DOCKETED	
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Document Title:	Presentation - Results from the Pacific Northwest CTA-2045 Water Heater DR Pilot
Description:	Presentation by Tony Koch (BPA) on the water heater load control pilot using eRadio broadcast and CTA-2045 communications
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Panel 3: Responding to hourly/sub-hourly grid signals

Results from PNW CTA-2045 Water Heater DR Pilot

Tony Koch
Bonneville Power Administration

January 14, 2020
2:15p
CEC Load Management Scoping Workshop

Project Objectives

Enrolled:

175 heat pump water heaters

90 resistance water heaters

DR Events: (daily load control events, one week alternating)

600 events in 220 days

Quantify:

Peak load mitigation (hourly kW)

Energy shifting (daily kWh)

Gage customer acceptance / satisfaction

Promote regional education

Design a market transformation plan

Develop a business case to justify market transformation plan

DR Communications Standard: ANSI/CTA-2045

A modular, open source, demand response specific communications port and command language

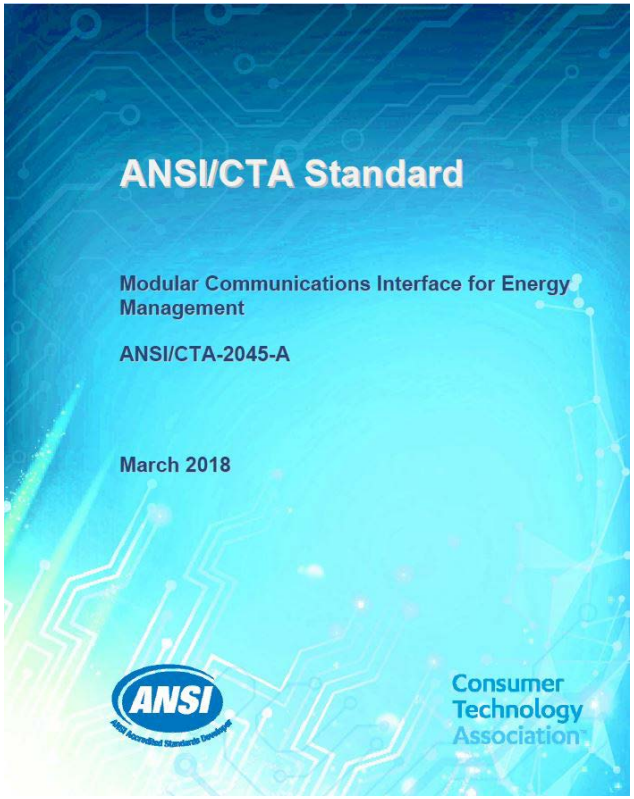
Consumer Technology Association (CTA) published the standard in 2013, updated in 2018

The standard is now ANSI approved and used internationally

Intended for multiple appliances

Two form factors:

- DC (3V) and AC (240V)
- Considering adding USB as a form factor



ANSI/CTA-2045: Product Demonstrations

Electric Power Research Institute (EPRI) provided initial technology proving and demonstrations (2013 – 2016)

water heaters, thermostats, EV charging, pool pumps, PTACs

PNW regional CTA-2045 water heater DR project (2016 – 2018)

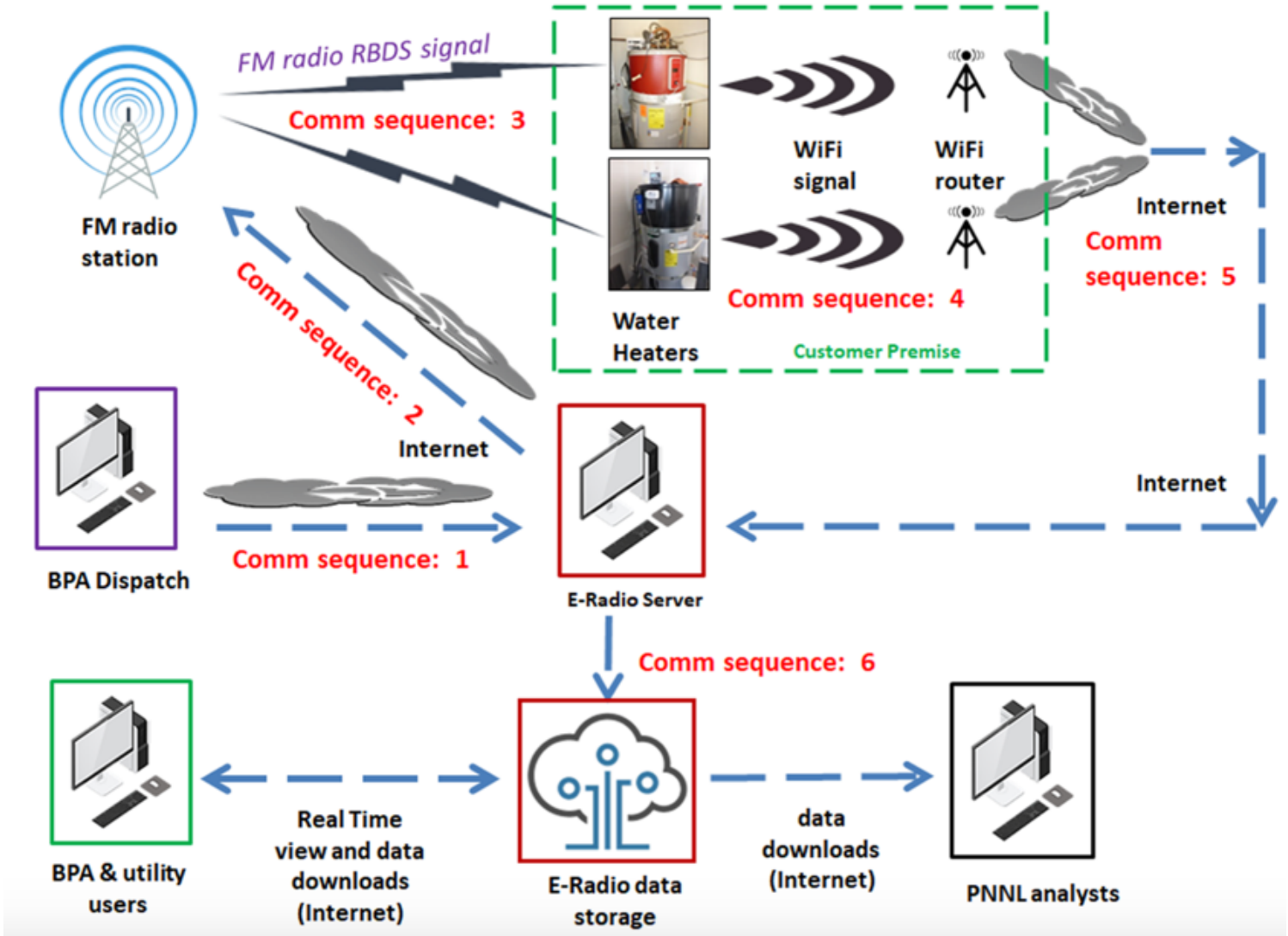
Project Report and additional materials can be found at:

www.bpa.gov/goto/smartwaterheaterreport

Duke Energy in the Southeast is also engaged in field studies

Examples of DC and AC forms

COMMUNICATIONS & DATA PATH SCHEMATIC



Peak Demand Reduction Results (Hourly Average Watts)

Shed command results (asks appliance to reduce load)

Winter Peak Results	3-Hour Shed Watts Reduction	95% CI
Heat Pump Water Heaters		
A.M. peak	223	±27
P.M. peak	165	±31
Resistive Water Heaters		
A.M. peak	374	±65
P.M. peak	321	±74

Summer Peak Results	4-Hour Shed Watt Reduction	95% CI
Heat Pump Water Heaters		
P.M. peak	85	±10
Resistive Water Heaters		
P.M. peak	347	±29

Grid emergency results (turns appliance Off)

Time	Winter/Spring Grid Emergency Watt Reduction	95% CI	Summer Grid Emergency Watt Reduction	95% CI
Heat Pump Water Heaters				
A.M. period	244	±32	122	±20
P.M. period	167	±43	96	±11
Resistive Water Heaters				
A.M. period	562	±69	393	±50
P.M. period	563	±105	389	±39

HPWP

2 x 0.75 kWh storage per day

Resistance

2 x 1.5 kWh storage per day

Customer Satisfaction

190 of 265 Participants completed survey: 10 Resistance and 180 HPWH

Ran out of hot water last year?

- 40% never
- 50% couple times

How satisfied were you with the Pilot?

- 83% Very
- 15% Somewhat

Likely to participate in DR Program in the future?

- 72% very likely
- 24% Somewhat likely

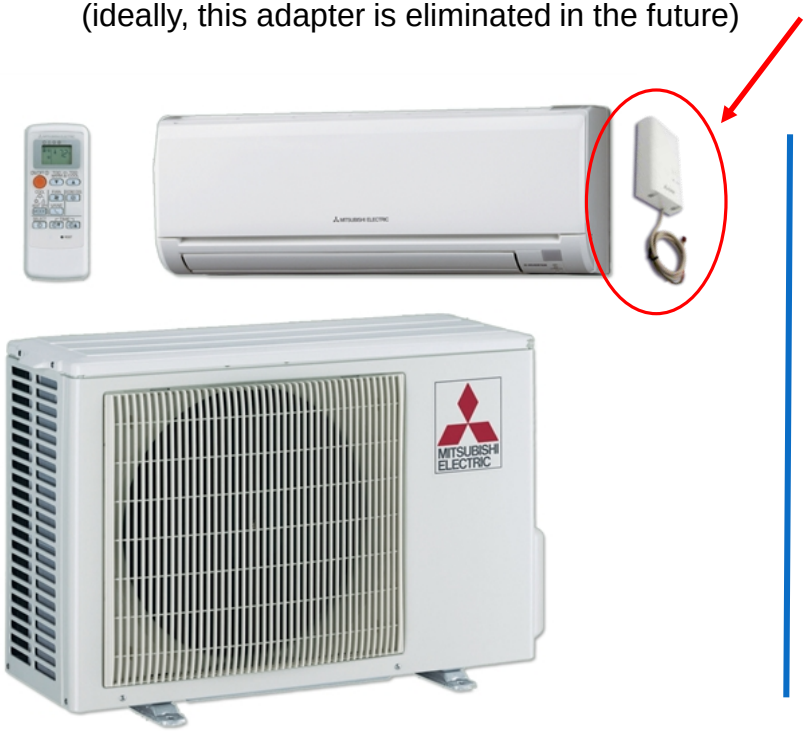
Primary Motivation to joining the study:

- 38% Amount of incentive
- 46% knowing that I'm helping to avoid a new power plant
- 43% knowing that I could influence more clean renewable energy on the grid
- 26% Getting an annual report that quantify my contribution to the CO2 reduction

Mitsubishi Heat Pump Space Conditioning via CTA-2045

New opportunity being explored by BPA in 2020

- Use the same communication module used for water heater on Mitsubishi unit
- Change temperature set point up or down 1- 4 F
- Available in most models sold in the US
- Can control central thermostat set-point for whole house ducted forced air heat pump
- Similar to water heater appliances, requires proprietary adapter
  (ideally, this adapter is eliminated in the future)



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

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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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