

# ET Summit 2024

Presented by



# Evaluating Demand Response Capabilities of Connected Variable Capacity Heat Pumps

A Project Review

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## Presentation Overview

- Project Overview
- Project Motivation
- Progress to Date
- AHRI 1380 Standard
- Approach/Control Scenarios
- Ongoing Activities and Next Steps



## SOW Review

- 24 months from Project Launch Q1,2024 – Q4, 2025
- National Study with 6 participating utilities
- 3 Project Phases
- 8 Major Tasks
- Technology Transfer



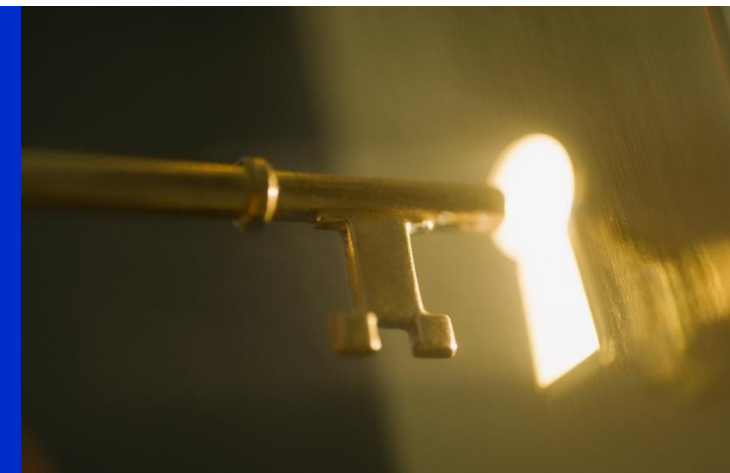
# Project Motivation

- Peak demand outpacing load growth
  - Renewables on the grid, changing climate, electrification, population
  - Driving system costs
- Variable Capacity Heat Pumps (VCHP) are increasingly being deployed in the market (~10-15%)
- Variable systems are an important part of utility *EE* and *electrification* programs, but have not been fully leveraged by DR programs



**Value Prop:** variable systems offers a key enhanced DR performance in terms of:

- (1) greater demand reduction, and/or
- (2) less impact on occupant comfort, which can drive
- (3) potential to reduce DR event opt-outs and program drop-off





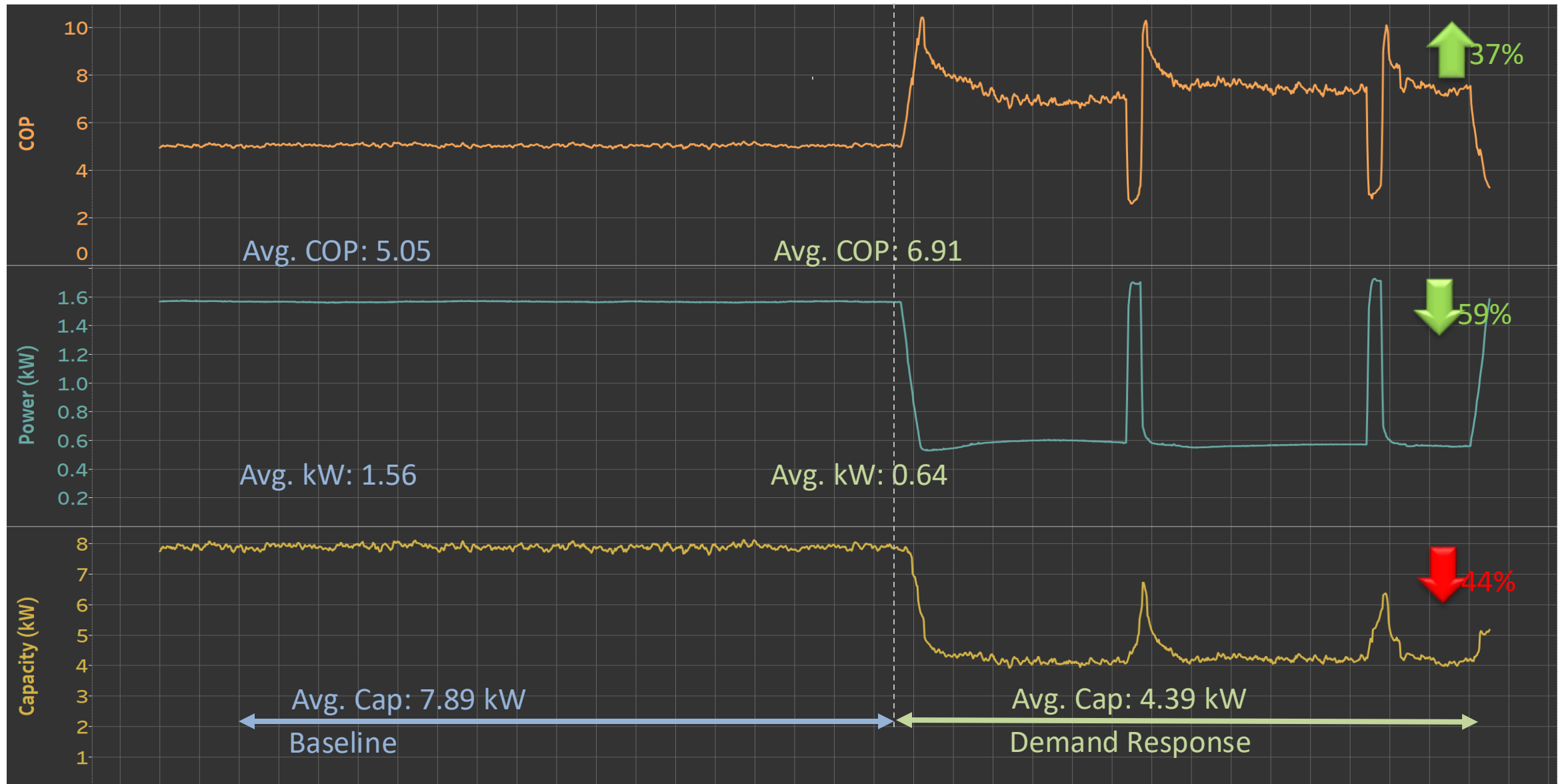
## Progress to Date

- Capability demonstrated with commercial systems and in one-off residential pilots
- Manufacturers alignment around standardized response (AHRI 1380) and ready to participate in this pilot
- AHRI 1380 functionality being tested
- Commercialization slowed by unclear market demand
- Engaging 3 major manufacturers with compatible systems in the field within utility service areas



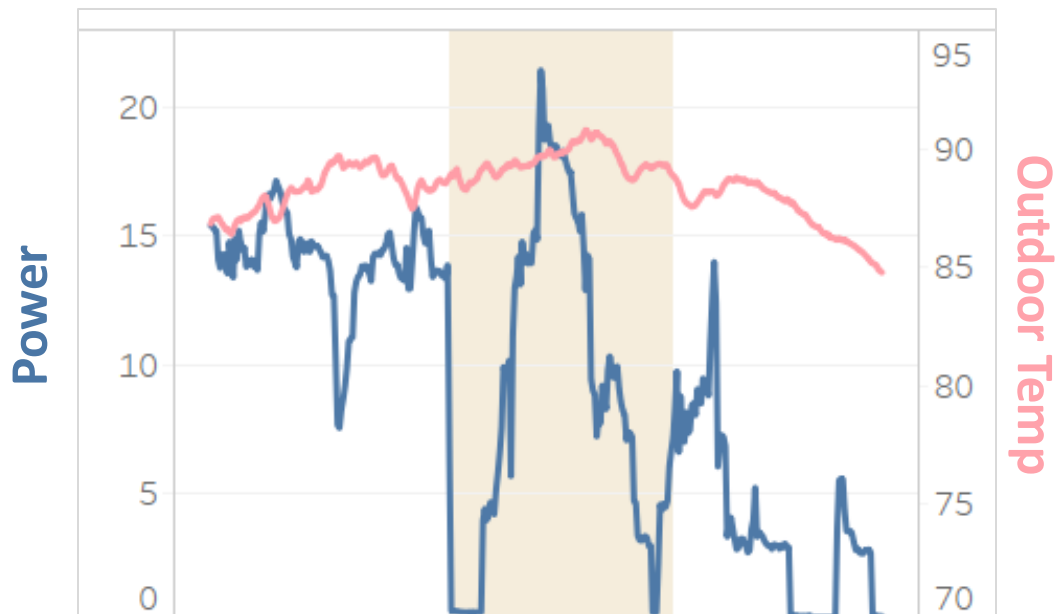
Collaborative effort to drive functionality into market

## The basic concept: more gain, less pain



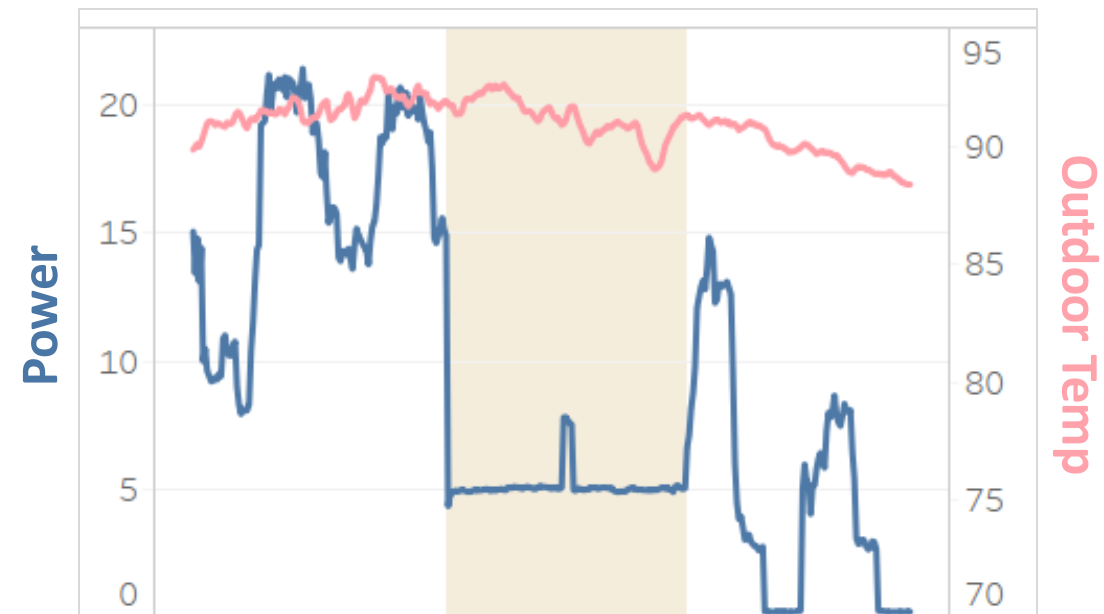
# Field Results With Variable HVAC DR (Commercial)

**Baseline Approach:**  
Setpoint Offset



Inconsistent demand reduction  
Highly “peaky”  
Inherent temperature rise

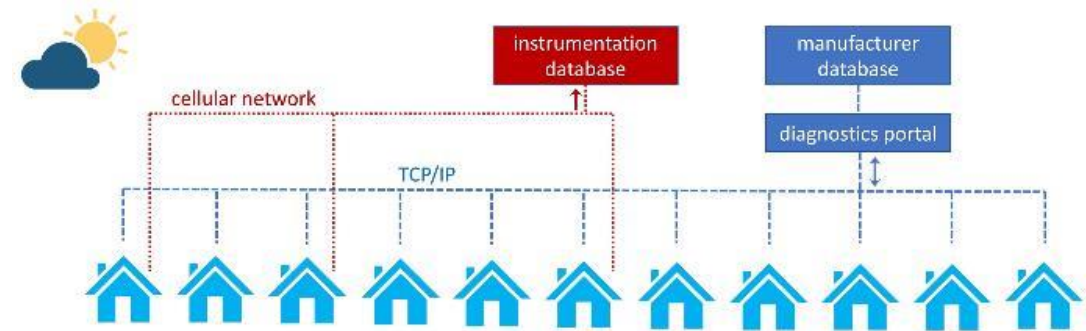
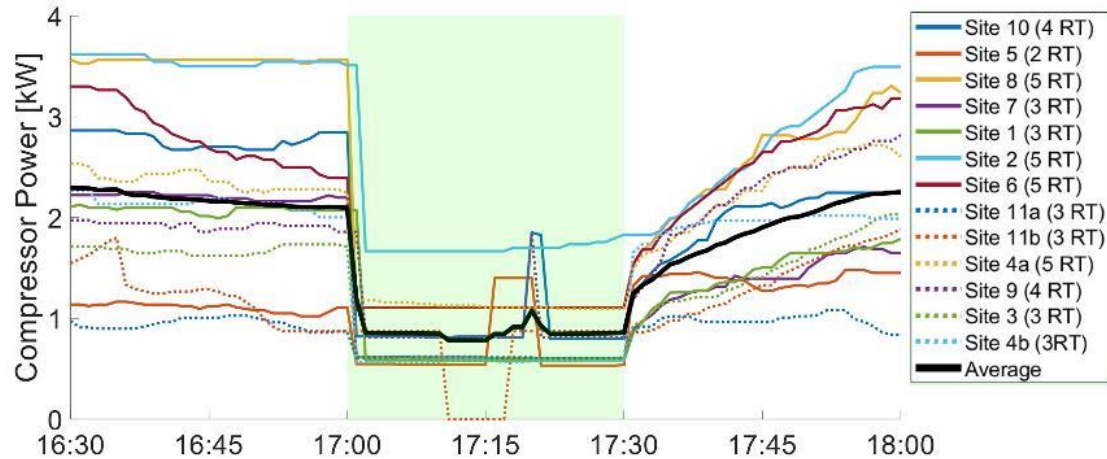
**Optimized Controls:**  
Capacity Limit



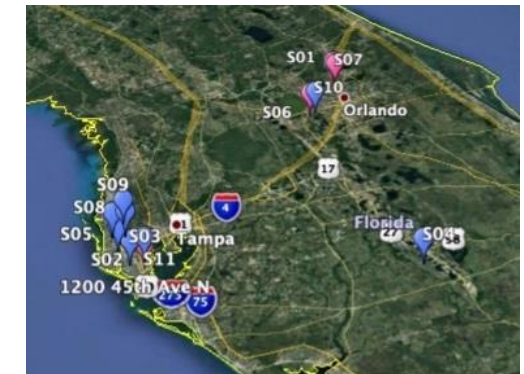
Predictable demand reduction  
Limited temperature rise



## Scaling Up through Residential Pilots



- 20 customers in central Florida
- Variable heat pumps (2-5 tons) from major US manufacturer
- Events initiated manually via manufacturer's cloud dashboard
- Results showed matched comfort conditions and no complaints



Key manufacturer engagement and proof-of-concept demonstrated

## AHRI 1380 Standard

### Applicable equipment:

- Variable-capacity air-conditioners and heat pumps with 2 or more stages, up to 65,000 Btu/hr

### Scope includes:

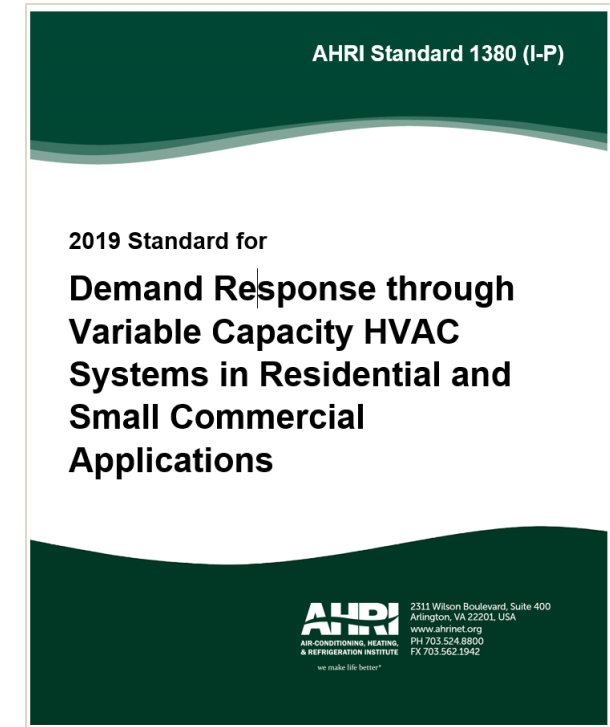
- Standardized equipment response
- Methods of testing
- Compliance with open communications standards (CTA-2045 and OpenADR 2.0)

### Functions defined

- General Curtailment (70% of rated load power)
- Critical Curtailment (40% of rated)
- Off (grid emergency)
- Maximum Indoor Temperature Offset
- Peak load price signal

### Performance Standards Aligning

- Latest EnergyStar spec includes DR requirements that mirrors AHRI 1380 functions



## Approach



Demonstrate new-to-market DR functionality through scaled field pilot



Engage manufacturers to identify existing systems and recruit participation of new sales

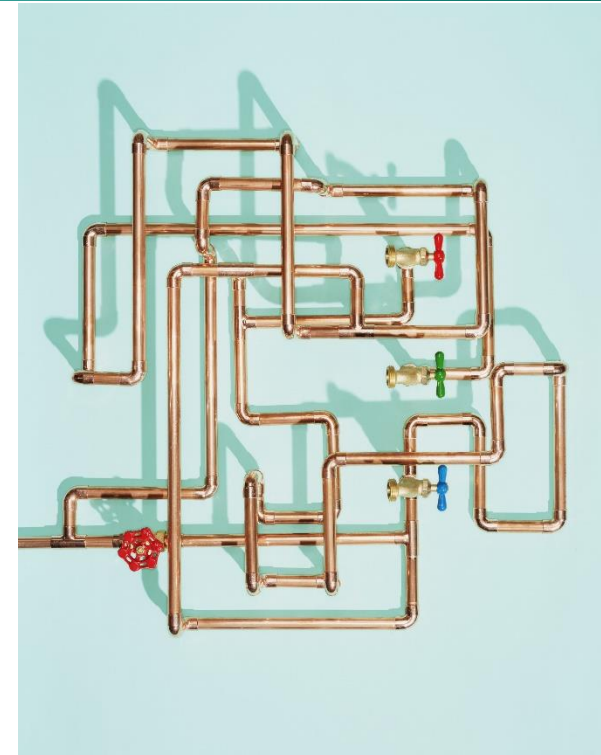


Initiate events using open communications protocols (OpenADR or CTA-2045)

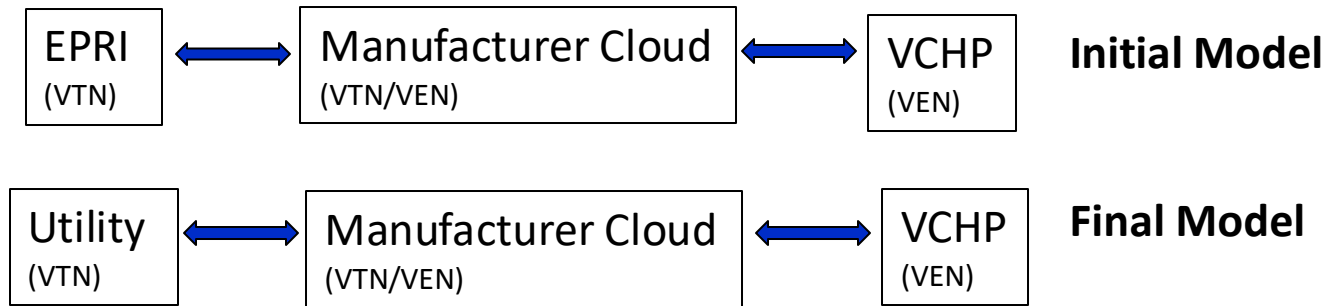


Confirm response using manufacturer cloud

Verify performance with instrumented subset

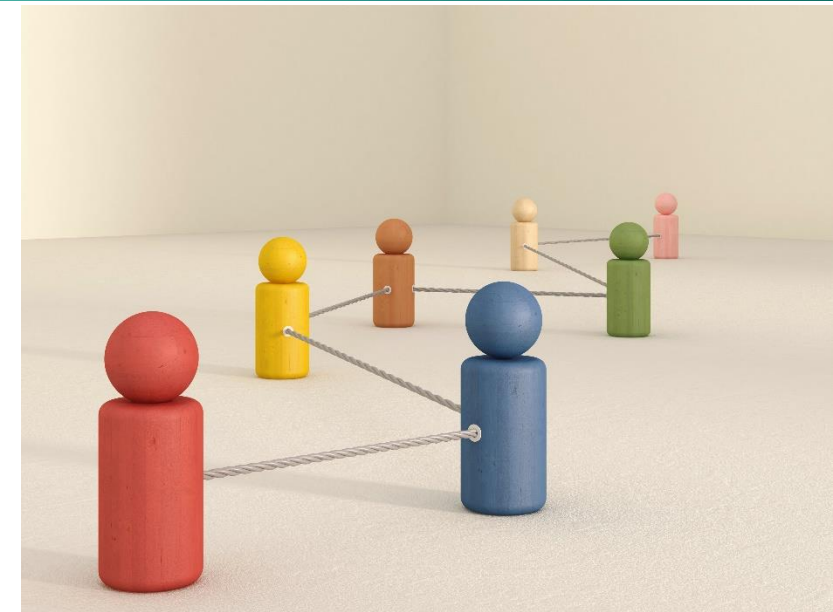


# Control/Use Scenarios



## Use-Case Scenarios/Events:

- General Curtailment (70% of rated load power)
- Critical Curtailment (40% of rated)
- Off (grid emergency)
- Maximum Indoor Temperature Offset (+/- X° F)
- Peak load price signal (future)



## Ongoing Activities and Next Steps

- EPRI recruitment portal launch
  - Standardized customer recruitment
  - Customer enrollment and Participant agreement
- Initial functional end-to-end testing
  - Verification of OEM cloud and data export functions
  - Stand-up EPRI VTN and data collection methodologies
- Conduct full testing at customer sites



## Contact and Questions



EH

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