Advancing Smart Home Intelligence to Enable Integration of Residential Distributed Energy Resources

The San Diego Smart Home Study

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Center for Sustainable Energy™

Project Partners

Background

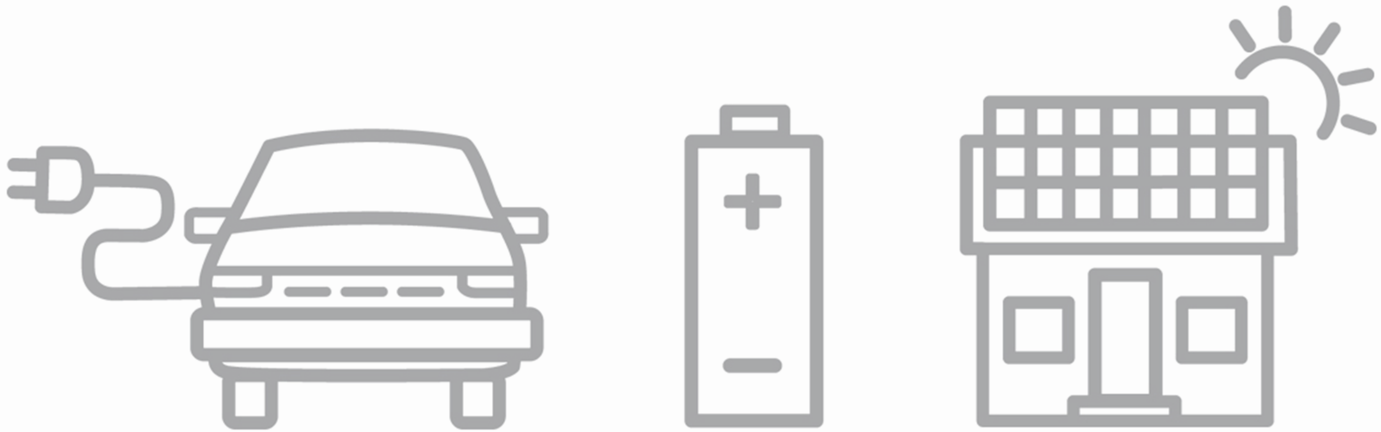
California has established an ambitious goal of relying entirely on zero-emission energy sources for its electricity by 2045.

The intermittency of zero-emission resources (e.g., solar, wind) has made it difficult for grid operators to balance the system.

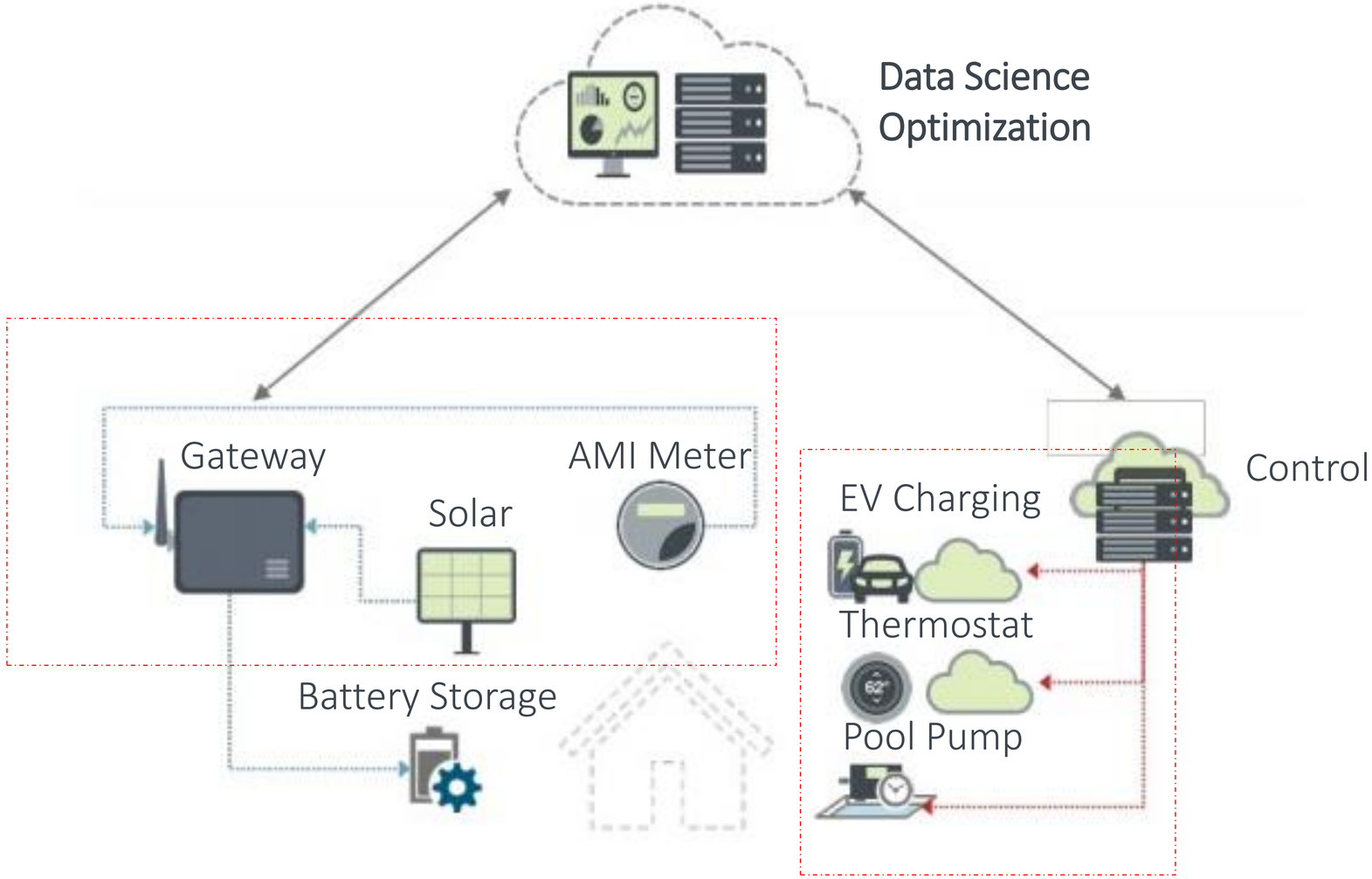
Distributed energy resources can add to this issue.

Objectives

To help customers, utilities and energy service companies automatically optimize the operation of distributed energy resources to maximize customer and grid benefits.

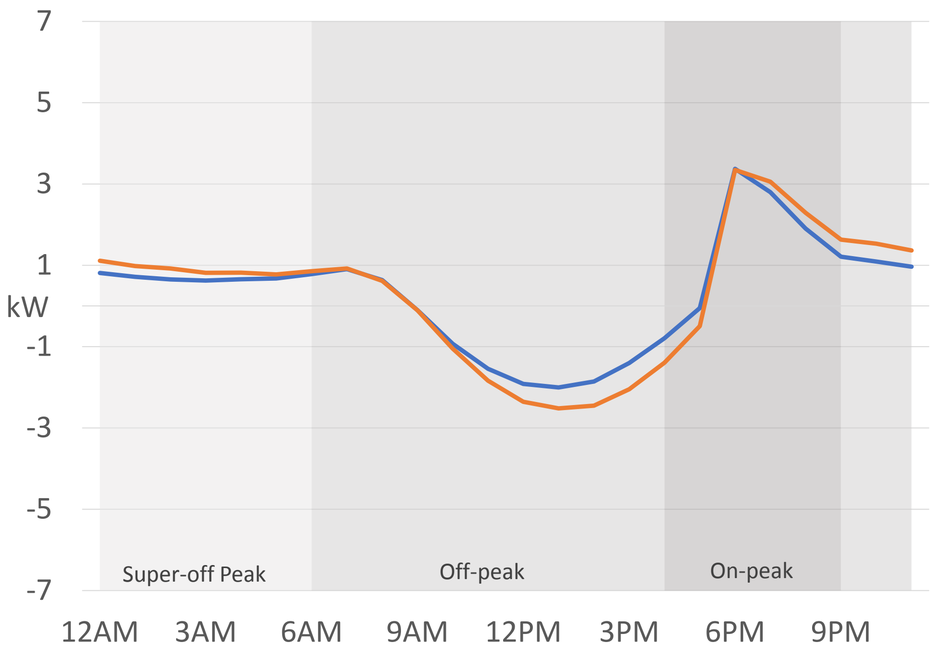


Technology of Interest - RDERMS

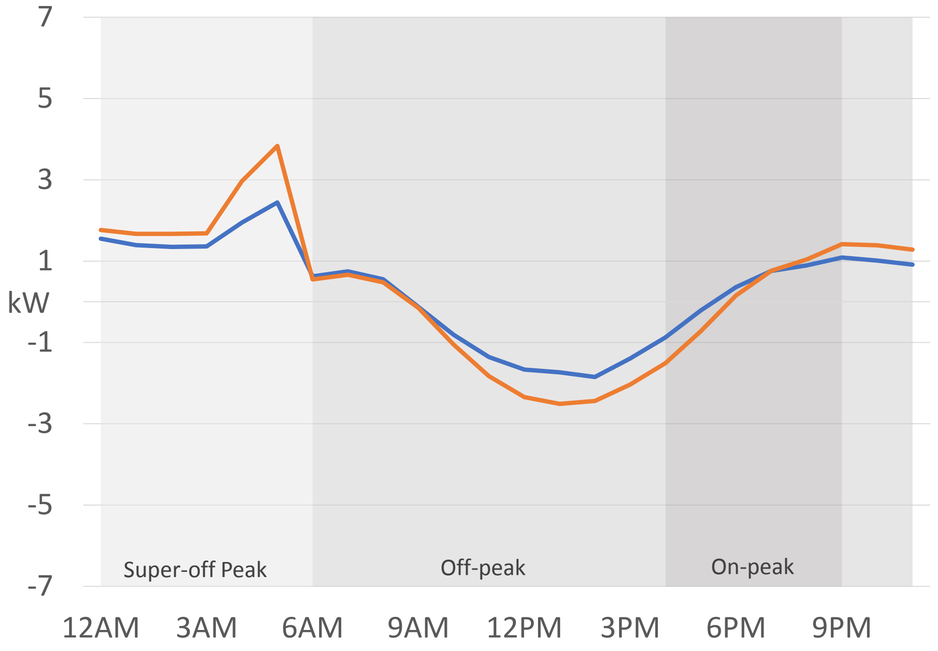


RDERMS Optimization

Uncontrolled Customer Loads



Time-of-Use Price Signal Optimized Customer Loads



Analyses

The study is set in the San Diego area of San Diego Gas & Electric territory across 100 homes.

Existing Retail and Dynamic Rate Structure

Two time-of-use rates and one dynamic rate.

Modified Existing Retail Rate Structure

One modified time-of-use rate.

Wholesale Market Rate Structure

Wholesale real-time market price.

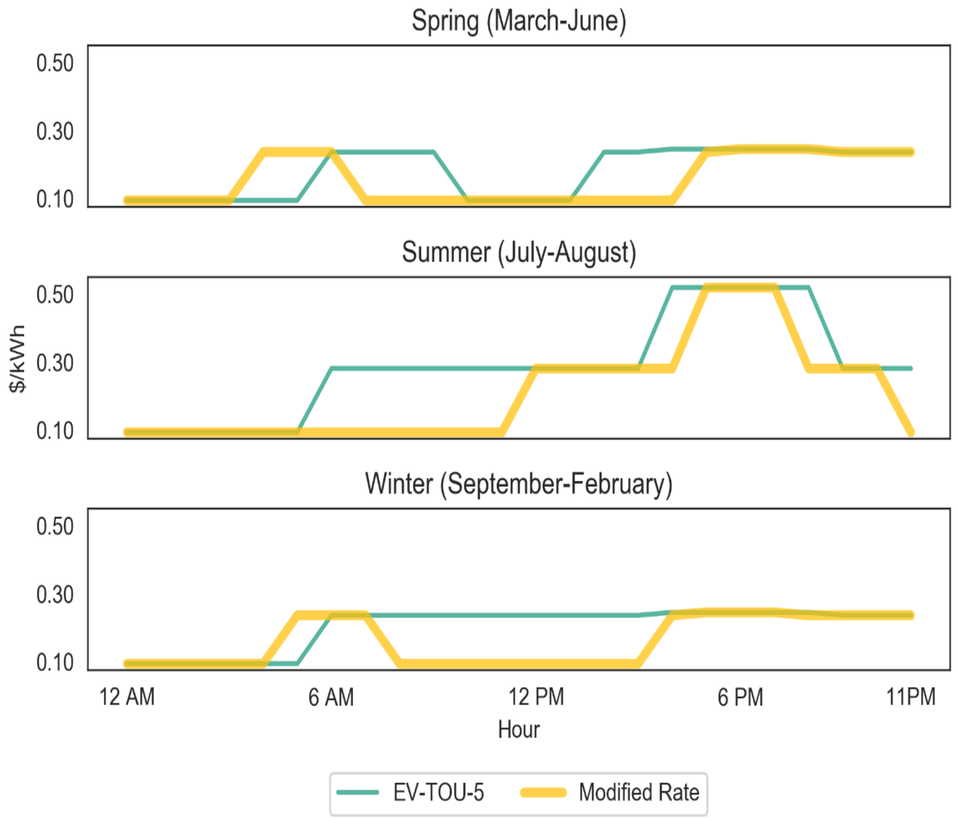
Results

Existing Rate Structure (Representative)

Customer Optimized Model	Rate Structure	Commute Length (miles)	Battery Size (kWh)	Vehicle Type	Average Customer Cost Difference	Average Grid Impacts Difference
Greatest Savings	Time-of-Use	Long	Large	With large battery capacity	$-1236	$-238
	Time-of-Use	Long	Large	With medium battery capacity	$-1152	$-205
Least Savings	Time-of-Use	Short	NA	With medium battery capacity	$-97	$-37
	Dynamic	Short	NA	With small battery capacity	$-54	$-34

Results: Modified Rate

Weekday Rate Structure Comparison



Addition of super off-peak hours during the daytime through in winter, spring and summer

Shorter on-peak period during the summer.

Decrease of 0.02 MT/year and 0.03MT/year of CO_2 for an optimized 4kWh and 8kWh energy storage system, respectively.

Results: Wholesale Market Price

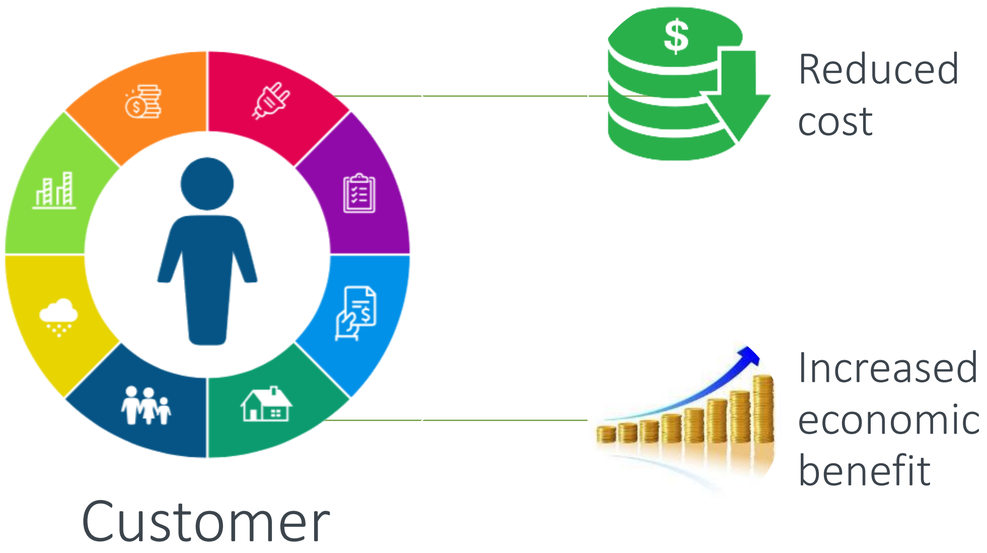
- Negative pricing trends provide opportunities for customer to receive compensation through the wholesale market for increasing load during negative pricing periods.

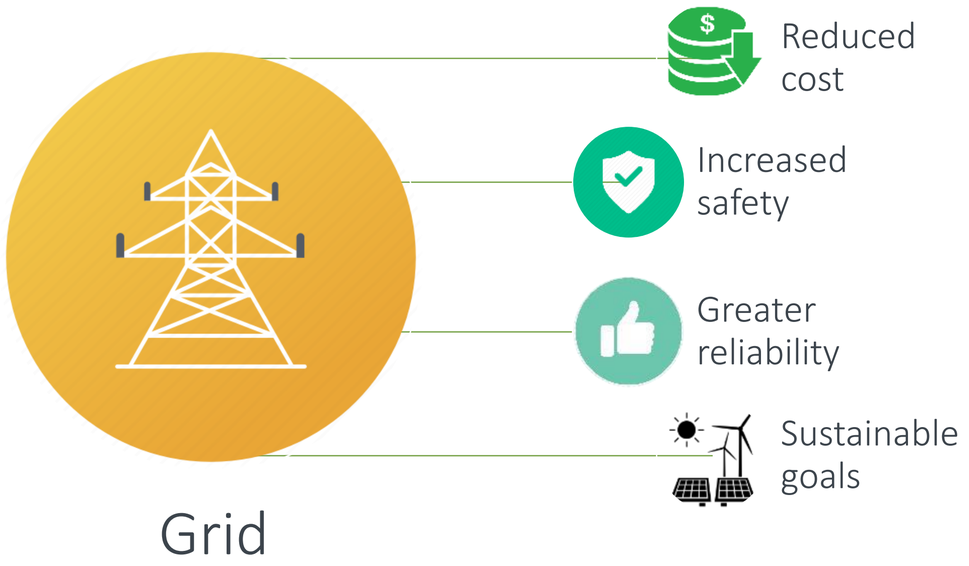
- The maximum potential economic benefit for customers was $1.87/kW of load shifting capacity per year.

Load Shift Capacity	Maximum Annual Economic Benefit
1 kW	$1.87
5 kW	$9.35
10 kW	$18.70

Conclusions

RDERMS is a novel energy management solution that provides benefits to customers and the grid.





One simple mission —

DECARBONIZE.

Our vision is a future with sustainable, equitable and resilient transportation, buildings and communities.

About CSE

A mission-driven 501(c)(3) nonprofit organization

Offering scalable clean energy program administration and technical advisory services for more than 20 years.

A national footprint, headquartered in San Diego, CA

Regional offices:

CA: Los Angeles, Oakland, Sacramento, MA: Boston, NY: Brooklyn, Stony Brook

185+ dedicated, mission-driven employees

Managing ~50 projects and programs

National programs | Statewide incentive projects | Region-specific solutions

Core Values

We lead with the passion and heart of a nonprofit and the operational experience and efficiency of a for-profit. To execute our mission and realize our vision, we integrate our values throughout our operations.

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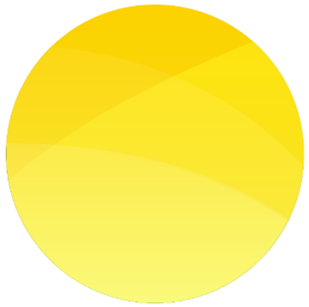
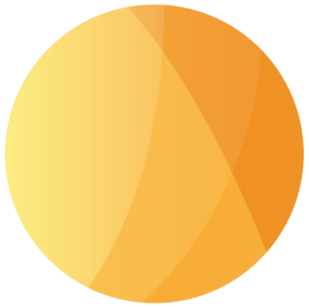


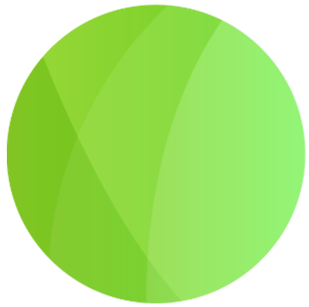
Sustainability

Equity



Transparency

Resiliency



Policy

Areas of Expertise

Clean Transportation

Adoption of electric vehicles and deployment of charging infrastructure

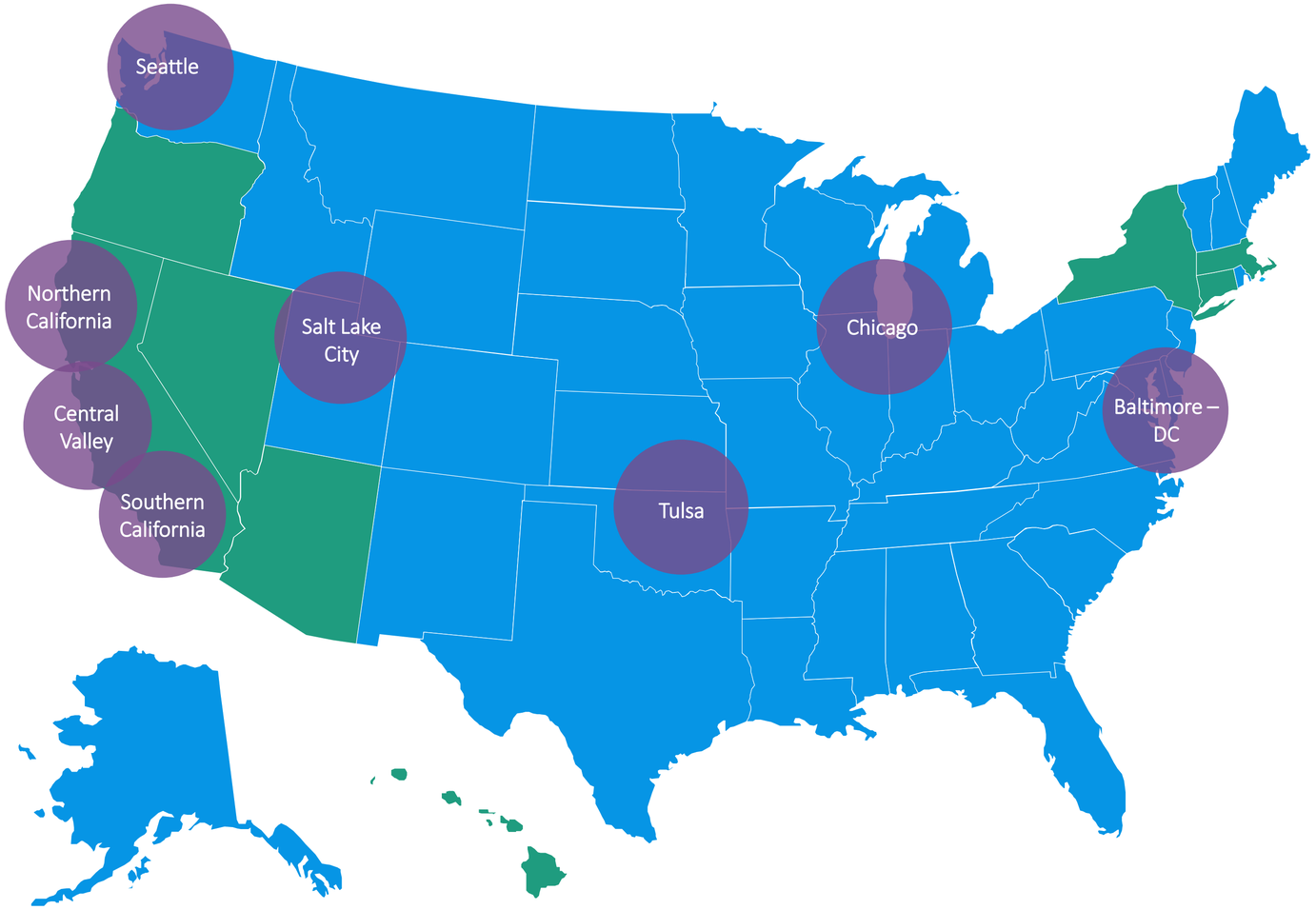
Built Environment

Advancing energy efficiency and renewable resources

Technology Convergence

Interconnecting systems to achieve decarbonization

Our Reach



We work with governments, regulators, utilities, CCAs, businesses, property owners and consumers as a trusted and objective implementation partner and technical advisor.

- Tackling issues of national importance
- Statewide incentive and distributed energy programs
- Region-specific solutions

Thank You

Contact Us

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