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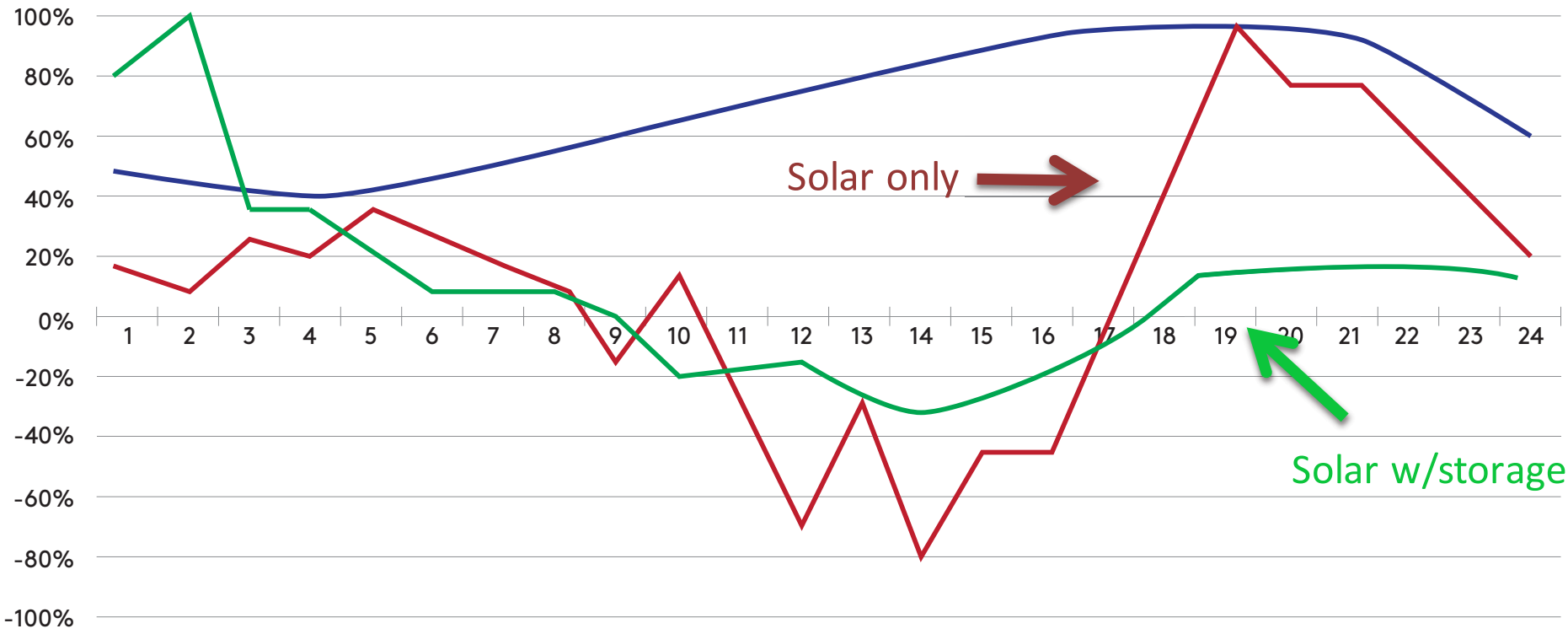
HYBRID ELECTRIC BUILDINGS

January 19, 2016

DISTRIBUTED ENERGY STORAGE IS NEEDED TO MANAGE DISTRIBUTION SYSTEM



CUSTOMER LOAD PROFILE (DISTRIBUTION SYSTEM VIEW)

CUSTOMER WITH SOLAR

CUSTOMER WITH SOLAR WITH ENERGY STORAGE

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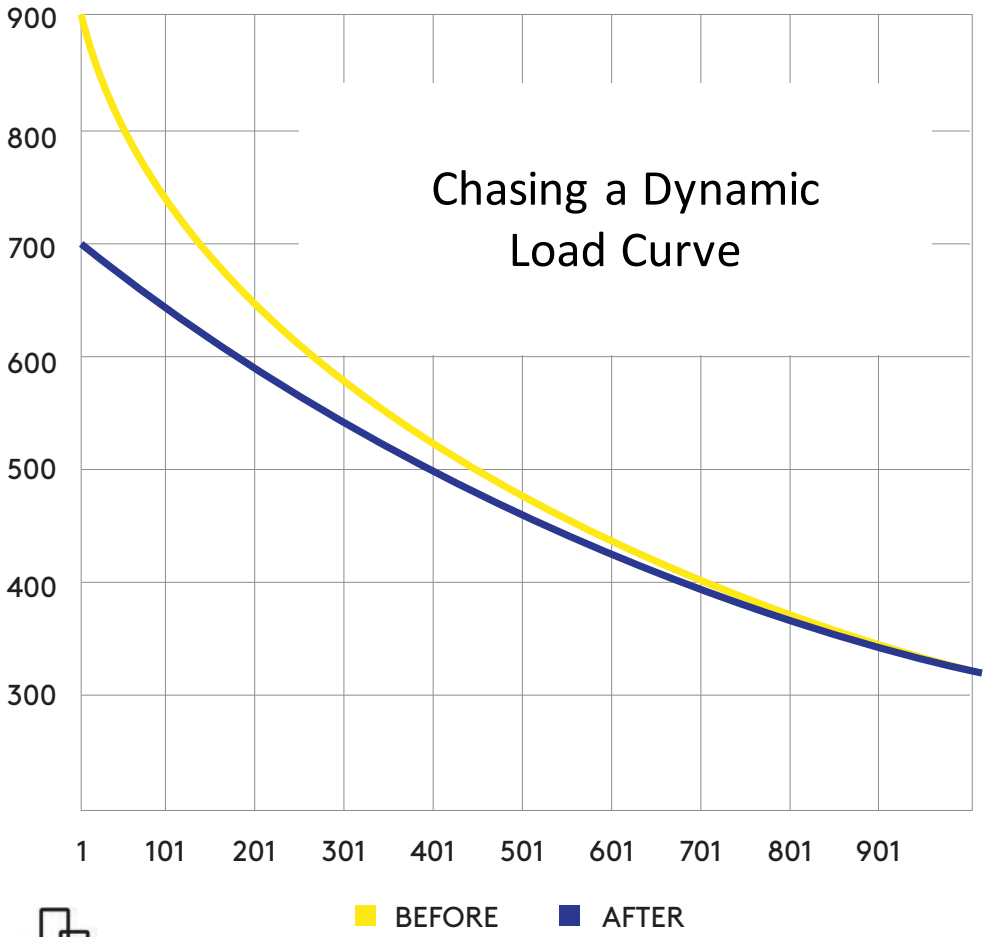
WHY ENERGY STORAGE?

Because utilities around the world will spend more than $1 trillion dollars over the next decade trying to manage changes in the distribution grid.



Energy Storage provides:

- ✓ Enhanced reliability and power quality
- ✓ Storage of renewable generation
- ✓ Avoided distribution upgrades
- ✓ Increased revenue from grid services

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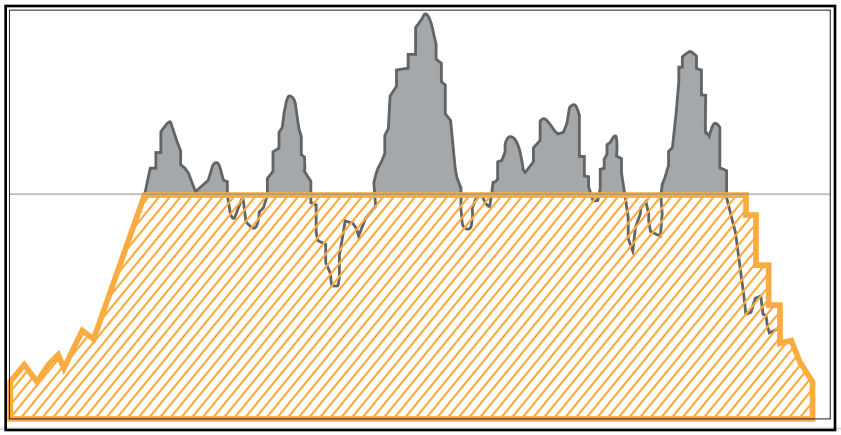
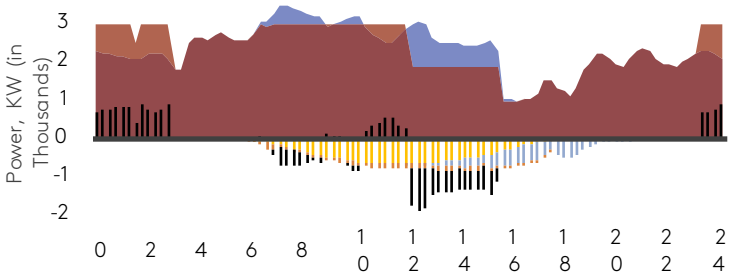
DISTRIBUTED ENERGY STORAGE PROVIDES MULTIPLE BENEFITS TO POWER CONSUMERS

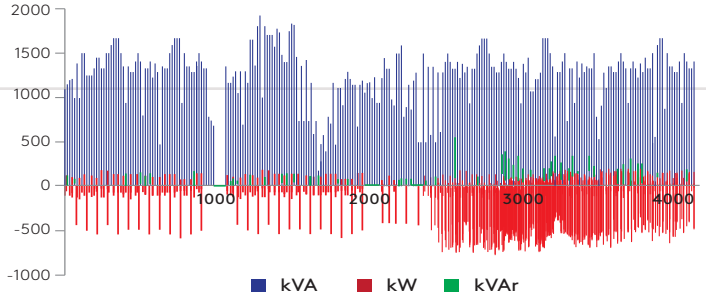
PEAK DEMAND REDUCTION



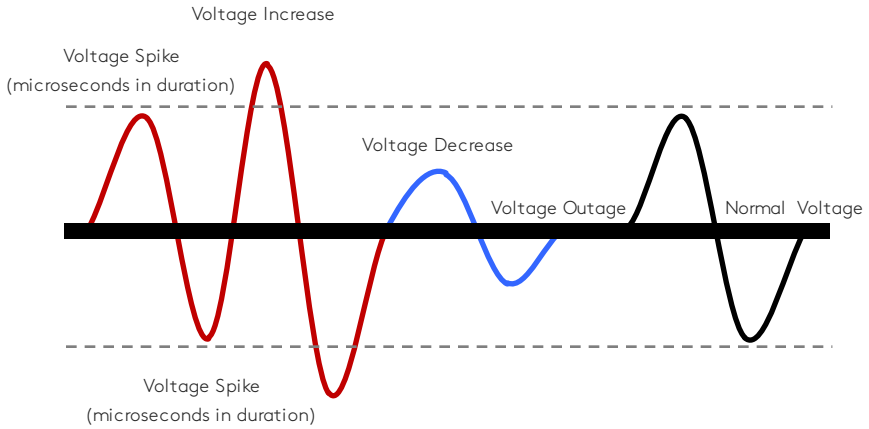
LOAD SHIFTING | SHAPING



NEGATIVE DEMAND RECAPTURE



POWER QUALITY | BACK-UP GENERATION



EV CHARGING

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DISTRIBUTED ENERGY STORAGE ALSO PROVIDES MULTIPLE BENEFITS TO GRID

Capacity
Load Following / Integration of Renewables
Voltage Regulation/ Reactive Power
Conservation Voltage Reduction

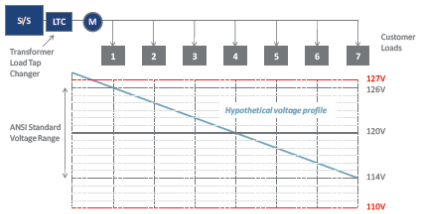


Figure 1. Hypothetical Feeder Voltage Profile with an LTC

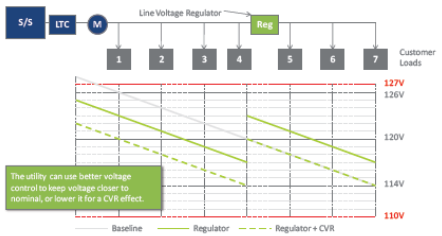


Figure 2. Hypothetical Feeder Voltage Profile with an LTC and Voltage Regulator

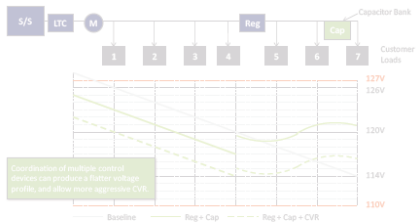
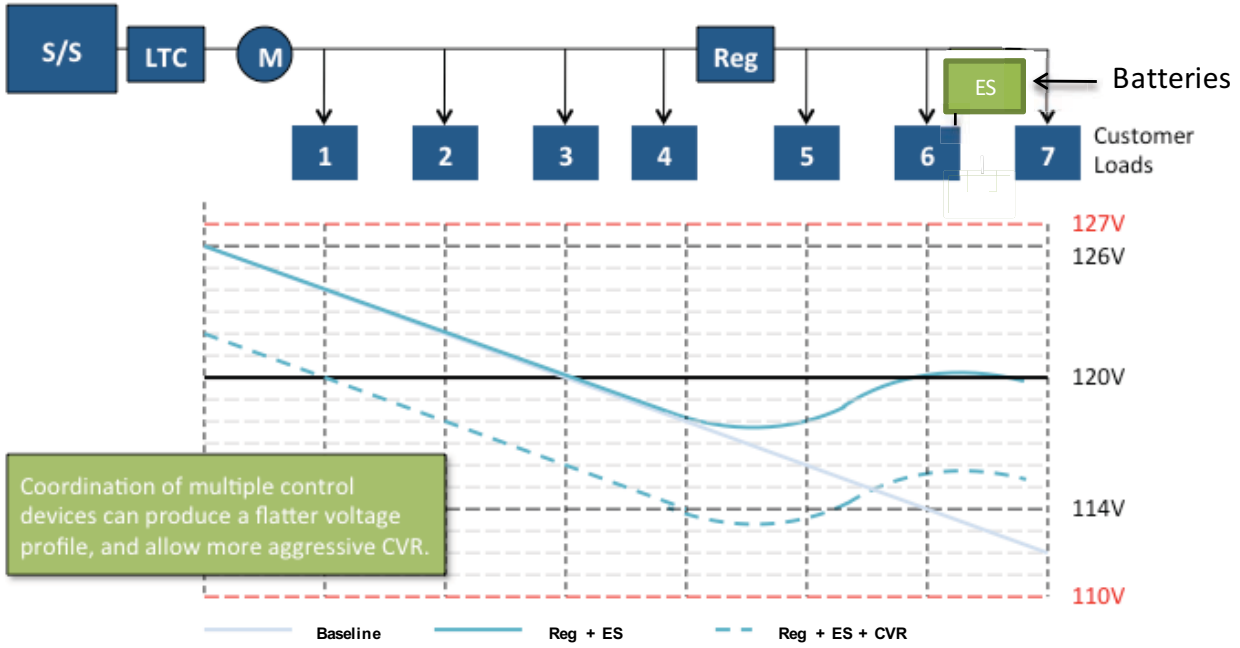


Figure 3. Feeder Voltage Profile with LTC, Voltage Regulator and Capacitor Bank



Source: Adapted from Application of Automated Controls for Voltage and Reactive Power Management – Initial Results. DOE – Smart Grid Investment Grant Program, December 2012

SOUTHERN CALIFORNIA EDISON®

An EDISON INTERNATIONAL® Company

SCE Signs Contracts for 2,221 Megawatts That Could Power 950,000 Homes in Southern California

ROSEMEAD, Calif.--(BUSINESS WIRE)--Southern California Edison (SCE) announced that it has signed contracts for 2,221 megawatts of power from diverse new resources to meet its customers' long-term electricity needs. The 2,221 megawatts will represent roughly 10 percent of SCE's current total customer peak usage and is enough to power about 950,000 average homes.

"These projects will provide energy solutions to meet the

The new contracts result from a plan recommended by SCE in response to state forecasts of local reliability needs due to the closure of the San Onofre Nuclear Generating Station and anticipated retirement of older, natural gas generation plants along the Southern California coastline that rely on ocean water for their cooling needs.

In this solicitation, SCE received more than 1,800 final offers and, for the first

greentechmedia

Inside SoCal Edison's Groundbreaking 2.2GW Grid Modernization Plan

A new model lets distributed solar, energy storage and efficiency stand with power plants as grid resources.

Jeff St. John
November 21, 2014

Two weeks ago, utility Southern California Edison launched a real-world experiment in grid-edge economics, one that's going to unfold in real time and at gigawatt scale.

In a first for the utility industry, SCE announced it would buy hundreds of megawatts of distributed solar, behind-the-meter batteries, automated demand response and targeted energy efficiency as part of its 2,200-megawatt Local Capacity Requirement (LCR) procurement for its grid-stressed West Los Angeles Basin region.

AMS is Building 50 MW of Energy Storage Systems for Grid Support in Southern California

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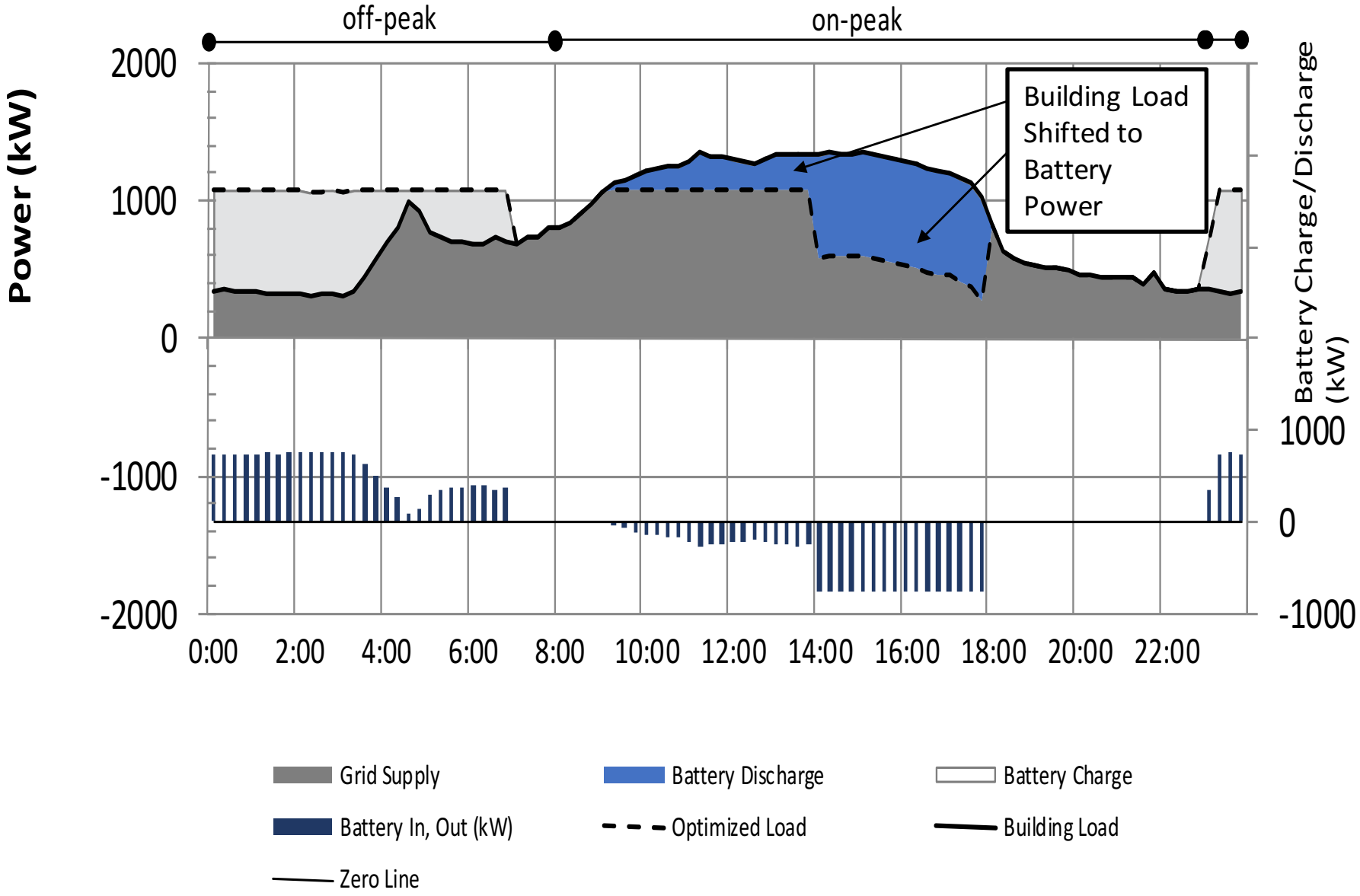
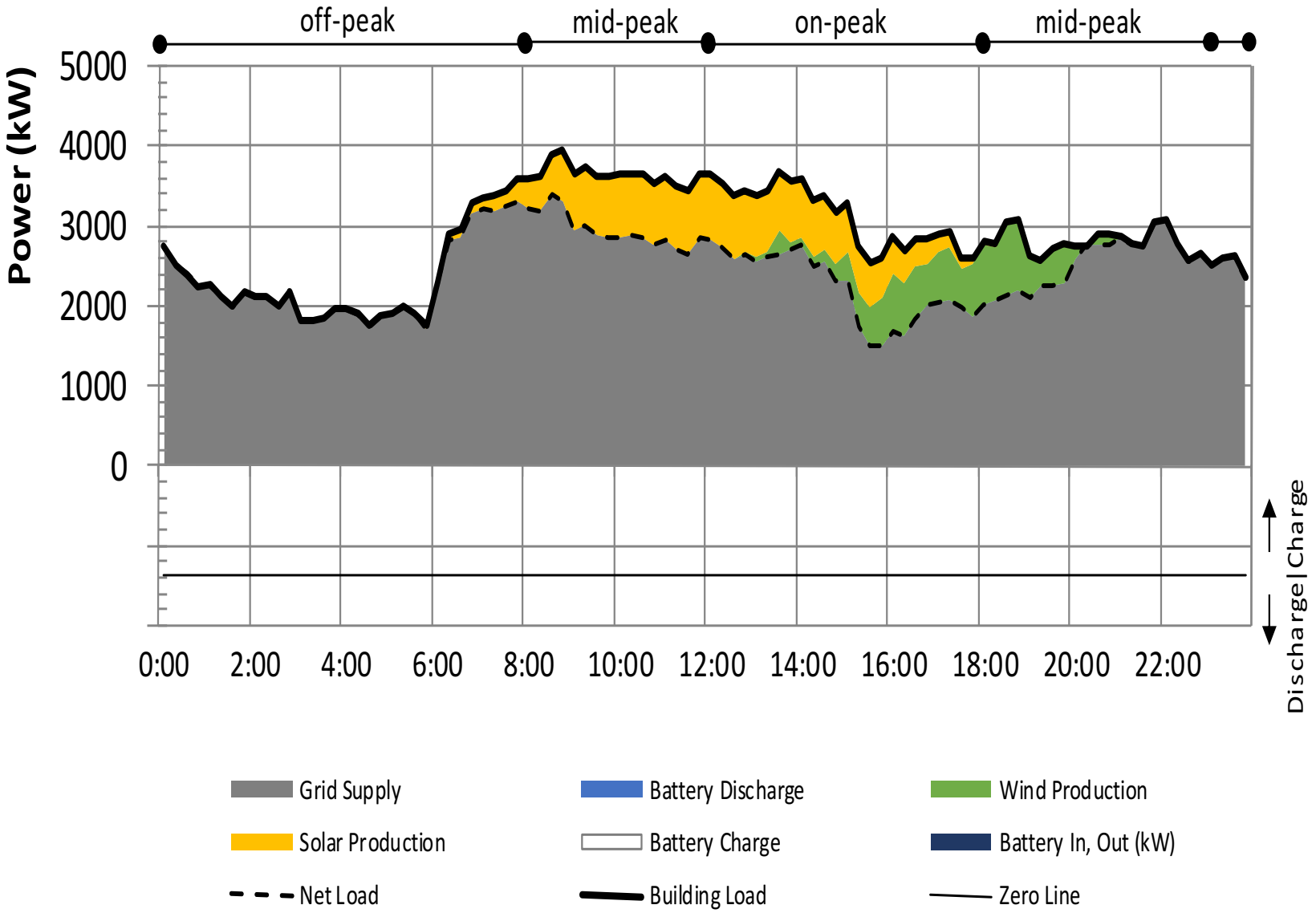
HYBRID ELECTRIC BUILDINGS SHIFT BUILDING LOAD TO BATTERIES WHEN NEEDED FOR GRID SUPPORT



AGGREGATED BUILDING LOAD WITH SOLAR & WIND



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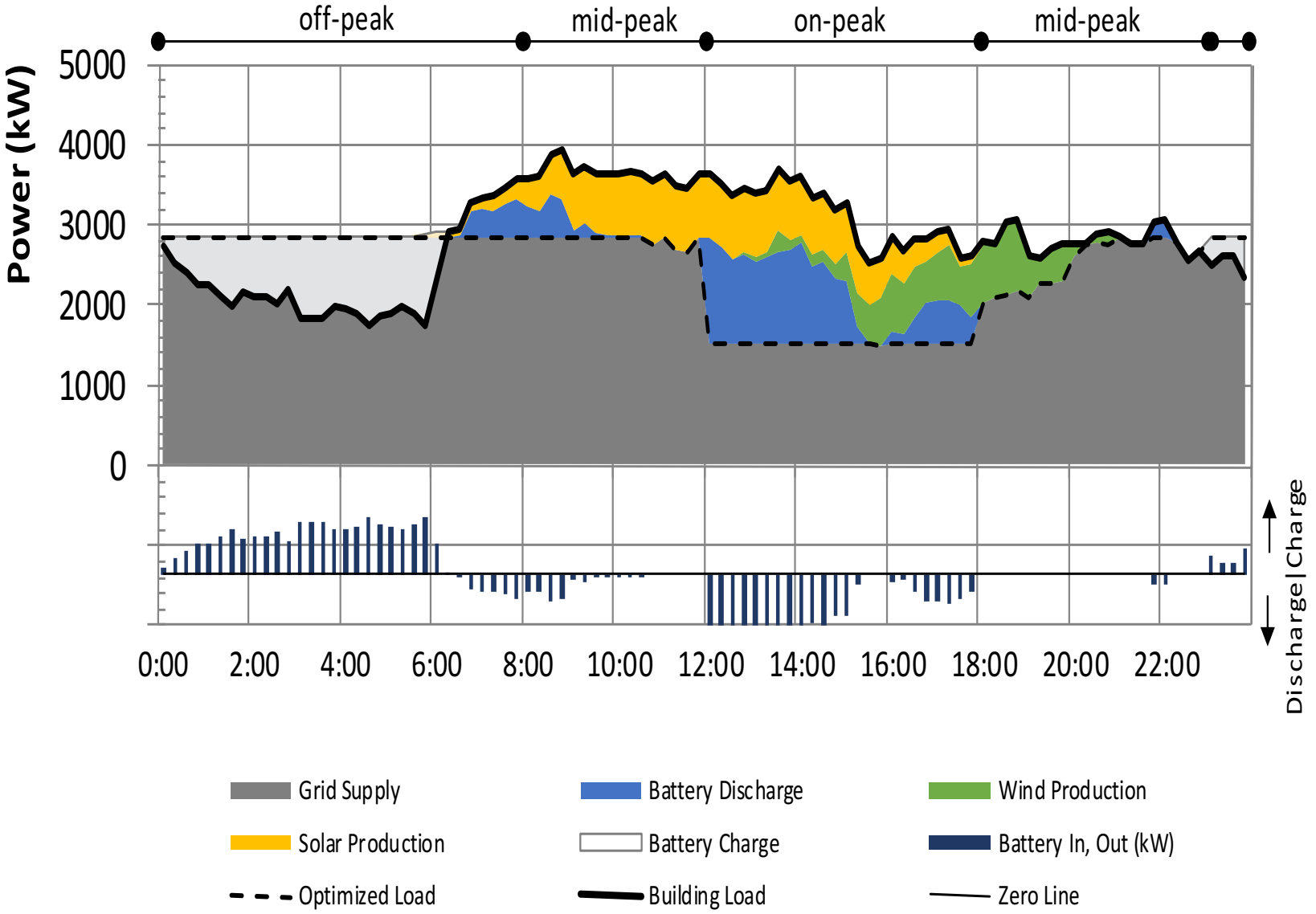
BATTERIES STORE SOLAR & WIND TO CONTROL DEMAND FROM GRID



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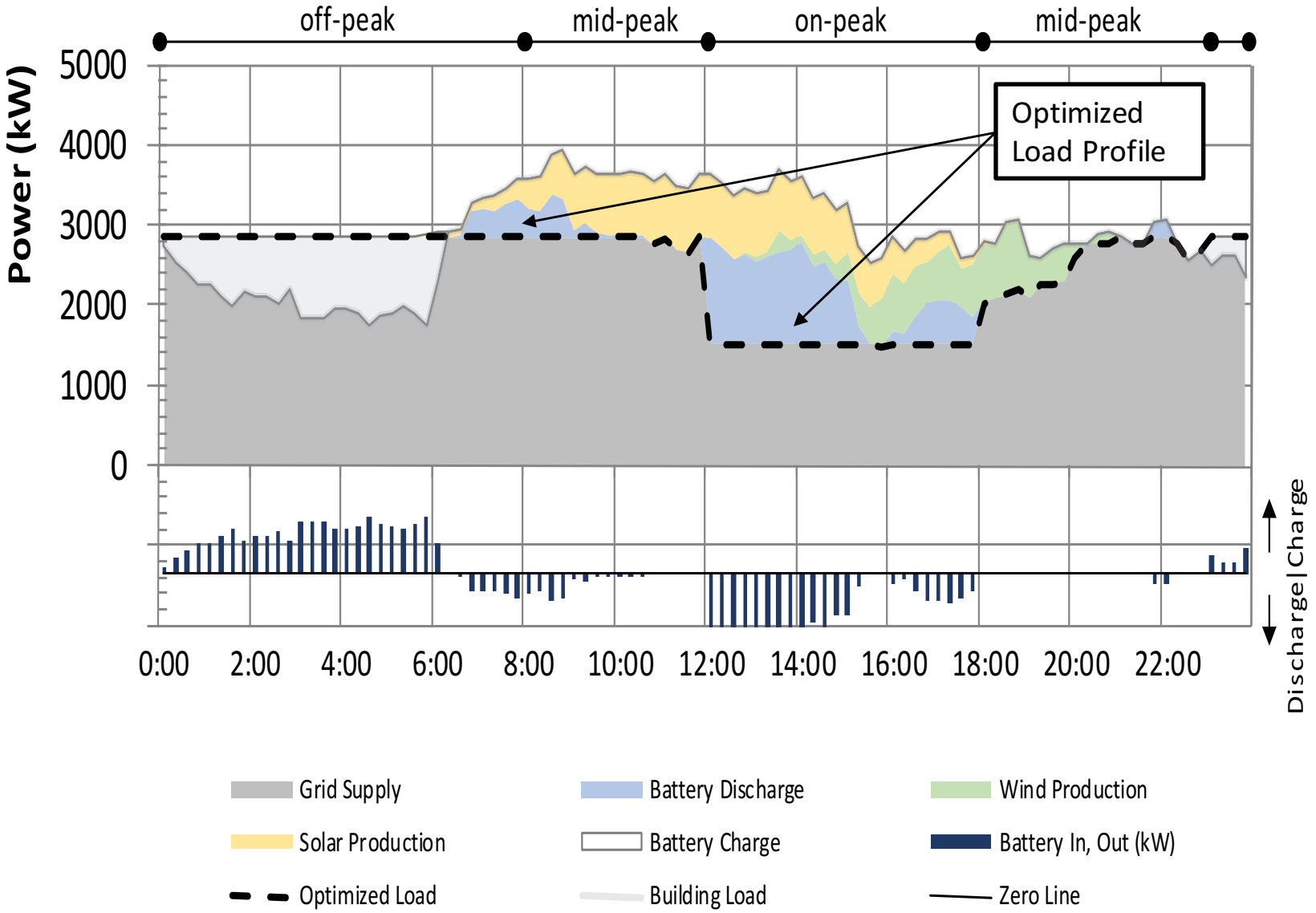
ENERGY STORAGE FULLY OPTIMIZES DISTRIBUTED RESOURCES



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10 MW HYBRID ELECTRIC BUILDING PROJECT

250kW / 15,000kWh
Energy Storage Systems

Harnessing Building Load as the Cleanest, Fastest Grid Resource

- **26** Office Buildings
- **25%** Peak Demand Reduction
- **20%** Reduction in GHG Emissions
- **10%** Reduction in Energy Costs
- **10 MW** Firm, Dispatchable Capacity
- **Zero** Emissions
- **Zero** Distribution Upgrades

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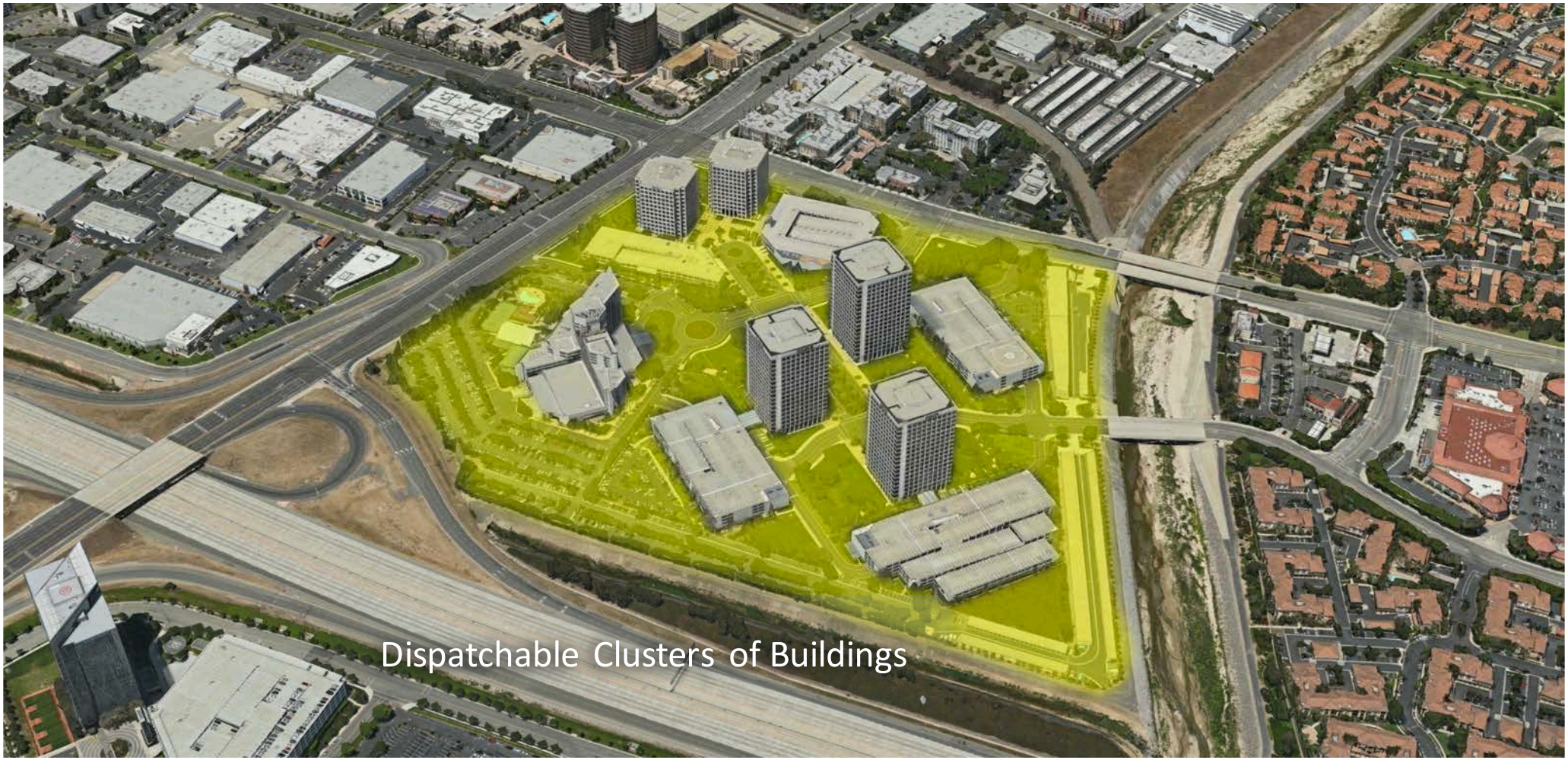
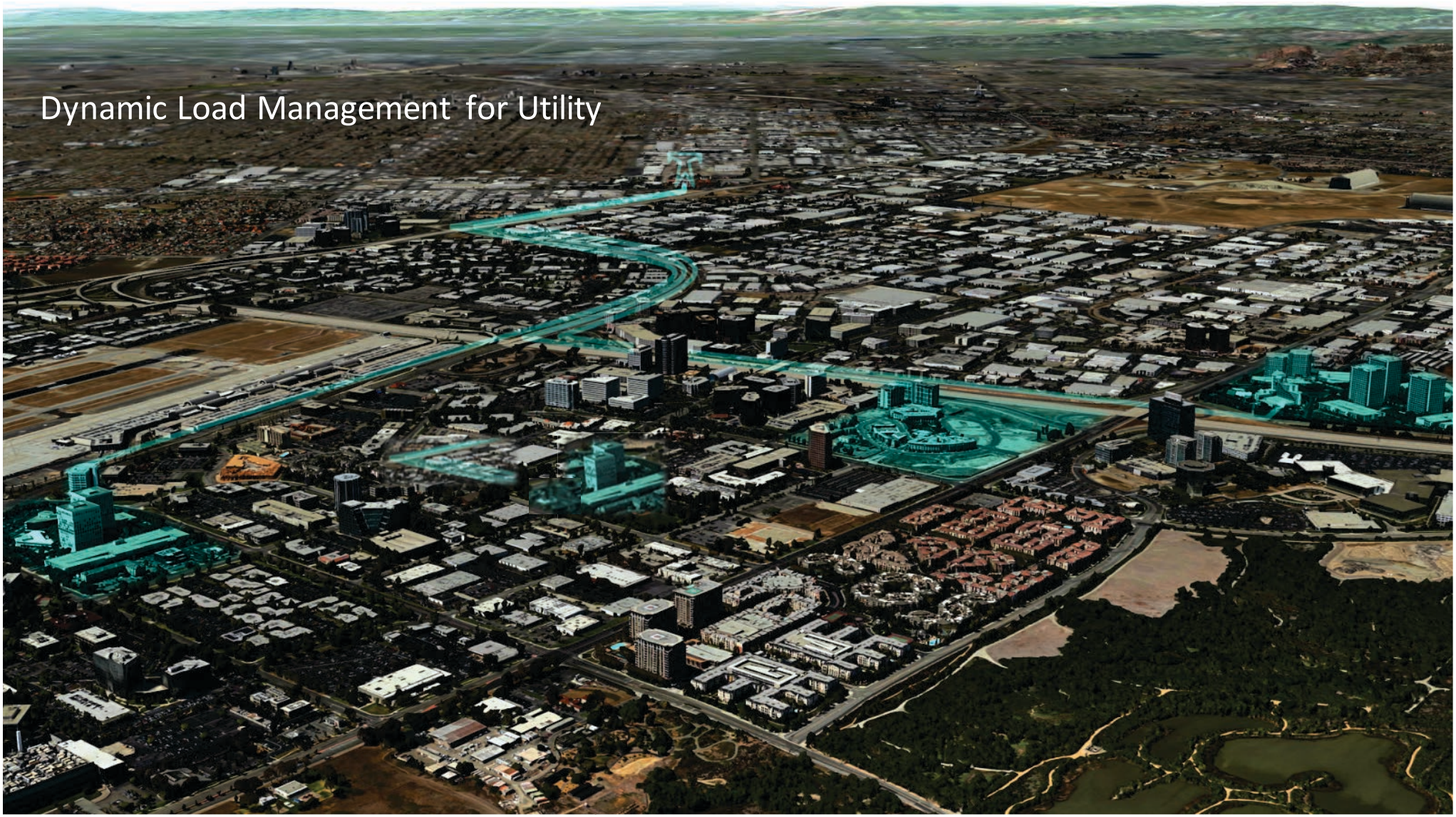


Dynamic Load Management for Utility



AGGREGATED DISTRIBUTED ENERGY RESOURCES
FIRM, DYNAMIC LOAD MANAGEMENT

UTILITY/GRID OPERATORS

END USE CUSTOMER

DISTRIBUTED RESOURCE AGGREGATOR

Asset Management, O&M, NOC,
Active Energy Management

DISTRIBUTION LEVEL SERVICES

Firm Dispatchable Capacity

Dynamic Load Mgmt.

Volt/VAR Optimization
Conservation Voltage Reduction

Wholesale Energy Market Products
-Day Ahead
-Real-time
-Frequency

GRID EDGE SERVICES

Peak Shaving
(GHG Reduction)

Energy Cost Reduction

Energy Islanding/
Critical Loads

Demand Response
Revenue Generation

Solar Integration

EV Charging Integration

