



# **SMART WATER HEATERS**

## **Thermal Storage and Demand Response**

# A. O. Smith

- Established 1874 (147 years)
- Manufacturing Water heaters for over 80 years
- Multiple Brands

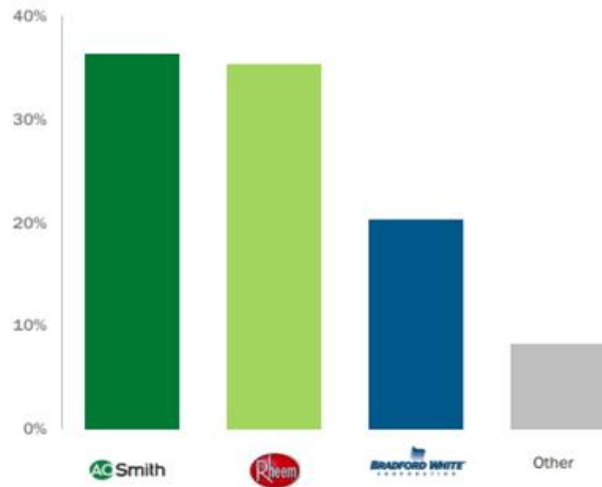


# A. O. Smith

## Leading Market Share in the U.S. Water Heater Market Segment<sup>1</sup>

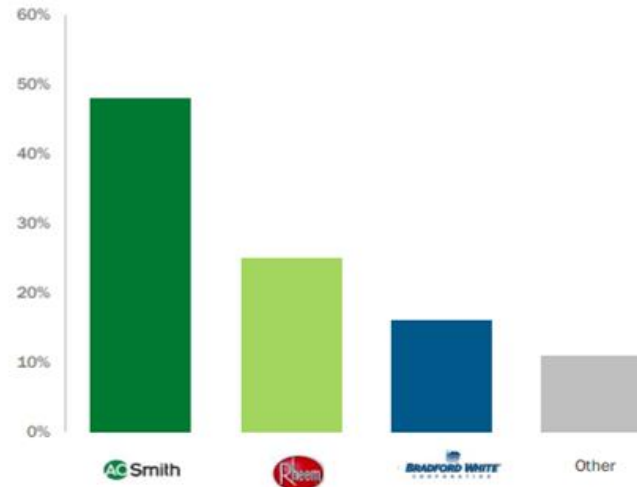
### Residential Market

2020 market share data (AHRI + Gas Tankless)



### Commercial Market<sup>2</sup>

2020 market share data (AHRI)



# Water Heater Market

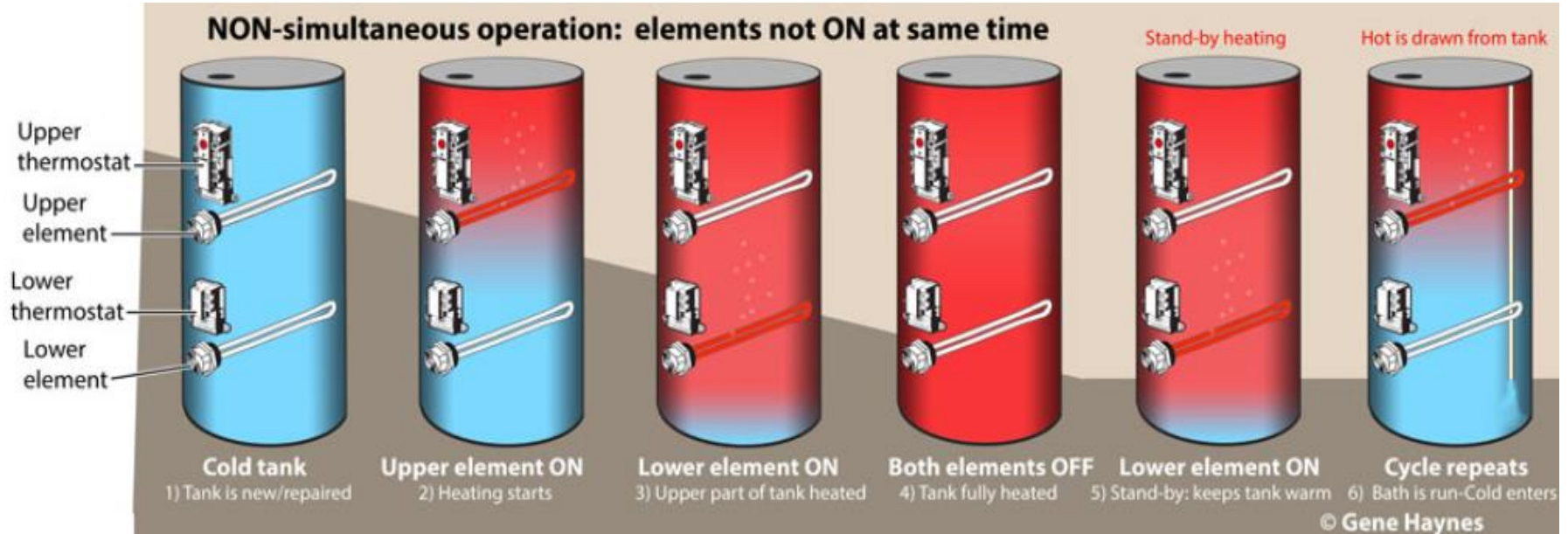
- Approx. 100M residential water heaters
- Approx. 50M residential electric water heaters
- Approx. 8.5M residential heaters installed each year
- Typical resistive electric heater 4,500 watt elements
- Average life expectancy 12 years

# How a Water Heater Works

- Heat Top
- Then Heat Bottom
- Dead Band – Lower tank temp drop
- Limit relay contact arcing
- Allows for long life of thermostats



# How a Water Heater Works



# Smart Water Heater Flexible Load Opportunity

- Assume 4M electric water heater per year
- Assume 4.5 kW load per water heater
- $4\text{M year} \times 4.5\text{kW} = 18 \text{ GW year}$
- $12 \text{ years} \times 18 \text{ GW} = 216,000 \text{ MW}$

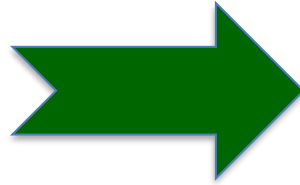
# Standard vs. Smart



Upper  
Thermostat



Lower  
Thermostat



Electronic  
Thermostat



Lower Temp  
Sensor



CTA-2045  
Port



CTA-2045  
UCM



# Smart Water Heater

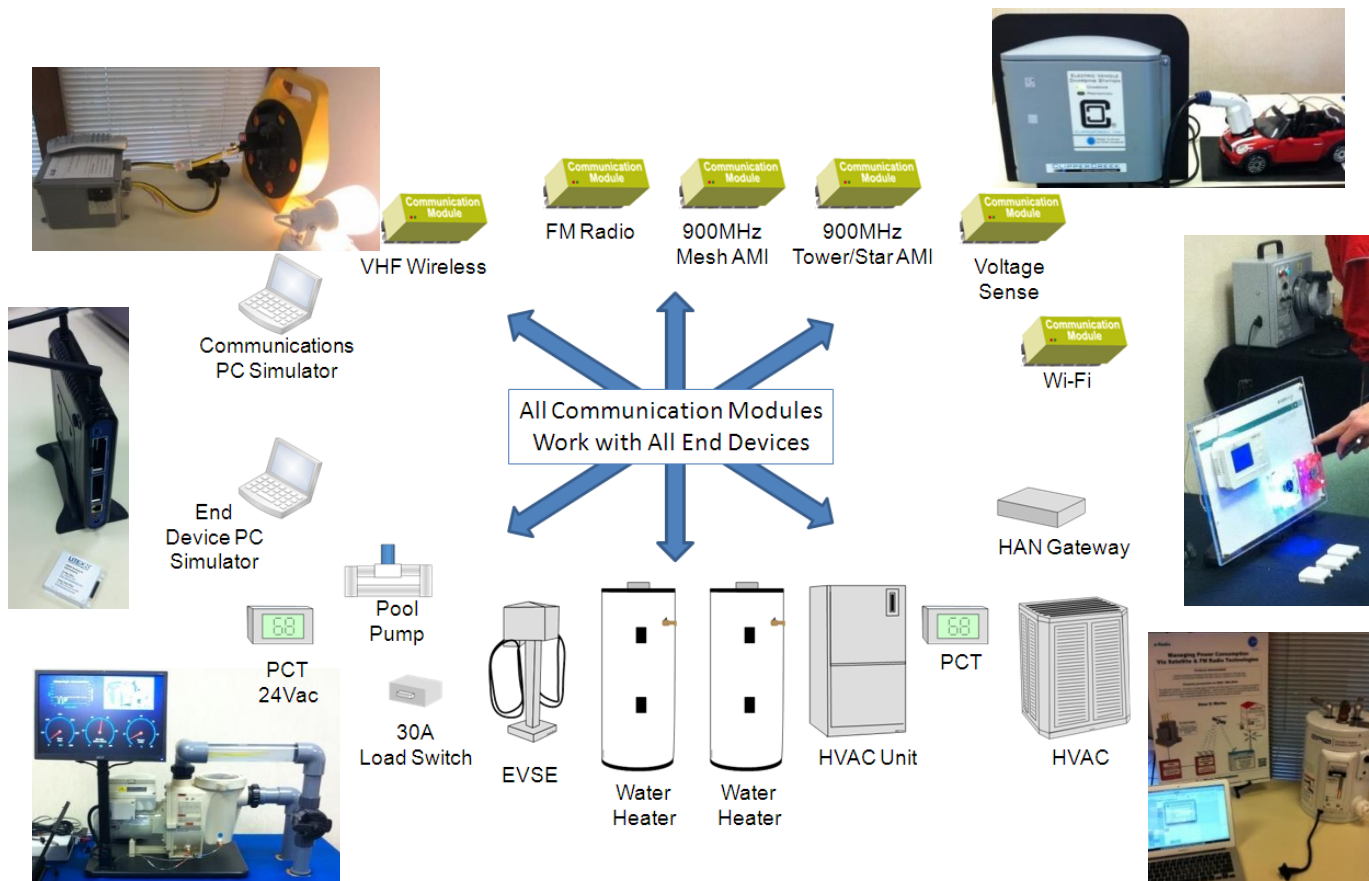
- Cold Water Prevention
- Multiple levels of Curtailment
- Increased Energy Storage
- Energy Storage Capacity reported in Watt Hours
- Simple installation - no truck roll
- Modular communication – Future Proof



# Smart Demand Response

- Peak Shaving
- Valley Filling
- Renewable Integration
- RPS Benefits
- ToU Value
- Load Balancing
- Energy Storage
- Beneficial Electrification
- De-Carbonization

# CTA- 2045 Universal Communication Port



# CTA-2045 Adoption

- Oregon
  - Electric storage water heaters to require CTA-2045 port as of Jan 1, 2022
- Washington HB1444
  - HPWHs January 1, 2021 must have a CTA-2045 communication port, other electric storage water heaters >+40 gallons Jan 1, 2022
- State of California Title 24 – JA 13
  - 2020 HPWH DR
    - Must accept OpenADR or CTA-2045 DR Signals

# Simple Installation



# Traditional DR vs. SMART Load Management

## Options

- ON
- OFF



Shed Load

Shift Load

Add Load

Advanced Load Up

Price Controlled

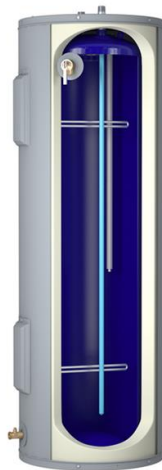
Current State on – off

State of charge in watt/hrs

Renewable Integration

# A.O. Smith SMART water heaters

- Consumer comfort – cold water prevention
- Increased Energy Storage with Load Up or ALU
- Self Preservation – prevents over control from utility
- More robust relays to support Load Up and ALU
- Low cost solution – no expensive truck roll for DR
- More grid benefits i.e. Load Balancing, ToU

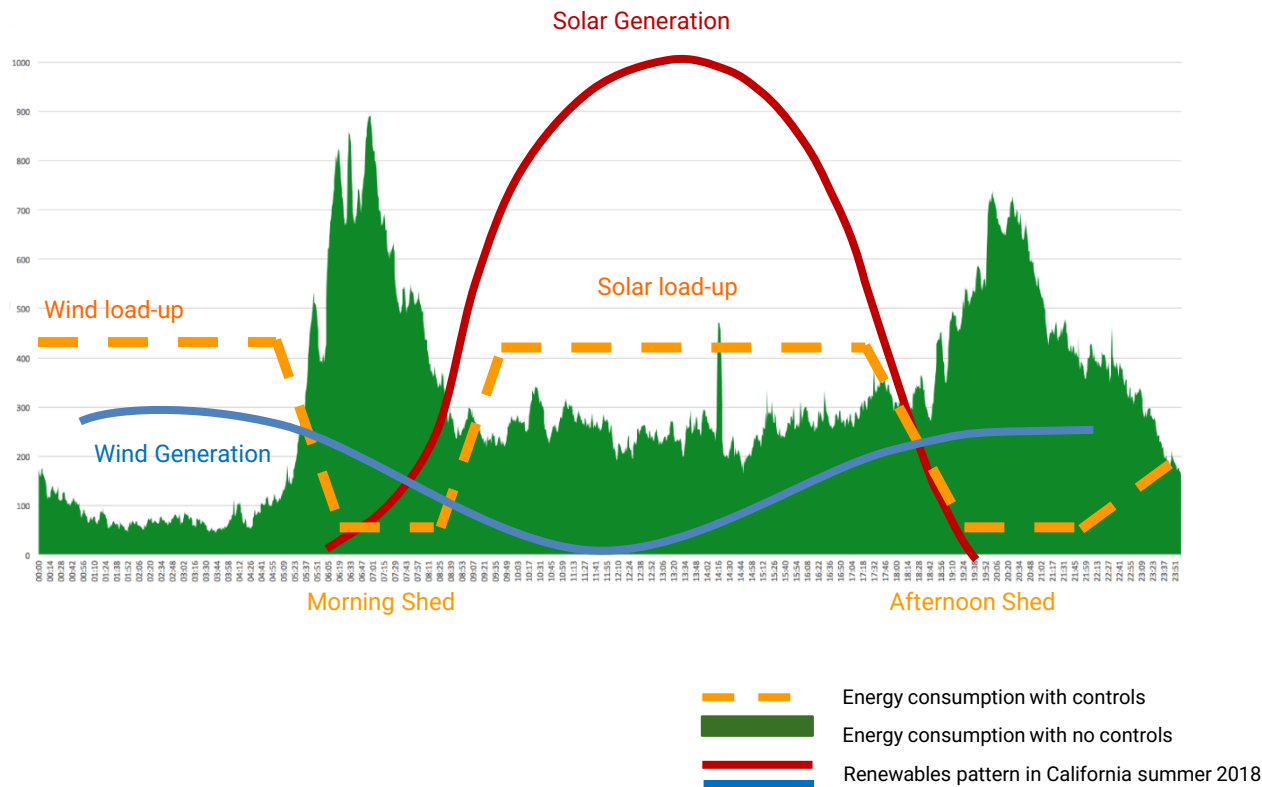


# CTA-2045 Commands

- Run Normal
- Shed (reduces volume of hot water a little)
- Critical peak (reduces volume of hot water significantly)
- Grid Emergency (effectively turns water heater off)
- Load Up – Heats up entire tank and holds temp (reduced dead band)
- Advance Load Up – Requires mix valve – Increases tank temp and holds.



# Why Water Heaters? Load-Up & Shed



# Energy Storage - Load Shifting

- Energy Star DR test procedure for 50 gallon HPWH
- Energy storage via Load Up after shed approx. 750 W/hr
- Energy storage via Advanced Load Up after shed 1,500 W/hr
- Resistive electric approx. 2 – 3 X that of HPWH

# Smart Product Resistive Electric



# Smart Load Management

- More Low cost, low carbon generation can be harvested by shifting load improving renewable generation asset ROI
- Increased renewable generation capacity is obtained by simply shifting load to maximize renewable capacity with no additional cost of generation or transmission.
- Consumers and utilities benefit from low-cost off-peak carbon reduced generation

# Cost of Energy



## Stakeholders



### PRIME ENERGY MOVERS

Prime Energy Movers are entities that regulate, generate, store, and move (transport) electricity.



### PARTNERS

Partners are device vendors, service providers, system integrators and consultants focused on the electrical power system.



### PARTICIPANTS

Participants are individuals that own and/or use devices that consume, store, and generate electricity.

About TeMix Ticker™	Jan 25 10:00 AM PST \$0.076/kWh	Jan 25 11:00 AM PST \$0.069/kWh	Jan 25 12:00 PM PST \$0.067/kWh	Jan 25 1:00 PM PST \$0.063/kWh	Jan 25 2:00 PM PST \$0.077/kWh	Jan 25 3:00 PM PST \$0.151/kWh	Jan 25 4:00 PM PST \$0.498/kWh	Jan 25 5:00 PM PST \$0.736/kWh	Jan 25 6:00 PM PST \$0.573/kWh	Jan 25 7:00 PM PST \$0.218/kWh	Jan 25 8:00 PM \$0.143/kWh
	0.566 Lbs/kWh	0.496 Lbs/kWh	0.478 Lbs/kWh	0.500 Lbs/kWh	0.541 Lbs/kWh	0.563 Lbs/kWh	0.704 Lbs/kWh	0.805 Lbs/kWh	0.846 Lbs/kWh	0.912 Lbs/kWh	0.891 Lbs/kWh

# QUESTIONS?

