - Weatherization potential / diagnostics
- **Barriers**
  - Retail
  - Manufacturer Data
  - Run away measure
  - Heat pump compatibility
  - User churn



# Smart Tstats – More than one type

**Connected:** Residents can control thermostat remotely, easily scheduling, track system runtime and receive feedback about energy consumption.

**Learning:** automatically creates schedule based on user setpoint adjustments and occupancy pattern.

**Geofencing:** – automatically adjusts to ‘away’ mode or occupied mode based on detects proximity of residents’ smart phone

**Occupancy sensors:** automatically adjusts to ‘away’ mode or occupied mode based on occupancy sensors

**Line Voltage Communicating Thermostats:**

Can have capabilities of other devices, but with less fluctuation in temperature.



# Exploring the Promise of Smart Thermostats

Dan Rubado, Evaluation Project Manager, Energy Trust of Oregon

# Energy Trust Smart T-s Research



2013-2014: Pilot of Nest as a heat pump control

- 12% heating savings
- High satisfaction and comfort ratings

2014-2015: Pilot of smart t-stats with gas furnaces

- 6% heating savings for Nest, -5% for Lyric
- High satisfaction and comfort ratings for Nest, not for Lyric

2016: Launched full-scale incentive for Nest and ecobee and began promoting widely

- Nearly 20,000 t-stats installed to date
- Energy savings of ~1.8 GWh and ~480,000 therms

2019: Large-scale billing analysis of Energy Trust smart t-stat participants

- Preliminary results confirm earlier pilot findings

# Energy Trust Smart T-s Research



Future Potential: ~100 GWh (11aMW) and 15 million therms per year in Oregon homes

Oregon Electric Applicable Homes	
Market	Total Elec Units
Single-family	216,830
Multifamily	18,838
Manufactured	89,429
Total	325,098

Oregon Gas Applicable Homes	
Market	Total Gas Units
Single-family	459,150
Multifamily	11,784
MH	5,318
Total	476,252

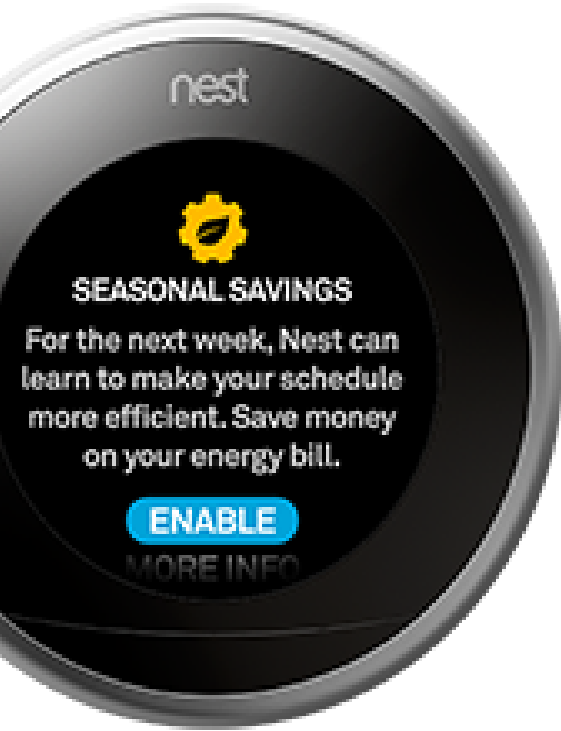
Oregon Residential Electric Technical Potential	
Market	Total Elec Savings
Single-family	71,770,862
Multifamily	4,897,882
Manufactured	29,601,050
Total	106,269,794

Oregon Residential Gas Technical Potential	
Market	Total Gas Savings
Single-family	14,692,787
Multifamily	294,611
Manufactured	170,164
Total	15,157,562

# T-stat Optimization

**Primary goal: Save energy through minor changes people won't notice**

- Software algorithms adjust setpoints, mostly at night and when away



**2016-2017: Pilot: Nest Seasonal Savings**

- 5% heating savings, essentially zero cooling savings
- Relatively low satisfaction and comfort ratings

**2018-2019: Other optimization services**

- Ongoing Randomized Control Trials (RCT) of Whisker Labs seasonal optimization service

# NEEA Smart T-stat Research

NEEA convened a task force to develop a research strategy for Smart T-stats

- **Primary Goal:** Develop method to estimate energy savings based on t-stat performance metrics—enable quicker product screening
- Method will align with ENERGY STAR Connected Thermostat labeling process and data requirements
- NEEA research strategy will:
  1. Establish firm savings estimates for smart t-stats in different scenarios using billing analysis
  2. Correlate energy savings with t-stat performance metrics based on t-stat data
  3. Periodically collect t-stat data to update performance metrics and savings for various models

## Research will begin in 2019.





# Exploring the Promise of Smart Thermostats

Clint Stewart, Market Manager,  
Residential Energy Management, PSE



# PSE Research – Past & Present

- 2013 Honeywell web-enabled thermostat field trial
- 2018 Geo-targeted gas demand response pilot
- 2019 Nest “Rush Hour Rewards” pilot
- 2019 Smart Thermostat impact evaluation
- **2017-present Line Voltage Connected Thermostats (LVCT) field trial**





# LVCT Field Trial

- Community Energy Efficiency Program (CEEP) Grant
  - Significant market opportunity
  - Hard-to-reach multifamily customers
  - Energy Efficiency Emerging Technologies LVCT research paper
- Pilot design
  - Evaluate energy savings potential & user acceptance
  - Randomized control trial
  - Leverage existing multifamily direct-install program infrastructure
- Honeywell (Phase 1)
  - 583 thermostats, 264 units, 17 buildings, 2 properties
- Sinope (Phase 2)
  - 792 thermostats, 312 units, 8 buildings, 3 properties



# LVCT Phase 3

## Mysa Empowered Homes

- Promising smart features
- Close coordination with manufacturer
- Joint partnership with BPA and WSU
- 747 thermostats, 290 units, 25 buildings, 3 properties



# Challenges & Opportunities

- Property recruitment
- Multiple contractual obligations and budget timelines
- Manufacturer delays on feature rollout
- High tenant and property staff turnover
  - Easily accessible operating instructions & training videos
- Low device pairing rates for phase 3
  - Resident engagement and education on benefits

# Breakout Session

- Homeowners
- Renters
- Apartment Building Operators
- Program Managers



# Discussion Questions

- Who controls the temperature?
- For savings, or comfort?
- Who pays the energy bill?
- Who pays for a new thermostat?
- What features should the thermostat have?
- *Would you pay to have it installed?*



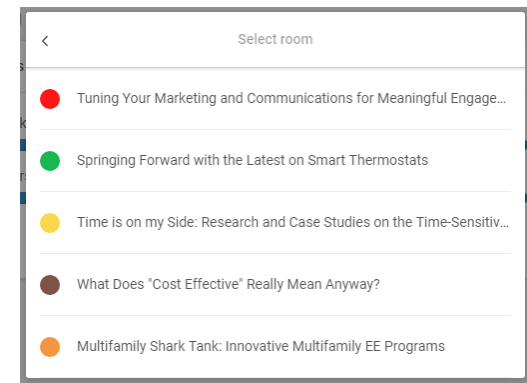
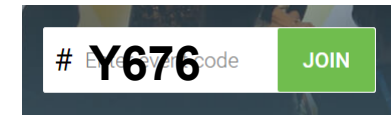
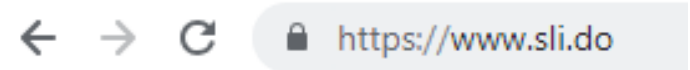


# Audience Survey (part 2)

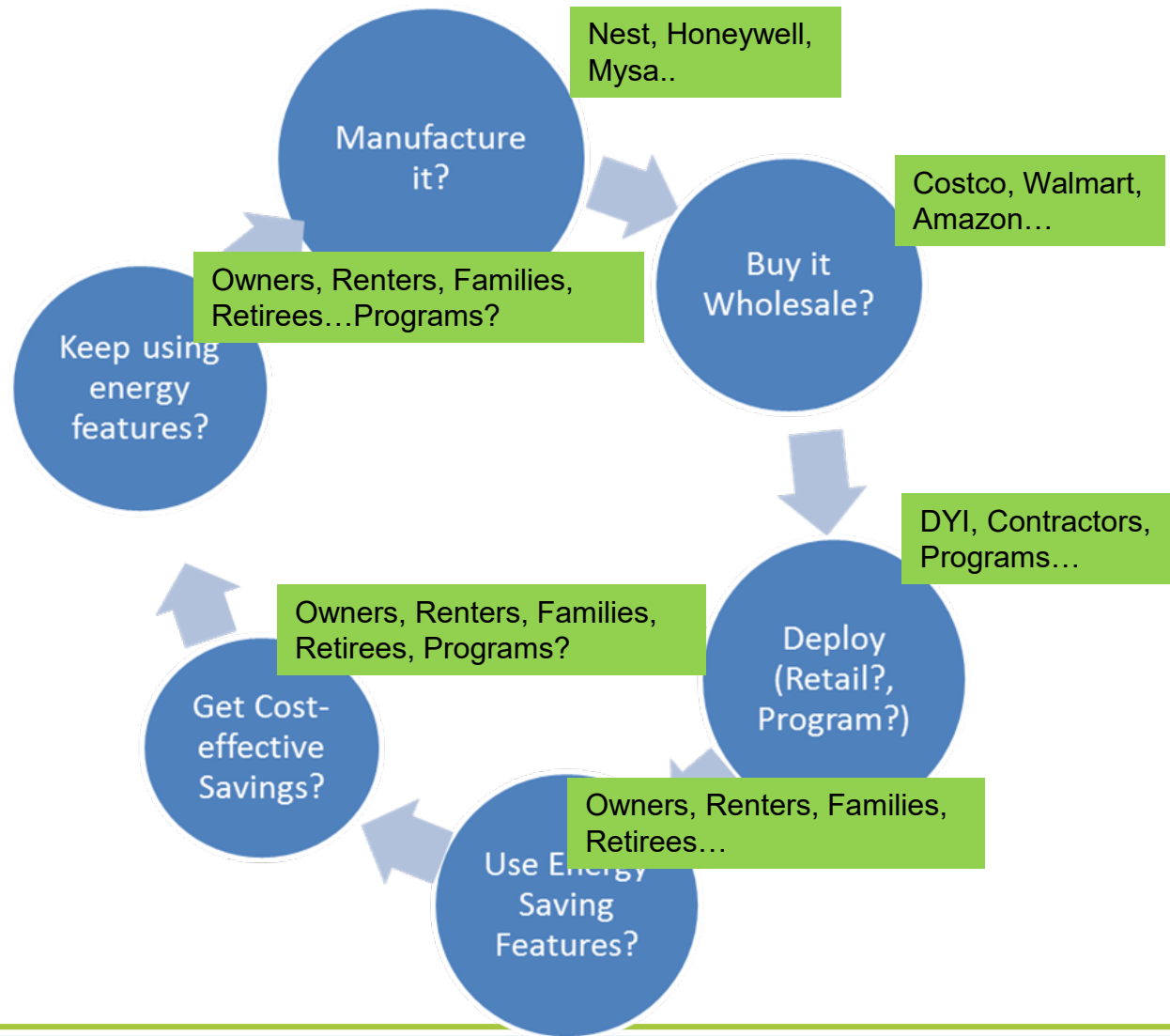


# Audience Survey Part 3

1. What do you consider to be the top three benefits of Smart Thermostats?
2. What do you consider to be top three drawbacks to Smart Thermostats?



# Moments of Truth...will they...





The background features a stylized illustration of a landscape. In the foreground, there is a light blue body of water, possibly a lake or a wide river. Behind the water, there are rolling hills or mountains covered in a dense forest of evergreen trees. The trees are depicted in various shades of green and blue, creating a layered effect. The overall style is clean and modern, typical of environmental or sustainability-themed graphics.

# 2019

**COEUR D'ALENE, ID**  
MAY 14-15

The logo for 'efficiency exchange' is located on the right side of the image. It consists of a green speech bubble with a blue arrow pointing upwards and to the right, entering the bubble from the bottom left. Inside the green bubble, the words 'efficiency' and 'exchange' are written in white, lowercase letters, stacked vertically.

efficiency  
exchange