Advanced Energy Communities: Enabling the customer centered grid

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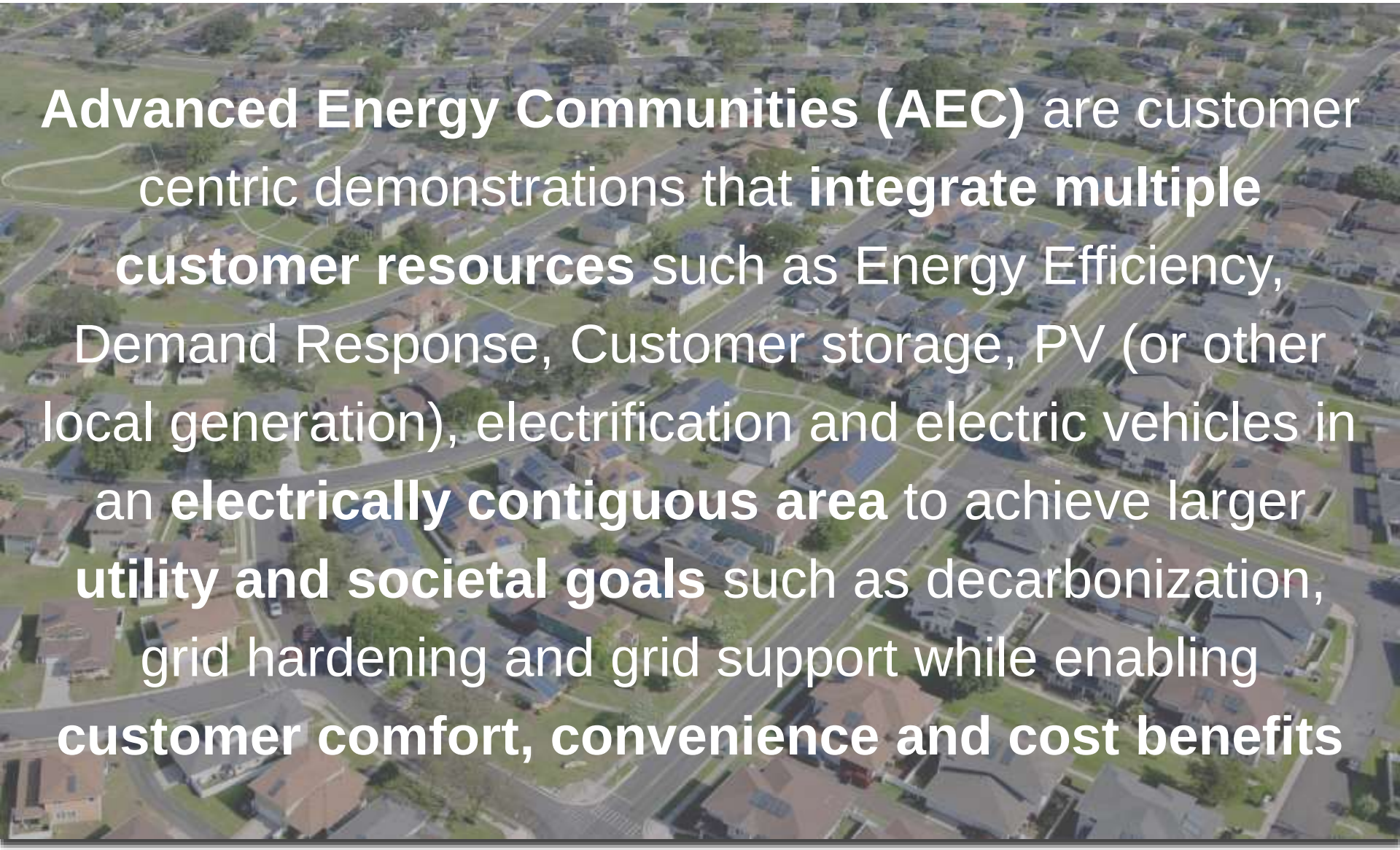
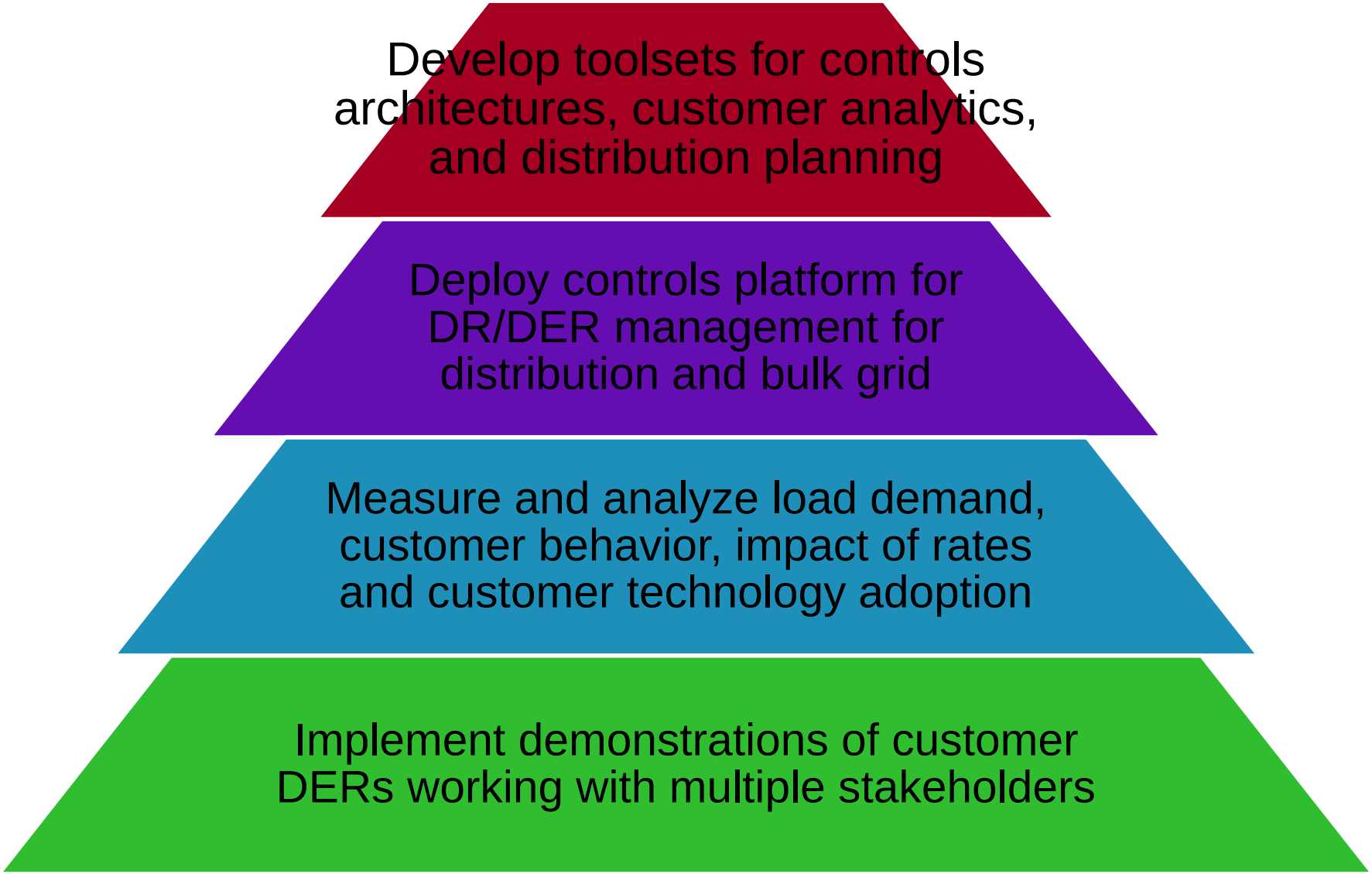
What is an Advanced Energy Community



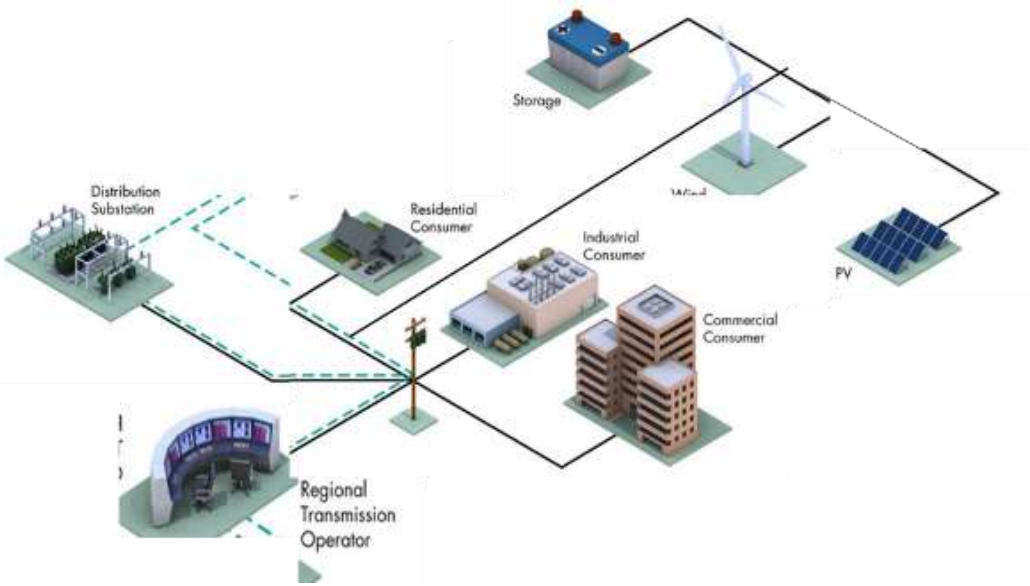
Advanced Energy Communities (AEC) are customer centric demonstrations that **integrate multiple customer resources** such as Energy Efficiency, Demand Response, Customer storage, PV (or other local generation), electrification and electric vehicles in an **electrically contiguous area** to achieve larger **utility and societal goals** such as decarbonization, grid hardening and grid support while enabling **customer comfort, convenience and cost benefits**

Building Blocks of Advanced Energy Communities

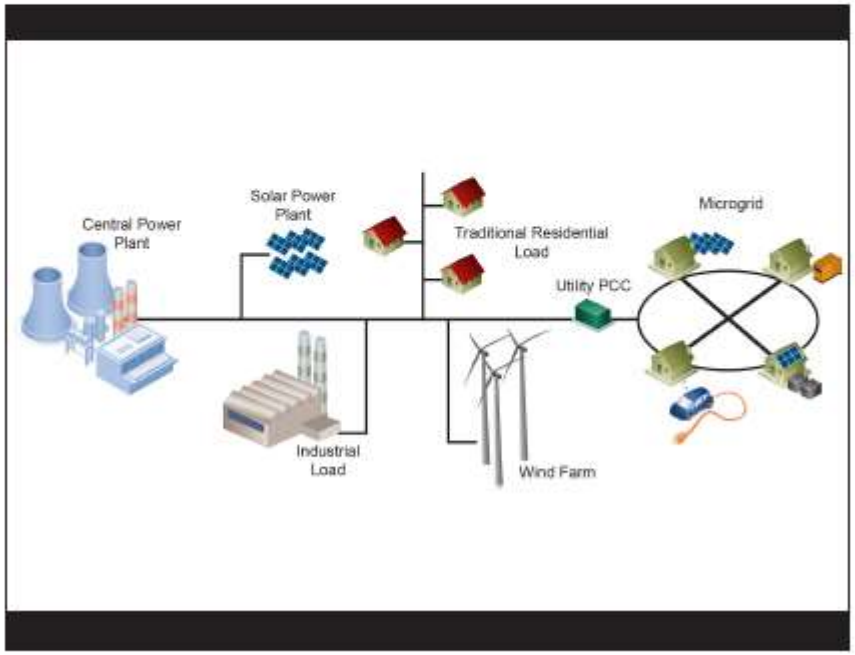


Key aspects of AEC demonstrations

- Customer driven DERs including EE, DR, PV, DG and EV
- Focus on scaled field placements of high TRL technologies
- In-depth monitoring and analysis of energy generation and use, and customer comfort and behavior
- Distribution system impact measurements
- Resource aggregation for renewable balancing

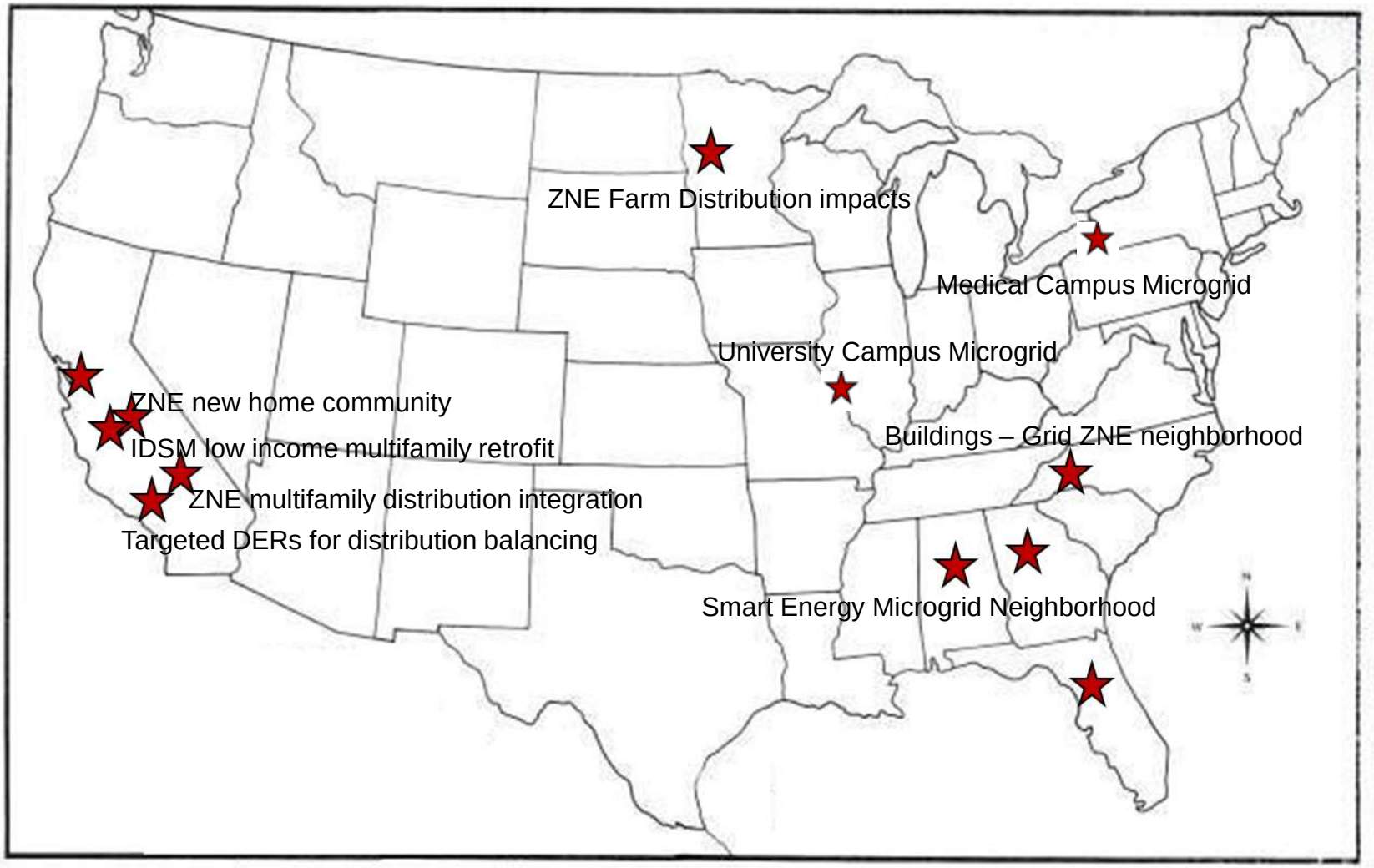


Advanced Energy Communities White Paper



- Published Advanced Energy Communities White Paper
- EPRI Product Number: 3002011115
- https://membercenter.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002011115

Ongoing examples of Advanced Energy Communities



AEC requires coordination of many stakeholders

Need to work with field partners and end customers

Manage multiple subcontractors and local authorities

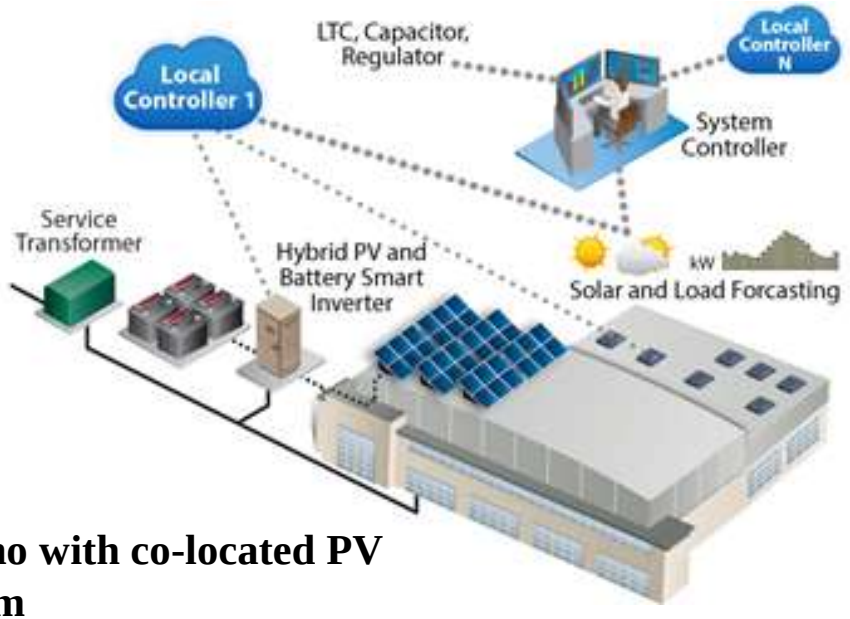
Customer centric connectivity architectures

Engage distribution planning and operations

Integrated Solutions are key to access full range of DER Benefits

- Need to develop ***integrated*** control and management systems for distribution systems
- Address high penetrations of interconnected DER

- **Planned residential demo with multiple roof-top PV and a single storage system**



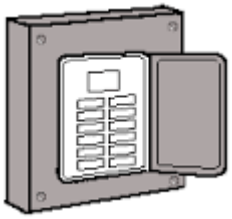
- **Planned commercial demo with co-located PV and energy storage system**

An example - Smart, Connected, Controllable Home

Smart Thermostat

Solar & Storage

Smart Heat Pump Water Heater



Controllable Loads

Combining Efficient electrification with controllable loads, local generation and storage

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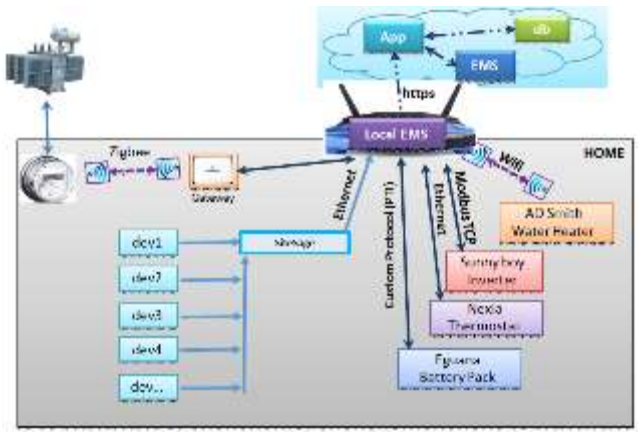
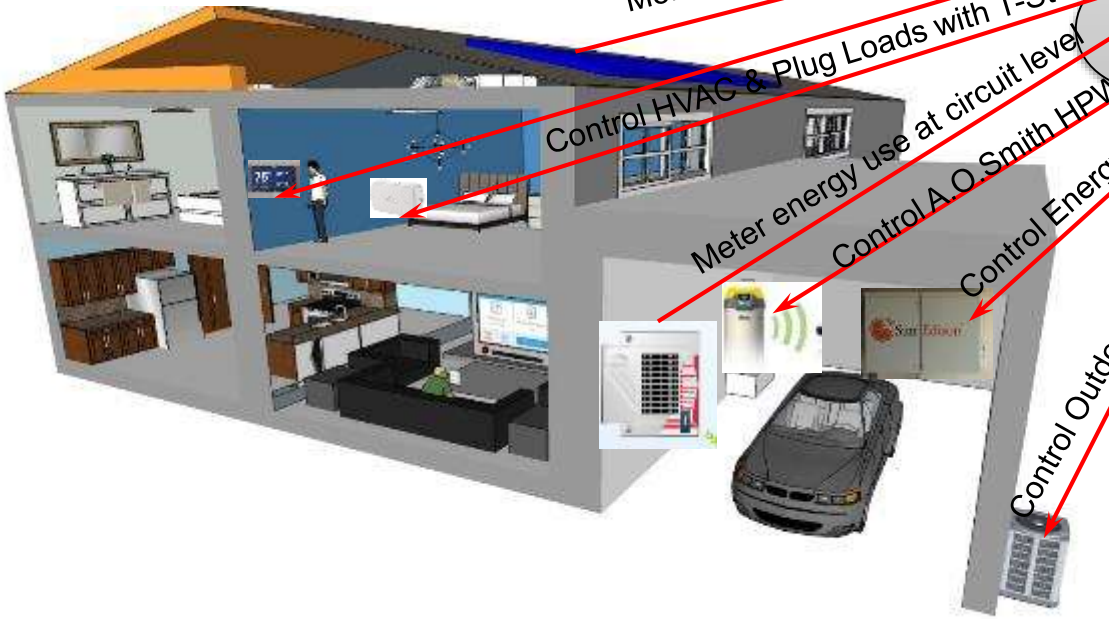
Controls to Integrate EE, DR, PV and Storage

Understanding the customer preferences, interplay with technology, and energy needs





Monitor PV production

Control HVAC & Plug Loads with T-Stat

Meter energy use at circuit level

Control A.O.Smith HPWH

Control Energy Storage

Control Outdoor and Indoor units

Customer Resources' Aggregation and Controls Platform

Monitor Transformer loading

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Example use cases for AEC results

IDSM Use Cases

Modeled vs. measured building energy use performance

Customer acceptance of utility energy management services

Electrification of building energy systems and impact on energy use and emissions

Control systems for aggregation of customer owned resources

Energy management for energy cost and rate optimization

Usage patterns for electric vehicles and other customer systems

Measurement of building capacitance for grid services

Grid Management Use Cases

Community scale distribution impacts

Demand management technologies for distribution

Microgrid technology and benefits

Load aggregation for ISO benefits

Recommendations for distribution planning practices

Utility Services Use Cases

Smart Home services and Advanced User Experience

Understanding customer preferences for DERs

Enabling utility IDSM programs through services and targeting

Examples of Advanced Energy Communities

Alabama Power Smart Energy Neighborhood

A 62 home Smart Home Community

- With Smart appliances, HEMS, 2x6 walls

A full scale microgrid with 300 kW solar and storage (size TBD)

Dedicated distribution line to neighborhood

Grid Integration of ZNE communities

Project Location 60 miles east of Los Angeles

Climate Zone 3B (warm and dry)

Annual peak temperatures ~ 105 F

20 homes on 2 transformers

9 Homes w/ monitoring & control of solar, loads **and storage**

11 Homes w/ monitoring & control of solar and loads **(w/o storage)**

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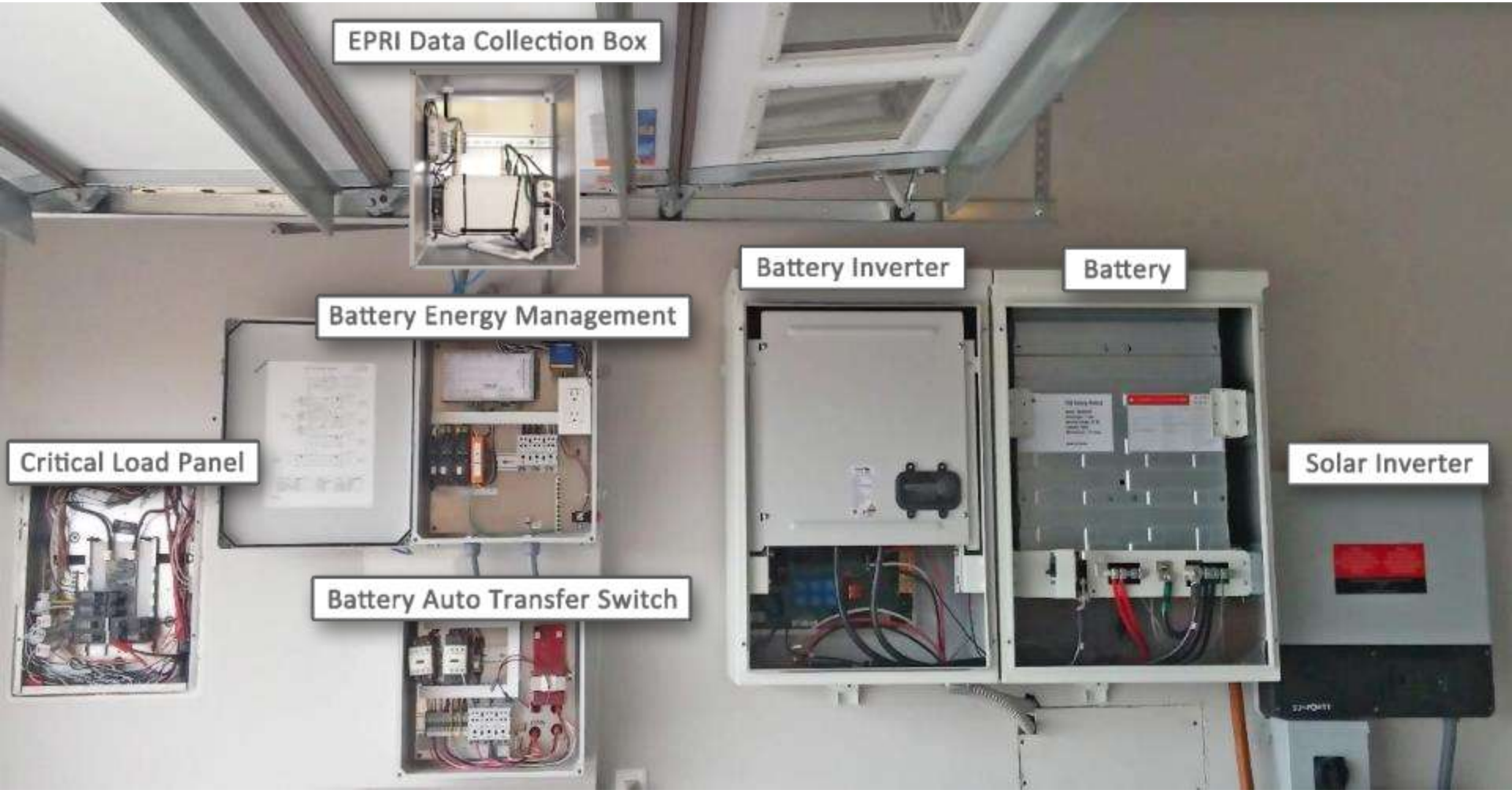
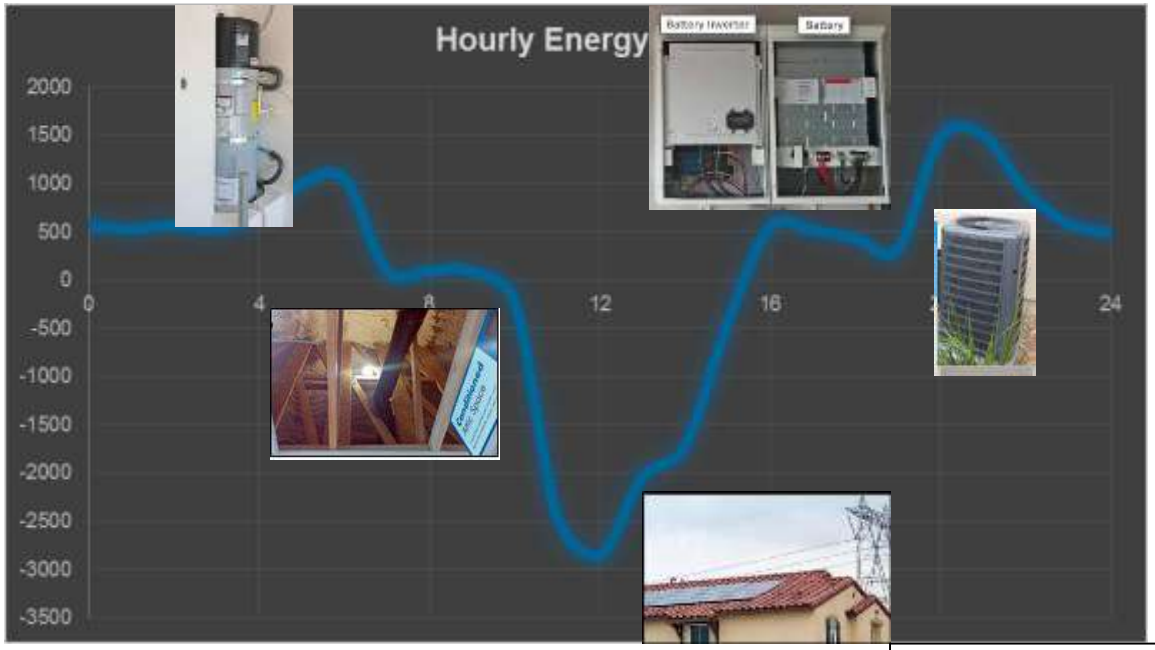
Integrated Home Control System



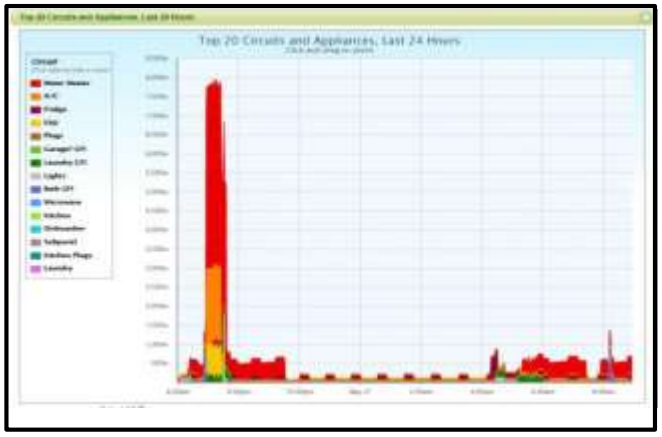
Summary of Lessons learned from Southern California neighborhood



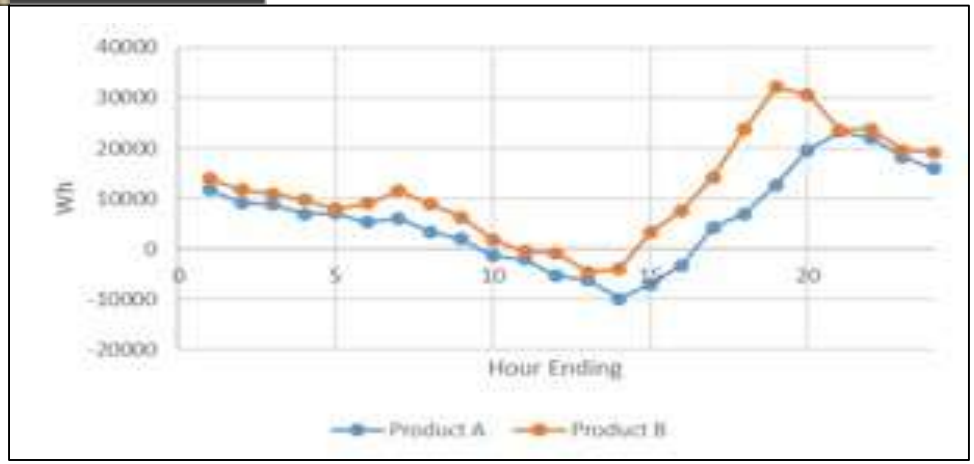
Interactive and competing impacts from electrification, energy efficient construction, solar PV, battery storage

"Duck Curve" at transformer.

- Storage makes small notch in peak and shifts by 2 hrs
- More capacity value for EE vs. PV
- EE helps distribution capacity limits



Needle peaks in home



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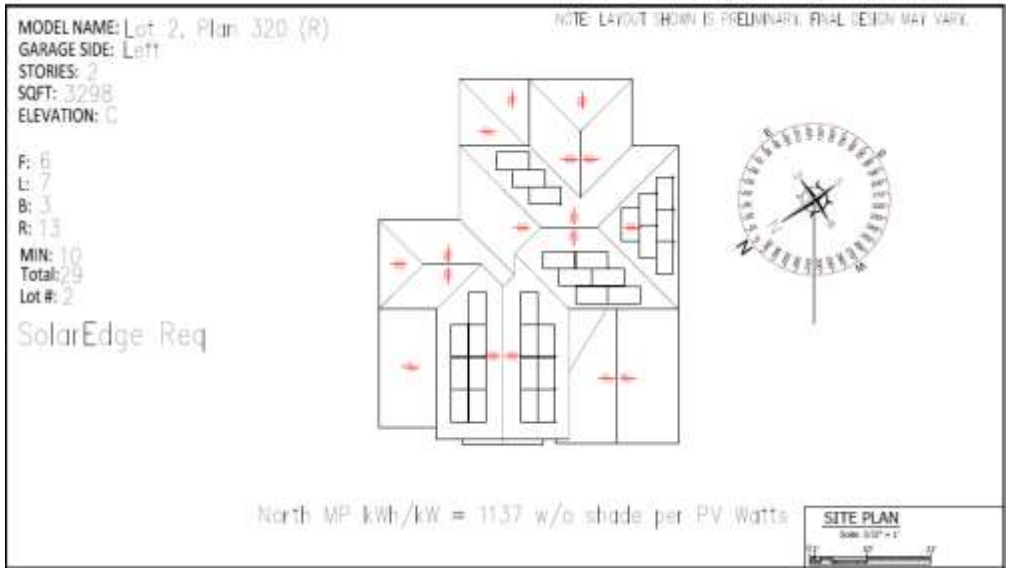
Community Scale integration of Solar, EE, DR, EV (and maybe storage)



Exploring technology integration (e.g., Blockchain), economic value and market barriers

	S-Facing PV				W-Facing PV				
Plan	North	West	South	East	North	West	South	East	No
170	11	11	11	11	11	11	11	11	
175	12	12	12	12	13	13	13	13	
185	12	12	12	12	12	12	13	13	
205	13	13	13	13	13	13	13	13	
210	13	13	13	13	14	14	14	14	
220	13	13	13	13	14	14	14	14	
240	14	14	13	14	14	14	14	14	
260	15	15	15	15	15	15	15	16	
320	16	17	16	17	17	17	17	17	
350	18	18	18	18	19	19	19	19	

Orlando Buildings – Grid Home

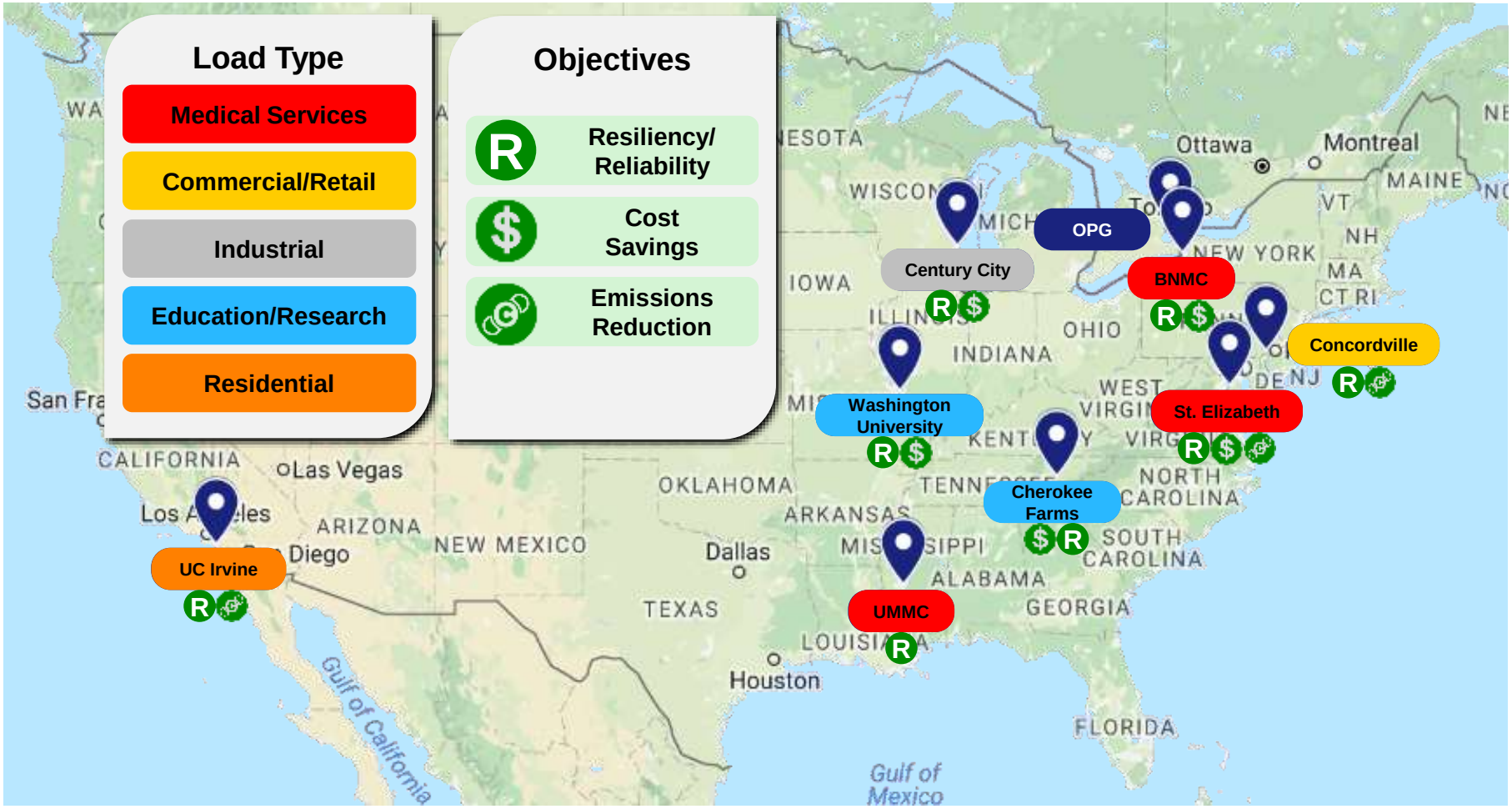
New technology for high thermal mass to provide grid balancing

All electric home with HPWH, HP, smart appliances and 8 kW PV

Energy storage included to test building capacitance with combined electrical and thermal storage for load balancing

EPRI will install Transformer Monitoring system to look at "edge of grid" impacts

EPRI Microgrid Feasibility Projects



Together…Shaping the Future of Electricity