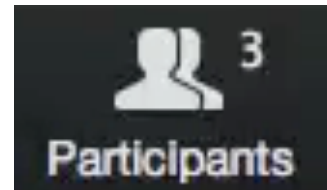# NW Energy Coalition Webinar

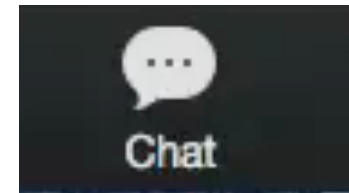# Flexible Demand

July 1st, 2020

Using Zoom in today's webinar
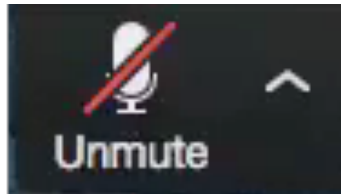
Unmute only
when it is your
turn to speak

Raise hand or
view the list of
participants

Ask questions
in the chat

NW Energy Coalition Webinar
Flexible Demand

- **Conrad Eustis,** REASCEND

- **Jeff Harris and Geoff Wickes,** Northwest Energy Efficiency Alliance (NEEA)

- **Tony Koch,** Bonneville Power Administration (BPA)

- **Moderated by Fred Heutte,** NW Energy Coalition

NW **Energy** Coalition
for a clean and affordable energy future

ANSI/CTA-2045 as the Enabler of Flexible Load
i.e.
Making the Communication link Cost Effective

Conrad Eustis

NWEC Webinar   July 1, 2020
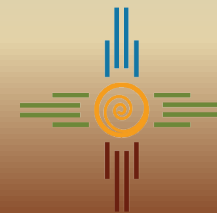
REASCEND

Are you Hungry for the arrival of **Sustainable** energy?

- We'll need a lot of storage to shift solar and wind energy to periods like windless nights

BUT

- Shifting load to times when renewable energy is available is both cheaper and lower impact than making and installing storage

- Shifting load is critical to lower costs, but how do we make this easy for customers?

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CTA-2045 Vision in 2005 & History

- In the age of modern Internet, the demand response focus has been on the "home gateway"; this does not address cost effective access to devices themselves

- Need standardized communication access (like USB) on all major devices

- Specification work 2008 to 2012 (EPRI & SGIP)

- Prototypes and define device response 2012 to 2015

- NW Demonstration 2016 to 2018

- Washington State HB 1444 signed June 2019

What Good are Words if You Can Not Speak?
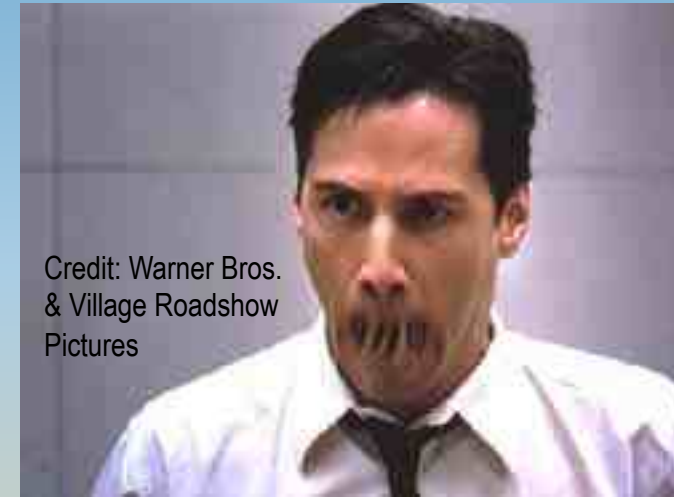
Credit: Warner Bros. & Village Roadshow Pictures

What good is a gateway if appliances can not hear?

CTA= Consumer Electronics Association
CTA is an accredited by ANSI, the American National Standards Institute

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- A communication port standard like USB

- Like USB, the appliance port enables flexibility and prevents obsolescence

- Customer "plugs in" communication device
  - Sent by utility or aggregator

- Communication device can support any type of communication link: e.g. Wi-Fi, 4G LTE, utility AMI network, HomePlug, ZigBee, etc., or any **FUTURE** communication protocol

- CTA-2045 supports any standard DR control language: e.g. OpenADR, SEP, BACNet, etc.

- OEM devices can "speak" one standard language, and the aggregator a different one

- **Enables common customer experience across all products!** (This is critical for high adoption.)

DR = demand response
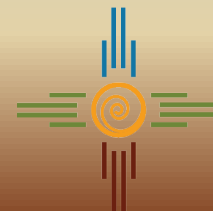
REASCEND

Standard Customer Experience
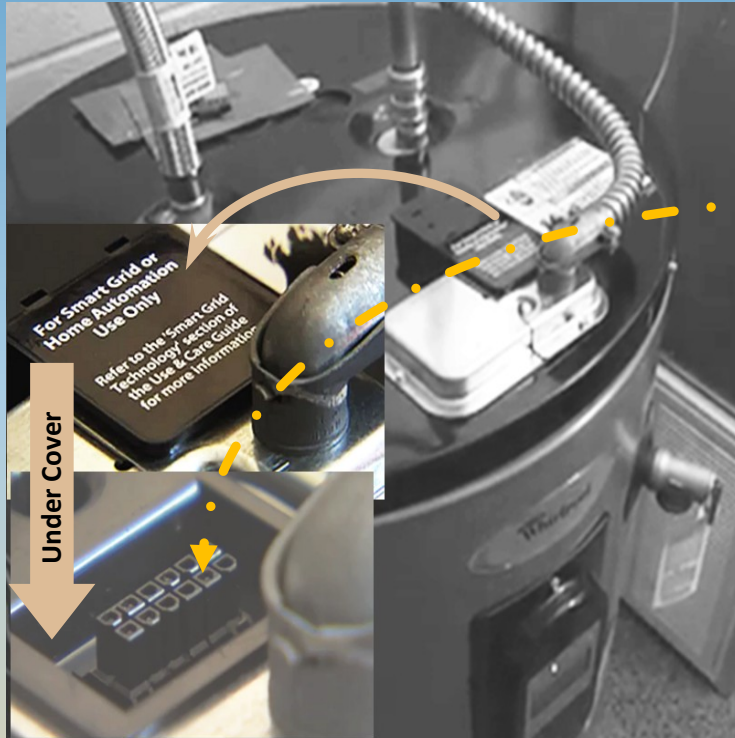
ANSI/CTA-2045 "plug" on communication device

Under Cover

AC and DC powered devices

- The E-Radio device above "hears" control commands **broadcast on FM** radio; water heater data returned by Wi-Fi **if enabled by Customer.**

- **The FM option can work in 99+% of US**, (including rural areas) today

SkyCentrics
s/n: **20F85ED33B8F**
Code: **BE4B2F**
Mdl: US03A
23.2016

1.6 inch

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NW Regional CTA-2045 Demonstration

BPA funds and leads project with two IOUs and six PUDs

www.BPA.gov/goto/smartwaterheaterreport

Objectives:

- Quantify 24x7 load shifts; including "on-peak"
- At least 2 events per day…every day
  - ~600 DR events in 220 days
  - ~300 customers
  - Test both resistance & HP WHs
- Measure customer satisfaction
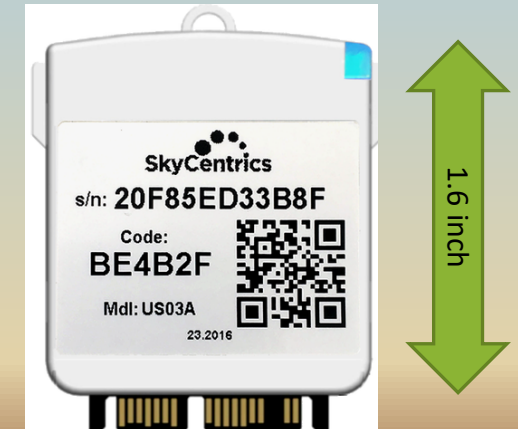- Conservatively quantify benefits
  - Benefits will increase over time
- Create a CTA-2045 market transformation plan [thank you NEEA!]
- Determine cost effectiveness
- Create stakeholder awareness of CTA-2045 benefits

Results:

- B/C of 2.6 compared to peaking plant with all costs included
- In OR & WA 301 MW and $230 million in net savings
- Conservative present value, if extrapolated to US, $4.3 billion
- Customer satisfaction: 80% very satisfied; low lifestyle impact because of CTA-2045
- Willingness to enroll in future program: 73% very likely;   21% somewhat likely
  - Benefits estimated based on 26% enrollment over 15 years
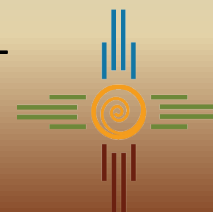
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Everybody Wins

- Utilities get:
  - A direct way to interact with customers
  - Means to fulfill customers' wishes for greener resources
  - A least cost resource

- Customers get:
  - Economic benefit of a least cost resource
  - A simple way to lower their carbon footprint

- Environment gets:
  - More use of sustainable energy
  - reduced consumption of materials

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Electric WH Storage Potential (w/o fuel switch)

- 50 million electric water heaters in US

- ~1 kWh flexible load, <u>twice</u> daily

- Implies potential of **50 GWh of storage**
  (i.e. ten times EIA 2021 forecast of installed storage)

- Marginal cost, at-scale:

  - $10 for additional OEM cost per tank

  - $20 for communication module

  - ☞Equivalent battery cost at LESS than $15/kWh!

    - Economic bonus: No in/out losses, or degradation of storage quantity over the product life.

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CTA-2045 & OpenADR

- OpenADR is a demand response <u>language</u>
  - Works securely over internet, server to server
  - Not designed for electronics in appliances
  - So manufacturers instead:
    - support OpenADR in the "Cloud"
    - use proprietary commands to reach the home appliance using the customer's Wi-Fi network

- CTA-2045 is the <u>physical interface</u> for communication (ears and voice)
  - So it has the ability to "hear and speak" any language

- CTA-2045 can support OpenADR, but the reverse is not true

I hear you but I don't understand you

No te entiendo

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Other Disadvantages of OpenADR
aka connecting to the manufacturer's cloud

1. Legal and IT cost

2. Only available in premium products

3. The Wi-Fi headache

4. Different customer experience with each OEM

5. Marketing thru OEM ☞ disintermediation

6. Limits on access to appliance data

7. Stranded products (e.g. GE Geospring water heater)

8. Limits innovation by entrepreneurs

9. Does not support future communication methods

Utility as Mushroom

Credit: Kennet Kjell Johansson Hultman

REASCEND

Ideally, federal government would follow Washington's lead, but…….

- Despite a majority of citizens that agree on the need to act on climate change, partisan stances at federal and state level prevent coherent policy e.g.:
  - Whether to take action on climate change
  - National carbon tax policy
  - Net metering only changed when reliability crisis arises
  - Legal disputes between state and FERC on subsidy for nuke plants
  - Region-by-region variations in retail markets, operations, & planning

- Standards to simplify control and communication too technical; causes inaction by policy makers

- It's time to lead by example and implement flexible load devices at scale.

72% of Americans say they want to reduce the effects of climate change, including a majority in each party.

50%

Republicans
55%

Democrats
86%

Independents
78%
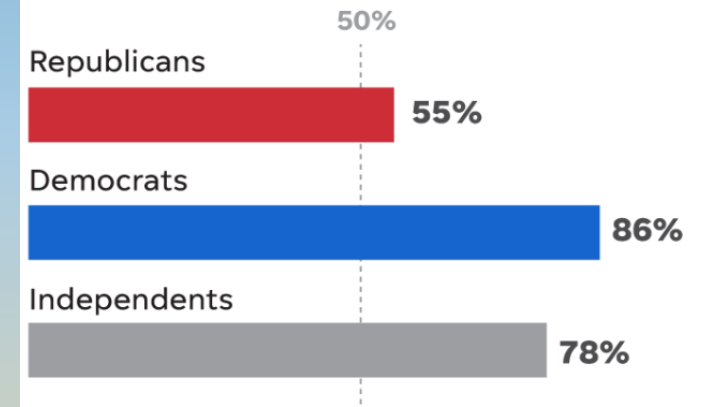
SOURCE USA TODAY/Public Agenda Hidden Common Ground Survey of 1,006 adults taken online by Ipsos Public Affairs Jan. 10-13. Margin of error +/- 3.5 percentage points.
JIM SERGENT/USA TODAY

REASCEND

Now is the time to lead

- For 120 years, the customer role was simply to consume electricity.

- In the next era, customers have an important role that most want to support[1], i.e. accelerating the arrival of renewable generation.

- With flexible loads they can shift load to desirable times, but they need the simple process that CTA-2045 creates for them

- However, like recycling, this is an education process that will take a couple decades. Start Now!

[1] 62% of demonstration participants cited ability to serve them with more renewable energy as reason to participate in a future program.

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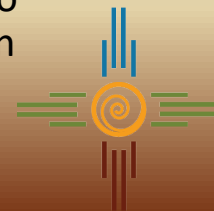
Questions

Conrad Eustis

conrad@reascend.LLC

503 381 1164
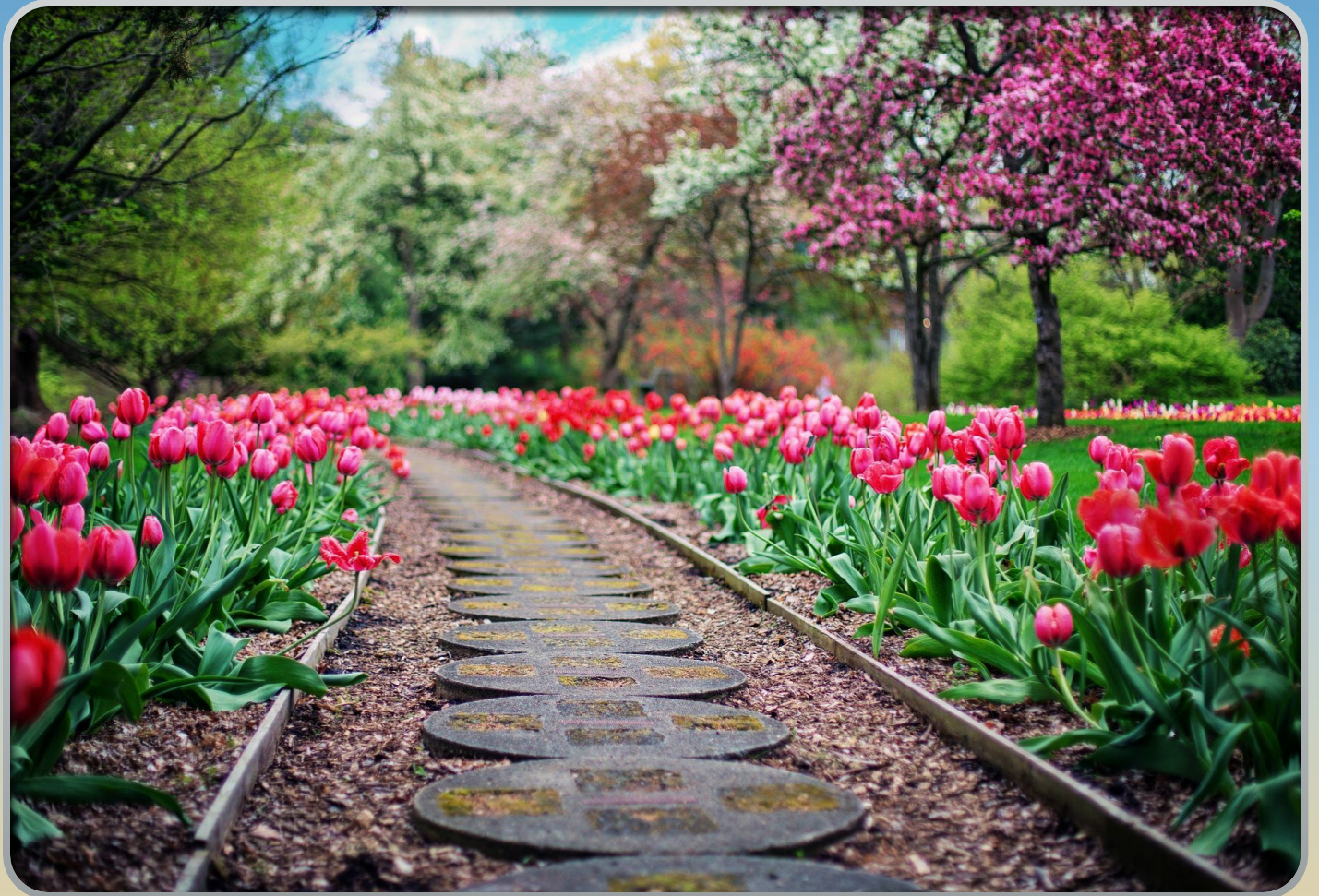
REASCEND

Capturing the Full Value of Grid-Enabled Water Heaters

Jeff Harris

Chief Market Transformation Officer, NEEA

July 1st, 2020

CLASSIFICATION LEVEL: PUBLIC

Vision: What does a transformed market look like?

- All electric water heaters over 40 gallons shipped to the Pacific Northwest have an open-source communication interface (CTA-2045)

- Variable output energy from renewables is fully used and useful to the grid

- ENERGY STAR and the DOE recognize and promote ANSI/CTA-2045

- Utilities integrate DR and flexible load capabilities into planning and operations

- Aggregators successfully leverage capabilities of CTA 2045 connected loads into energy markets

Benefits of a Transformed Grid-Enabled WH Market

Aggregated Benefits of Market Transformation

Legend: ----Installed Smart WH   — · —Enrolled Customers   —— Resource MWs   Resource MWs Lo Part (23%) Hi Part (75%)
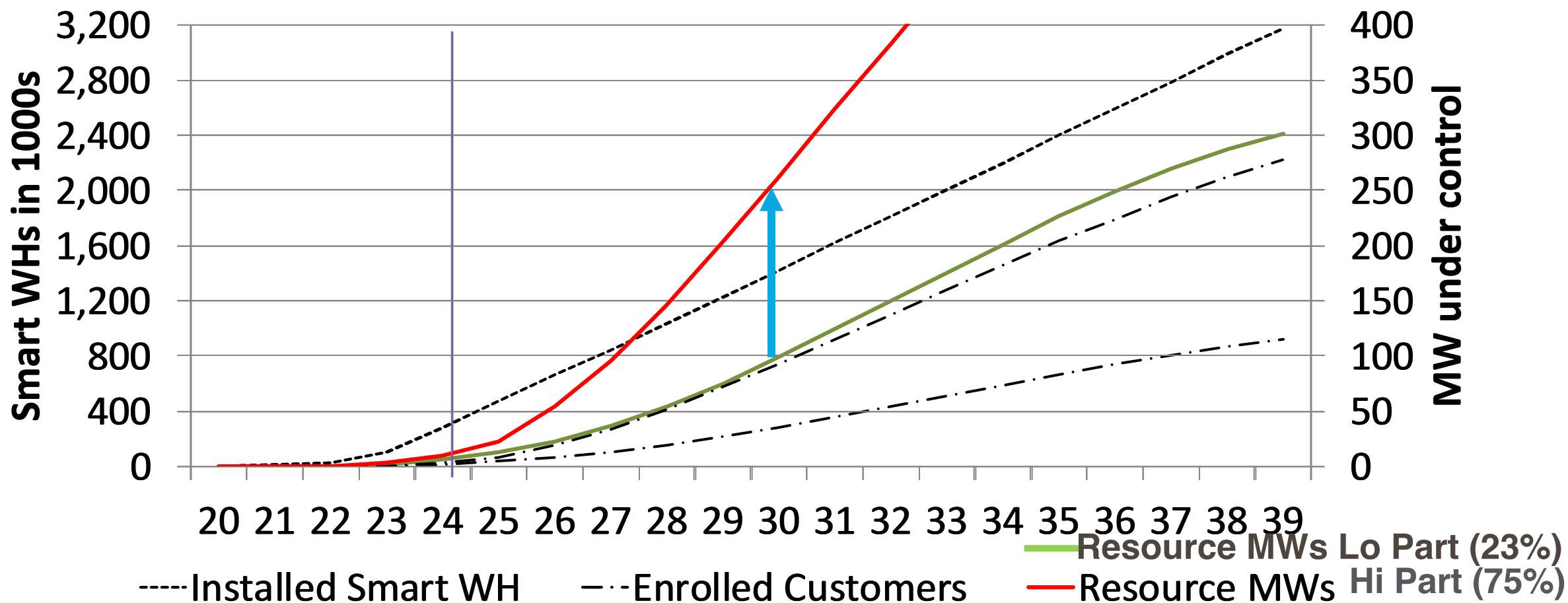
Source: CTA 2045 Water Heater Demonstration Report; BPA Technology Innovation Report 336; Nov. 2018

Value Proposition for Grid-enabled Water Heaters

Customers
Save money & make a difference
More scheduling & control
Optimize for time of use rates
Choice of manufacturers

Utilities
Increase renewables & reliability
Choice of communication modes
Avoid vendor lock-in
Lower power rates

Manufacturers (OEMs)
Standard solution for mass market
Enhanced customer experience
Connection to customer
Enables smaller OEMs

Grid
Integrate renewables more easily
Increase low-cost storage resources
Support microgrid solutions to grid congestion

Smart Cities & States, Low Income Opportunity
Meet carbon goals
Resiliency, Self-sufficiency
Decarbonization

Aggregators
Choice of communication modes
Standard solutions for mass market
Enables local gateway control
Solutions for small loads

Smart, Grid-Connected Appliances

ANSI / CTA-2045 Universal Port

Universal Communications Modules

Need for intervention and support: Its All About Scale

- Large scale installations (60,000 = 25 MW) required for utility operational value

- High levels of customer participation (>85%) required to get to scale in time to impact NW grid

- OEMs need scale to lower cost/unit

- Scale needed to allow for load diversity during real-time interaction with device to capture full value of flexible loads

|

Opportunities

- ~200,000 eWH and HPWHs sold each year

- HPWHs already have sophisticated controls; multiple operating modes and connectivity

- Customers have increased interest in "smart" appliances and desire to "do the right thing" for climate change;

- Washington State leading the way in standards, Oregon and California following suit

- ENERGY STAR is considering connectivity as a requirement

- National interest in low-cost energy storage; potential extra-regional partners

Barriers

- Lack of grid to manufacturer value exchange

- Added cost to provide communication and control

- Lack of end customer value proposition or perceptions

  - *Lack awareness about water heaters in general*

  - *Privacy and security*

  - *Performance concerns*

- OEM's worry about customer experience

- Minimal and variable demand side value to the northwest grid

- Competing communication standards

- Contractors need education and awareness

- Connectivity can be sketchy if not standard

Equipment

Customer Participation

Utility Engagement and Operation→Value

Current/Planned interventions - Equipment:

In process:

- Washington Standards 2021-2022

- State of Oregon Standards – 2022?

- California Title 24; Title 20

- OpenADR ← → CTA 2045

- ENERGY STAR specifications

Still needed:

- "Comm-ready" installations: Module installed at factory or in-field

Current/Planned interventions – Customer Engagement

Still needed:

- High-participation customer recruitment program; e.g. PGE Testbed "opt-out" model

- Targeted consumer messaging on benefits of participation: e.g. GHG reduction, increased use of renewables; energy independence

Current/Planned interventions - Utility:

In process

- Utility DER integration into operation

- EIM / DAM

- NW Resource Adequacy Valuation

Still needed:

- Utility operational process that capture full value of flexible behind the meter thermal storage

- Utility planning process that recognizes distributed thermal storage as controllable asset to avoid other resources dispatch/local T&D upgrades

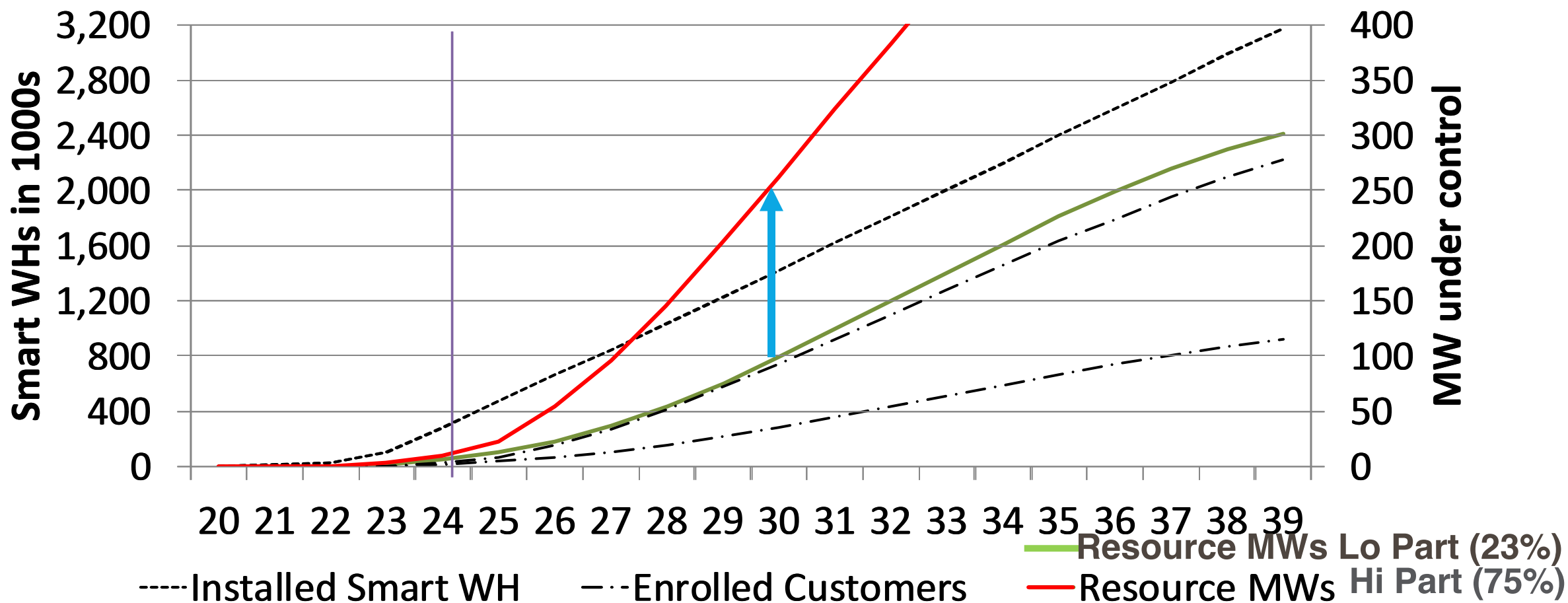- Regulatory models that support "opt-out" customer models

Call to Action / Next Steps

- Align standards for e-WHs & HPWHs across the NW states;

- Regionally coordinated program to turn "dark assets" into "comm-ready" flexible load assets – ready to "light up" by utility.

- Consumer friendly "opt-out" engagement models with high participation rates.

Benefits of a Transformed Grid-Enabled WH Market

Aggregated Benefits of Market Transformation

Legend:
- ---- Installed Smart WH
- -·- Enrolled Customers
- — Resource MWs
- Resource MWs Lo Part (23%)
- Hi Part (75%)

Y-axis (left): Smart WHs in 1000s — 0, 400, 800, 1,200, 1,600, 2,000, 2,400, 2,800, 3,200

Y-axis (right): MW under control — 0, 50, 100, 150, 200, 250, 300, 350, 400

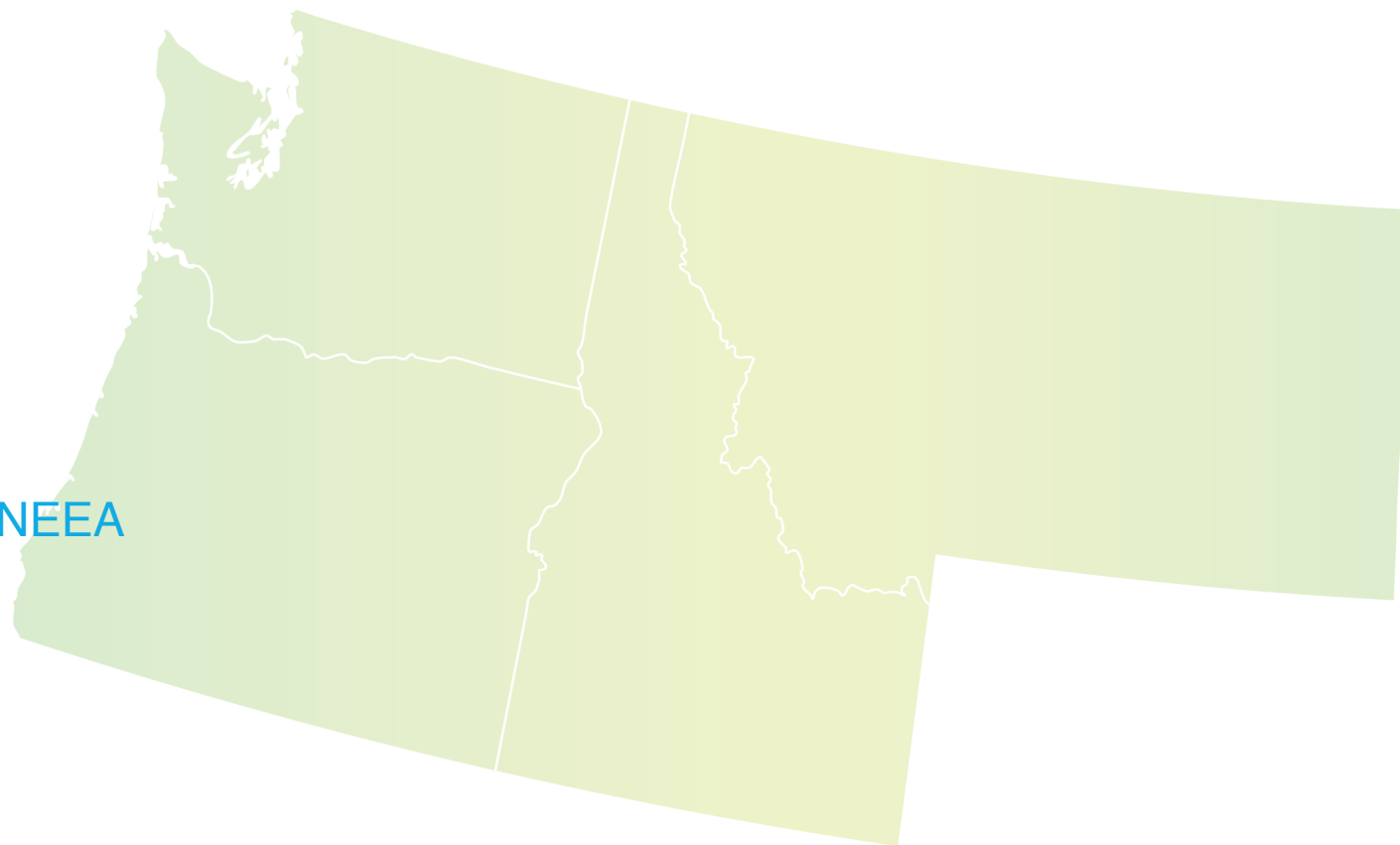X-axis: 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39

Source: CTA 2045 Water Heater Demonstration Report; BPA Technology Innovation Report 336; Nov. 2018

Jeff Harris

Chief Market Transformation Officer, NEEA

jharris@neea.org

Making Electricity Demand Manageable in the Northwest

The CTA-2045 Standard and Flexible Demand

July 1, 2020   9:30 - 11:00am Pacific

Presented by the NW Energy Coalition

Tony Koch

Bonneville Power Administration

Intent of ANSI / CTA-2045

Created with intent to be used on any demand response friendly appliance

EPRI tested (**in addition to water heaters**):
Pool pump, PTAC, thermostat, EV charger

PNW regional deep-dive effort started with water heaters

….and now, we turn to HVAC

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Mitsubishi HVAC Heat Pump via CTA-2045

BPA explored a hand full of sites with "friend & family" in 2020
- Wall mounted duct-less units
- Central blower, whole house ducted systems
- Re-used left over water heater communication modules
  (after firmware flash from eRadio)

Performed successful "Shed" commands which had the direct effect of 3 F thermostat set-point change via 2045

Thermostat set point delta is selectable by DR dispatch user

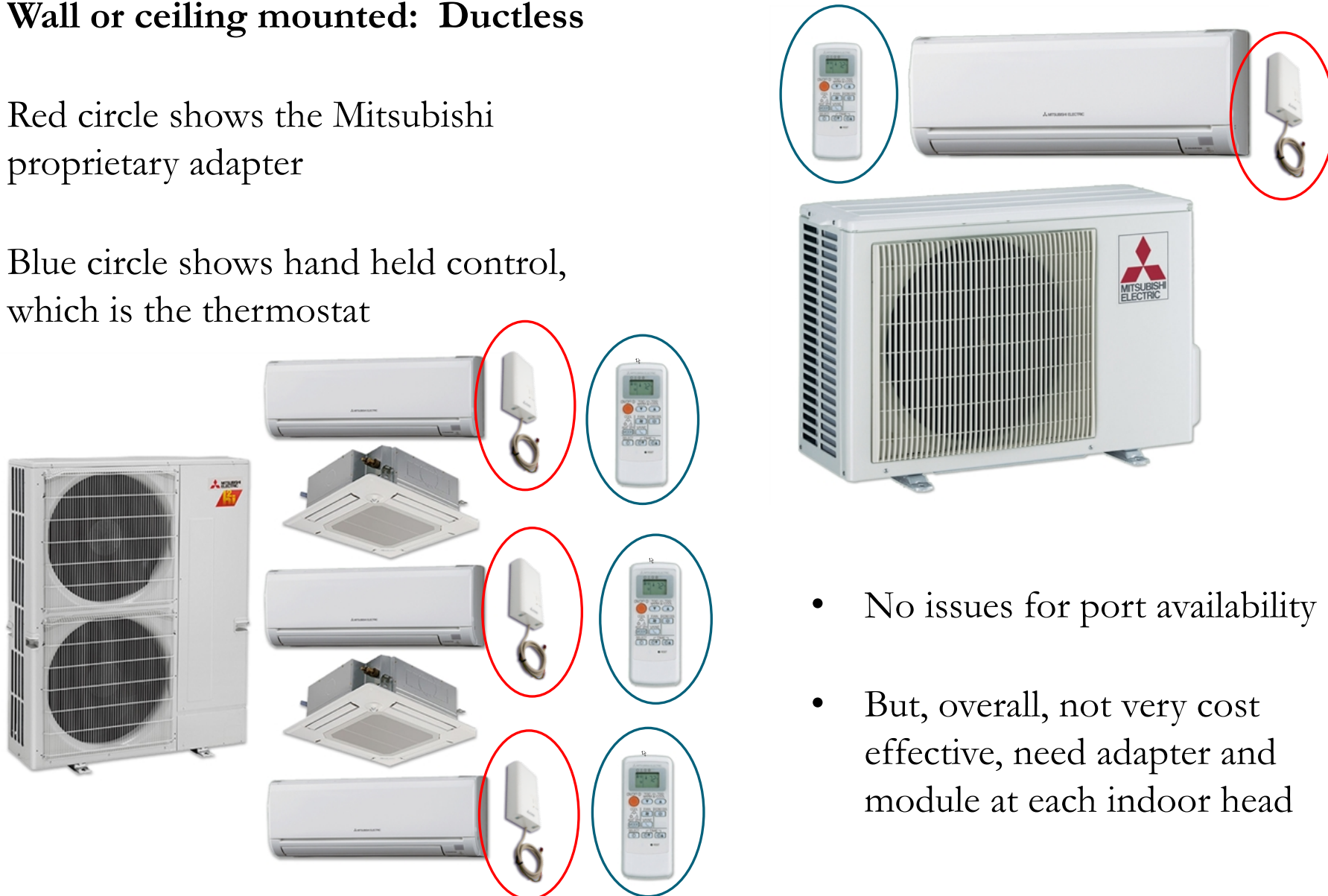New opportunity being explored by BPA/PNNL/PGE in 2020-21
- Participants are PGE customers at large
- Wall mounted and central blower applications

Mitsubishi HVAC: Ductless

Wall or ceiling mounted: Ductless

Red circle shows the Mitsubishi proprietary adapter

Blue circle shows hand held control, which is the thermostat

- No issues for port availability

- But, overall, not very cost effective, need adapter and module at each indoor head

Mitsubishi HVAC: Central Ducted Blower

Central Ducted Blower

Red circle shows the Mitsubishi proprietary adapter

Blue circle shows the thermostat, can be wireless or wired

Outdoor Unit:
PUZ-HA42NKA

Indoor Unit:
PVA-A42AA7

- Significant issues for port availability
- Port commonly used for wireless stat application
- Very cost effective, one adapter and module for the entire house

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Mitsubishi HVAC Collaboration

BPA, PNNL, and eRadio are actively engaged with Mitsubishi product development team in Atlanta

Have communicated issues discovered in the early field testing

Mitsubishi is interested in the feedback and is beginning to be responsive to our requests

Currently, to the best of our knowledge, there are no other HVAC heat pump manufacturers that offer a CTA-2045 port

OpenADR and CTA-2045

These are not interchangeable standards

They can be complimentary

- **OpenADR** was designed for server to server communication via internet
  - Intended for utility / DR entity dispatch to DR aggregator and/or C&I customers
  - No physical port requirement, assumes robust and secure IT hardware and internet

- **CTA-2045** was designed for use on residential / small commercial appliances
  - Physical port and command set embedded in the appliance
  - Modular comm, back haul communications to the DR entity chosen by the utility

----

Two examples of OpenADR being misapplied

AHRI 1380 (2019) - Demand response through variable capacity HVAC systems in residential and small commercial application

ENERGY STAR Connected Water Heater Specification, Draft v3.3 (not yet finalized)

- Both of these specs allow CTA-2045 or OpenADR, or both

- That is not a cost effective or practical solution

Thank You

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206.818.0191

Questions?