

# Connected Ecosystems and the Potential to Enable an Integrated Energy Network

**Ben Clarin**  
Sr. Project Manager

**38<sup>th</sup> Utility Energy Forum**  
April 26<sup>th</sup>, 2018

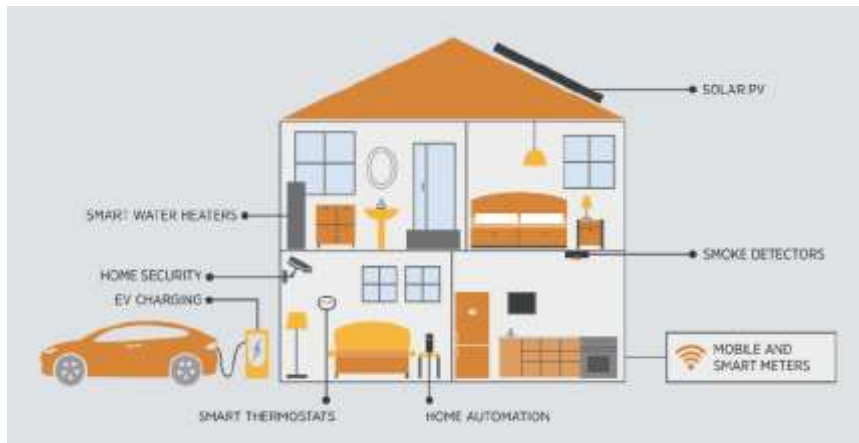


# What is EPRI and Energy Utilization at EPRI?

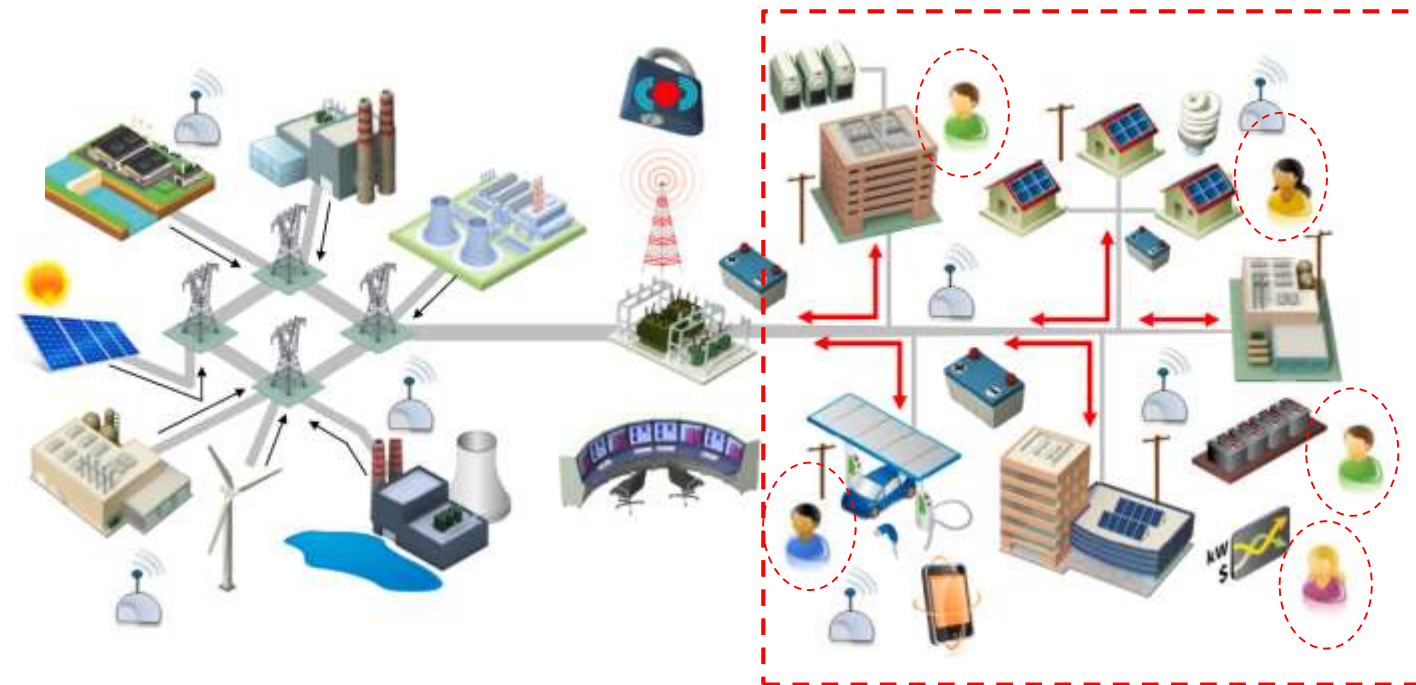
**Mission:** Advancing *safe, reliable, affordable* and *environmentally responsible* electricity for society through global collaboration, thought leadership and science & technology innovation



Address All Levels of Technology Pipeline



Connecting Customers (and Devices)



# Key Long Term Trends

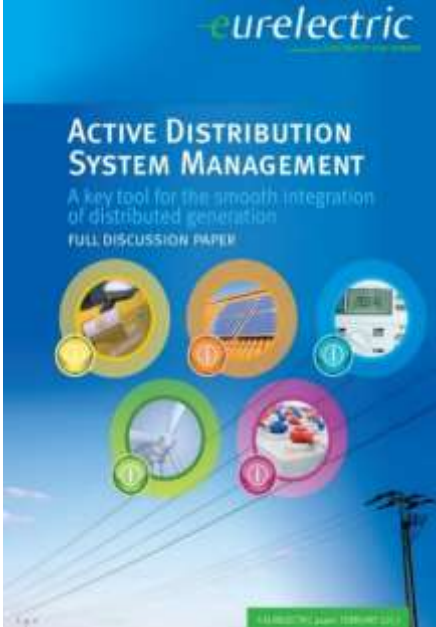
## Advanced Energy Communities



**Decarbonization**

**Grid Integration and Grid Hardening**

**Electrification**



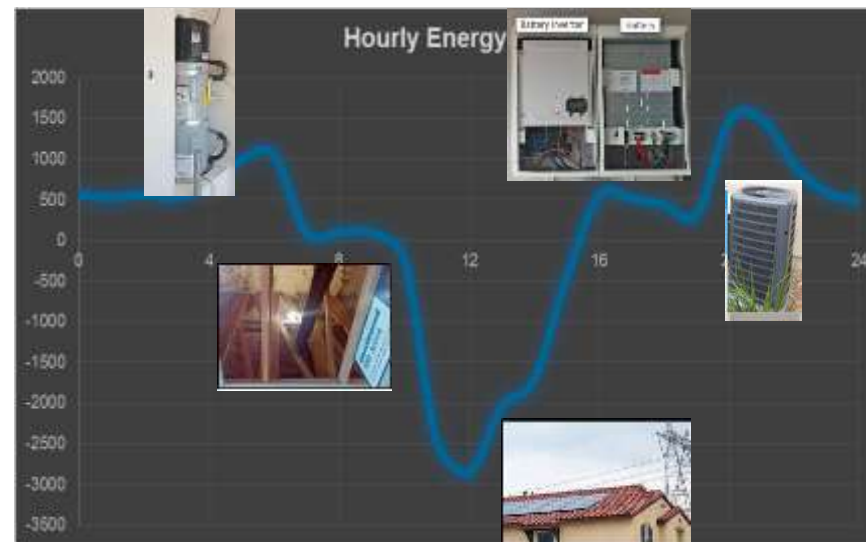


# Introduction to Advanced Energy Communities

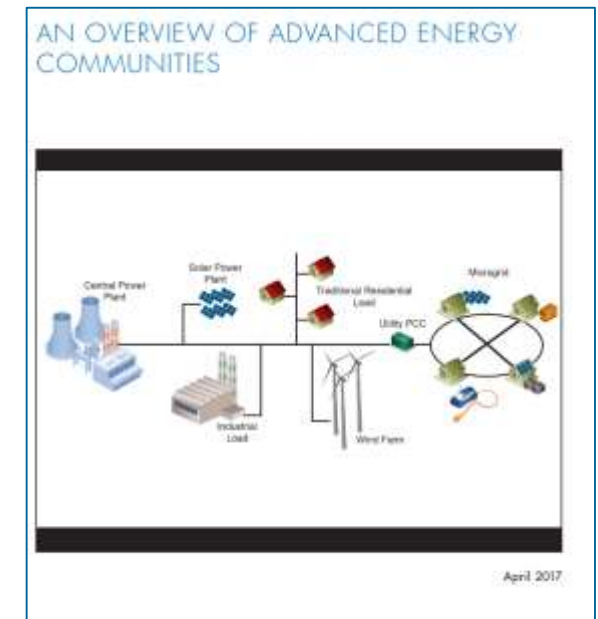
- **Advanced Energy Communities (AECs)** integrate multiple customer resources such as energy efficiency, demand response, customer storage, solar PV (or other local generation), electrification and electric vehicles in **an electrically contiguous area**. An AEC differs from a generic group of DER such that the portfolio of end use technologies and energy resources within an AEC are **planned from inception** to achieve **common customer objectives** such as comfort, cost and convenience while **delivering societal goals like decarbonization and grid hardening**.



AEC Demos Requires Multi-Stakeholder Engagement



Understanding AEC Performance using Smart Energy Devices



AEC Whitepaper

# Example AEC – Southern Company/Alabama Power Smart Neighborhood



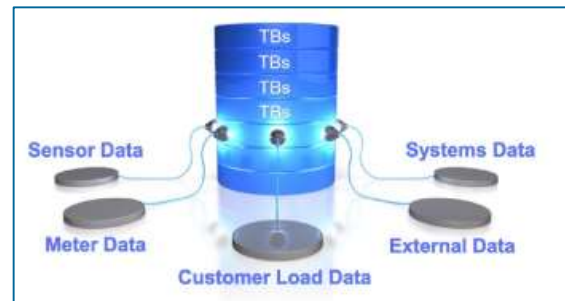
62 HERS 45 Homes



Emerging Residential Technologies



Front of the Meter DERs (Microgrid)



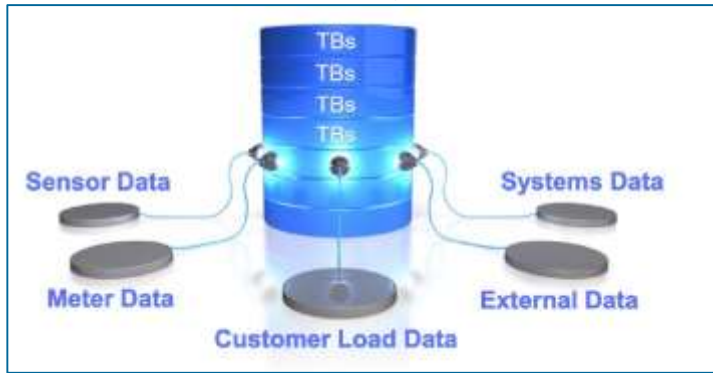
Comprehensive data collection of both utility and customer data

Device	Data Parameters (example)
AMI	kW/kWh
Circuit Level Monitoring	kW/kWh at the circuit breaker level
Smart Thermostats	Temperature Setpoints, Indoor Temperature, HVAC runtime, etc.
Connected Water Heaters	Water Temp, Runtime, Setpoints, Operating Modes, etc.
Smart Appliances	Temperature settings (Fridge), DR event participation, etc.
Microgrid	Frequency, Voltage, Main Power, Solar Power, Battery Energy, State of Charge, etc.
Survey Data	Customer responses

# Alabama Power Smart Neighborhood (Some Analysis)



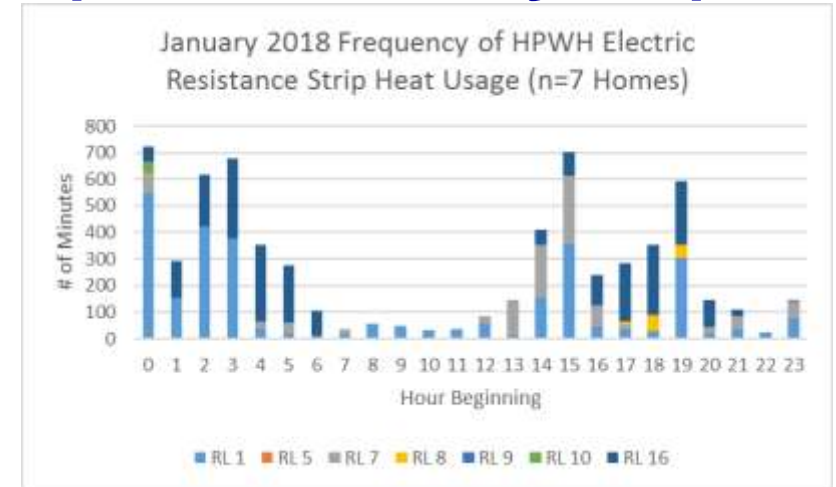
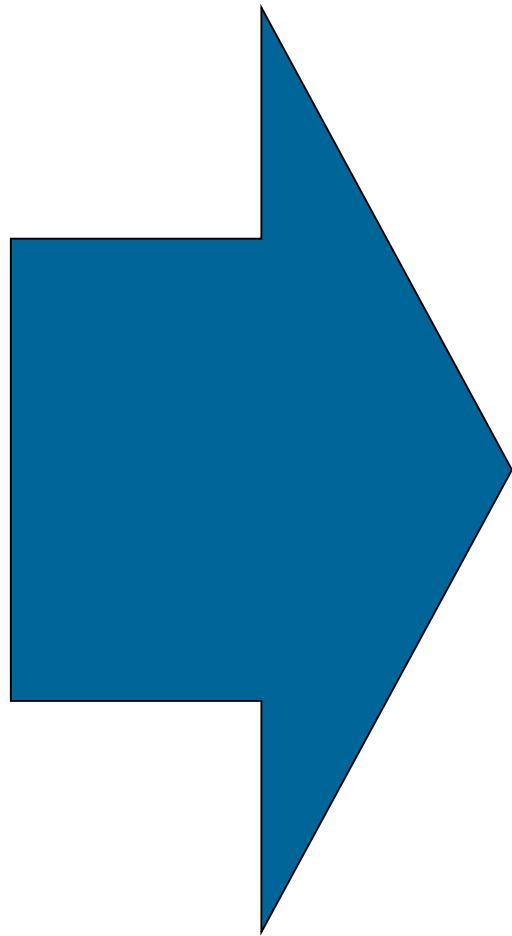
Advanced Energy Community



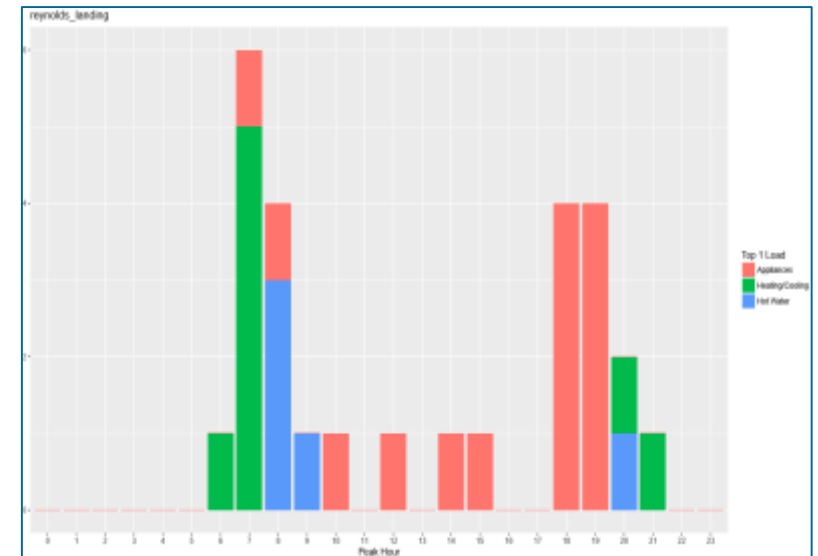
Advanced Energy Community (est. 5-10TB)

IDSMS Use Cases	Grid Management Use Cases	Utility Services Use Cases
<ul style="list-style-type: none"> <li>Modeled vs. measured building energy use performance</li> <li>Customer acceptance of utility energy management services</li> <li>Electrification of building energy systems and impact on energy use and emissions</li> <li>Control systems for aggregation of customer owned resources</li> <li>Energy management for energy cost and rate optimization</li> <li>Usage patterns for electric vehicles and other customer systems</li> <li>Measurement of building capacitance for grid services</li> </ul>	<ul style="list-style-type: none"> <li>Community scale distribution impacts</li> <li>Demand management technologies for distribution</li> <li>Microgrid technology and benefits</li> <li>Load aggregation for ISO benefits</li> <li>Recommendations for distribution planning practices</li> </ul>	<ul style="list-style-type: none"> <li>Smart Home services and Advanced User Experience</li> <li>Understanding customer preferences for DERs</li> <li>Enabling utility IDSMS programs through services and targeting</li> </ul>

Research Questions of Interest



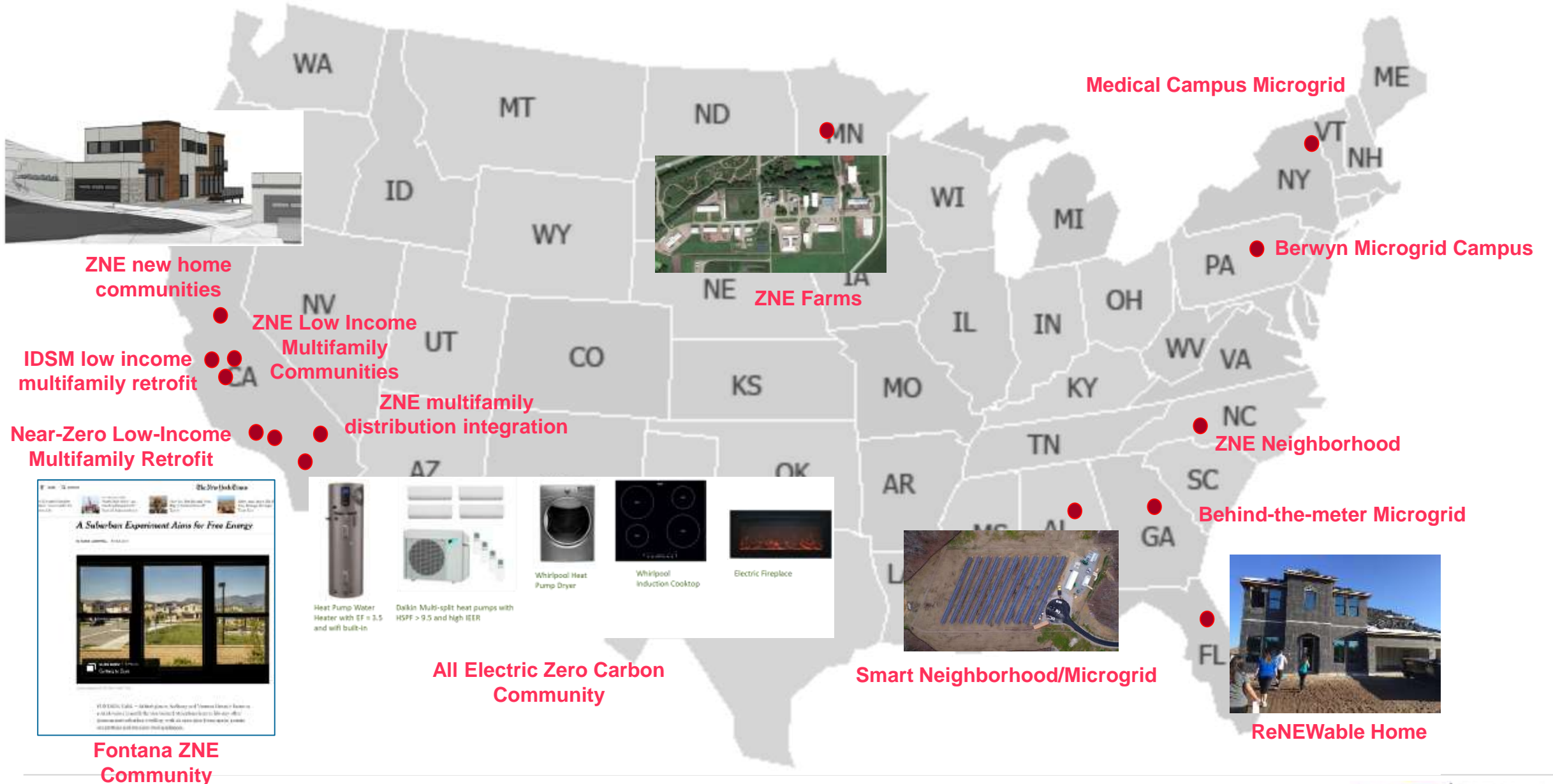
Operational performance of Advanced Heat Pump Water Heaters



Attributing community peak-load system energy consumption



# Other Advanced Energy Communities Across the Country



# Connected Devices → Connected Ecosystems

## Drivers

### Market has Value

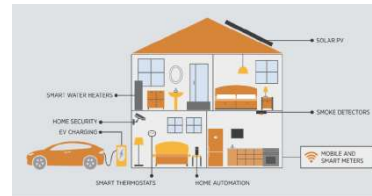
Technologies have an embedded “market pull.”

### Utilities want flexibility

Utilities looking at new methods of managing a dynamic grid.... And understanding their customers... and...

### Customers Want Choice

Drive to provide customers options (devices, rates, services) while energy is not first



## Effect

Transition from connected devices “widgets” to ecosystems

Need to investigate connected ecosystems that have the potential to stack customer and utility value streams

Identify Technical and Market Gaps to Enable Stacked Value Streams

**All in a space of rapid technology change**



# Core Functions of Connected Ecosystems



**Optimization** – Use of data and customer inputs to provide autonomous programming and response targeted for a specific need.

**Examples** – Whisker Labs and Nest Labs

**Orchestration** – Coordinated programming and response of end-use loads with a premise.

**Examples** – Amazon Alexa, Samsung SmartThings

**Aggregation** - Grouping of end-use loads, typically of the same end-use to respond to particular utility controlled signals.

**Examples** – EnergyHub, AutoGrid.

# Why Voice Assistants?

## Background:

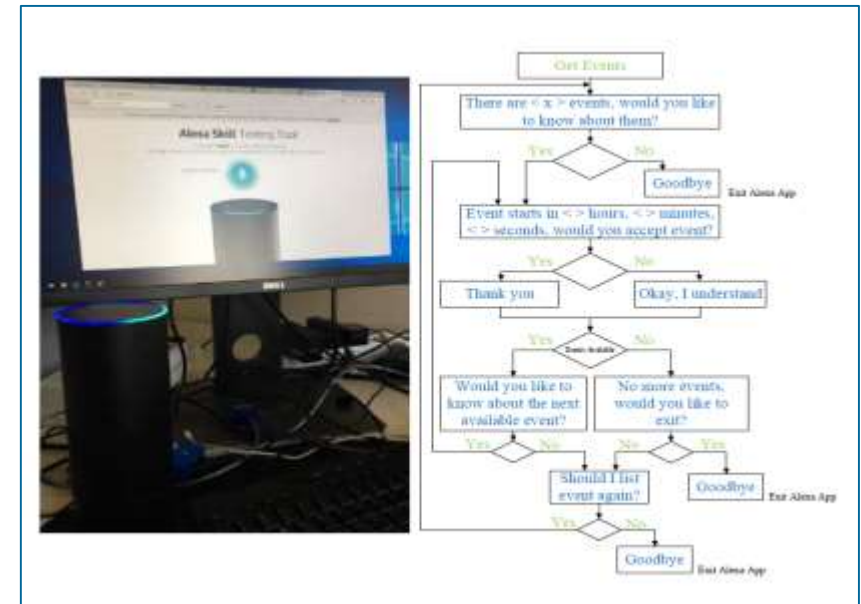
- The technology says we should
- Utility customer use cases say we should
- The market said we should
- My mom said I should

## Previous EPRI Research (2017)

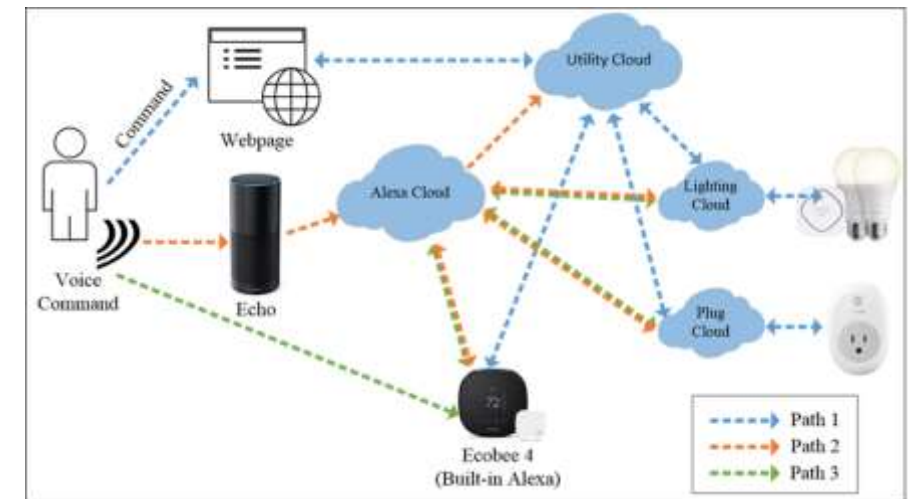
- Lab implementation of proxy utility DR event using Amazon Echo
- Field deployments of Amazon Echo

## Research Questions

- How can voice assistants control multiple loads within a premise and enable whole-building DR?
- What DSM opportunities can be enabled via home ecosystems centered around voice assistants?
- What other customer engagement opportunities are enabled by these platforms?



Amazon Echo Skills to Enable Premise-Level Demand Response



Architecture for Whole-Home DR

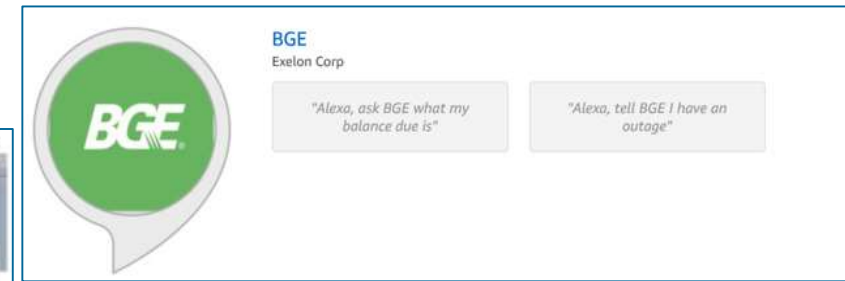
# Hey Google and Alexa, What's Next?

## Research Question

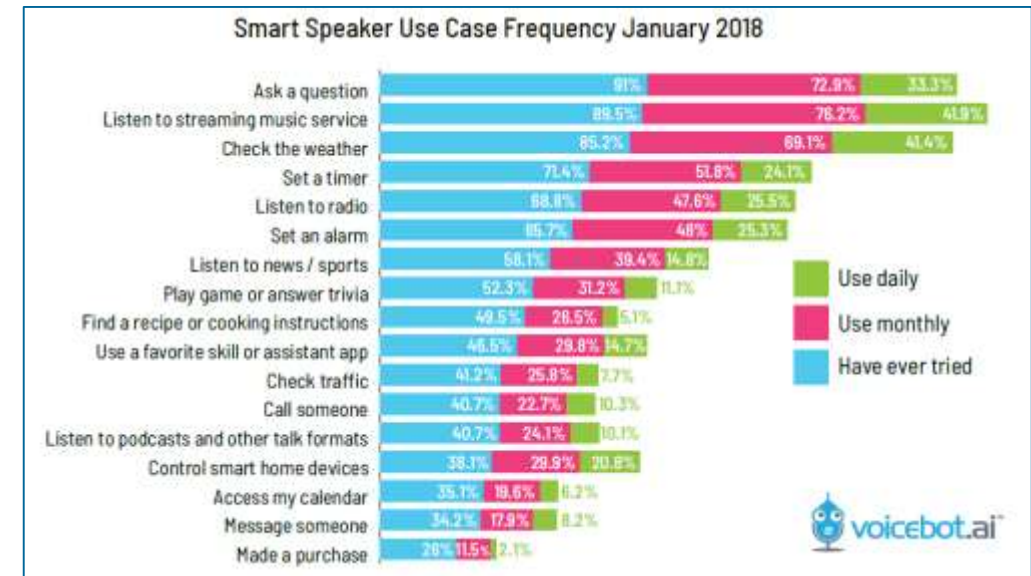
*“Hey Google and Alexa, How can we embed an energy journey into an existing customer journey?”*

## Get Involved:

- Webcast: May 9<sup>th</sup>, 2018 11AM PDT (2PM EDT)
- Guest Panelist from Google Home
- Discussion on utility use cases and existing technical and market gaps to enable these use cases.
- Connected Ecosystem Workshop



Market and utility integration w/ Voice Assistants



How (and how frequent) customers are using voice assistants (Source Voicebot.ai)



# Why Just Control? Orchestration Leading to Personalization



**Better understanding of the customer leads to personalized/customized energy journeys**

# Questions... And Save the Date!



- **Building Electrification and Decarbonization Workshop on Monday Aug 20**

**ELECTRIFICATION 2018**  
INTERNATIONAL CONFERENCE & EXPOSITION

AUGUST 20-23, 2018  
LONG BEACH, CALIFORNIA



Convergence of technical, program, and policy aspects of Electrification

Presentations, panels, and workshops:

- Transportation electrification
- Residential, commercial, and industrial electric technologies
- Emerging technologies – indoor agriculture, additive manufacturing, and others
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