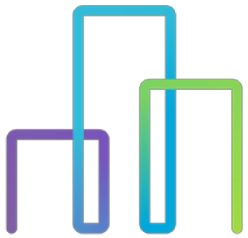


Advanced Microgrid Solutions

Tomorrow's Energy Grid

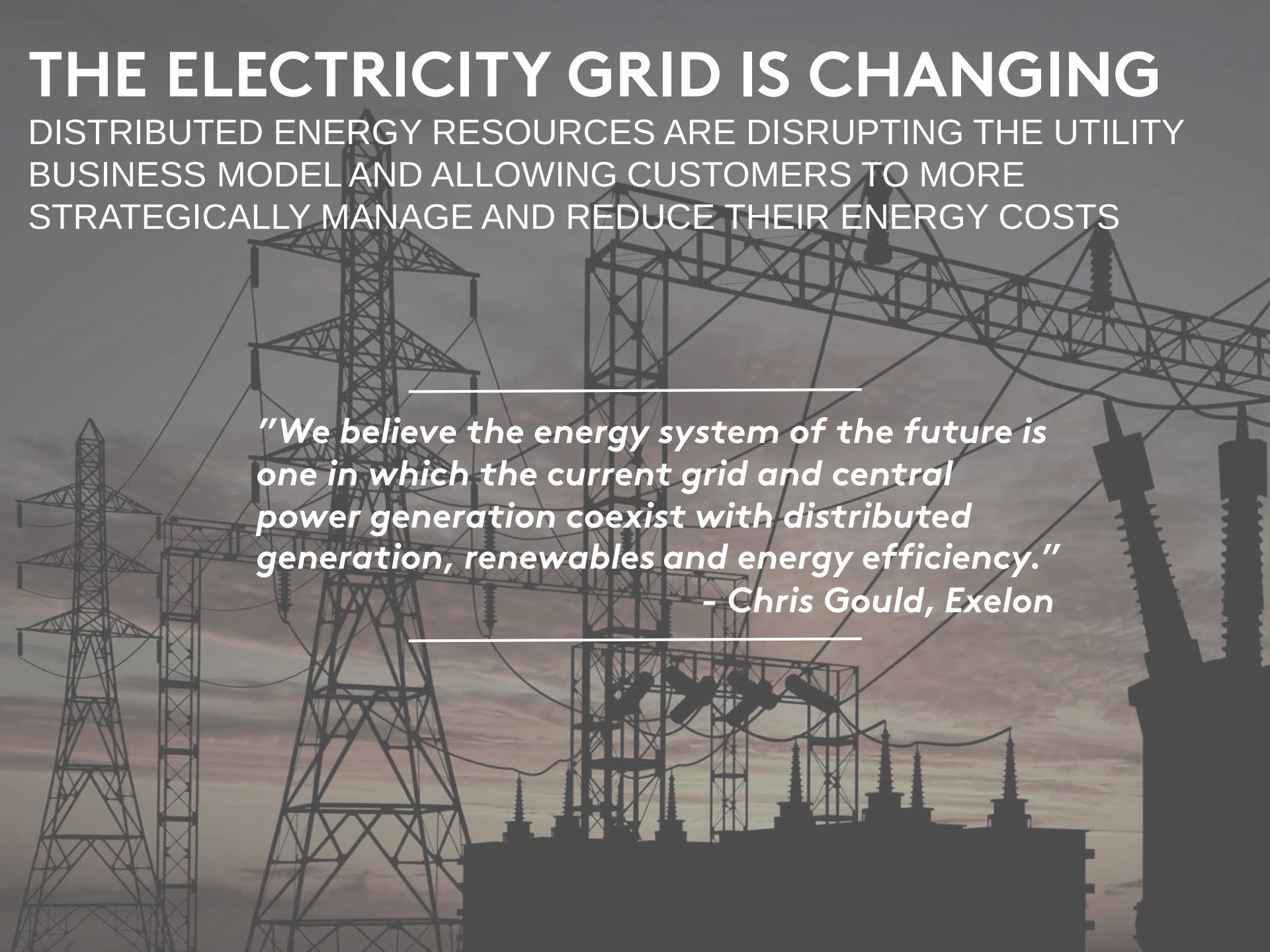
7th Annual Statewide Energy Efficiency Forum
Riverside, CA

The Energy Efficiency Foundation of Integrated Demand-Side Management

Audrey Lee, Ph.D.
Vice President, Analytics and Design
June 16, 2016

THE ELECTRICITY GRID IS CHANGING

DISTRIBUTED ENERGY RESOURCES ARE DISRUPTING THE UTILITY BUSINESS MODEL AND ALLOWING CUSTOMERS TO MORE STRATEGICALLY MANAGE AND REDUCE THEIR ENERGY COSTS



"We believe the energy system of the future is one in which the current grid and central power generation coexist with distributed generation, renewables and energy efficiency."

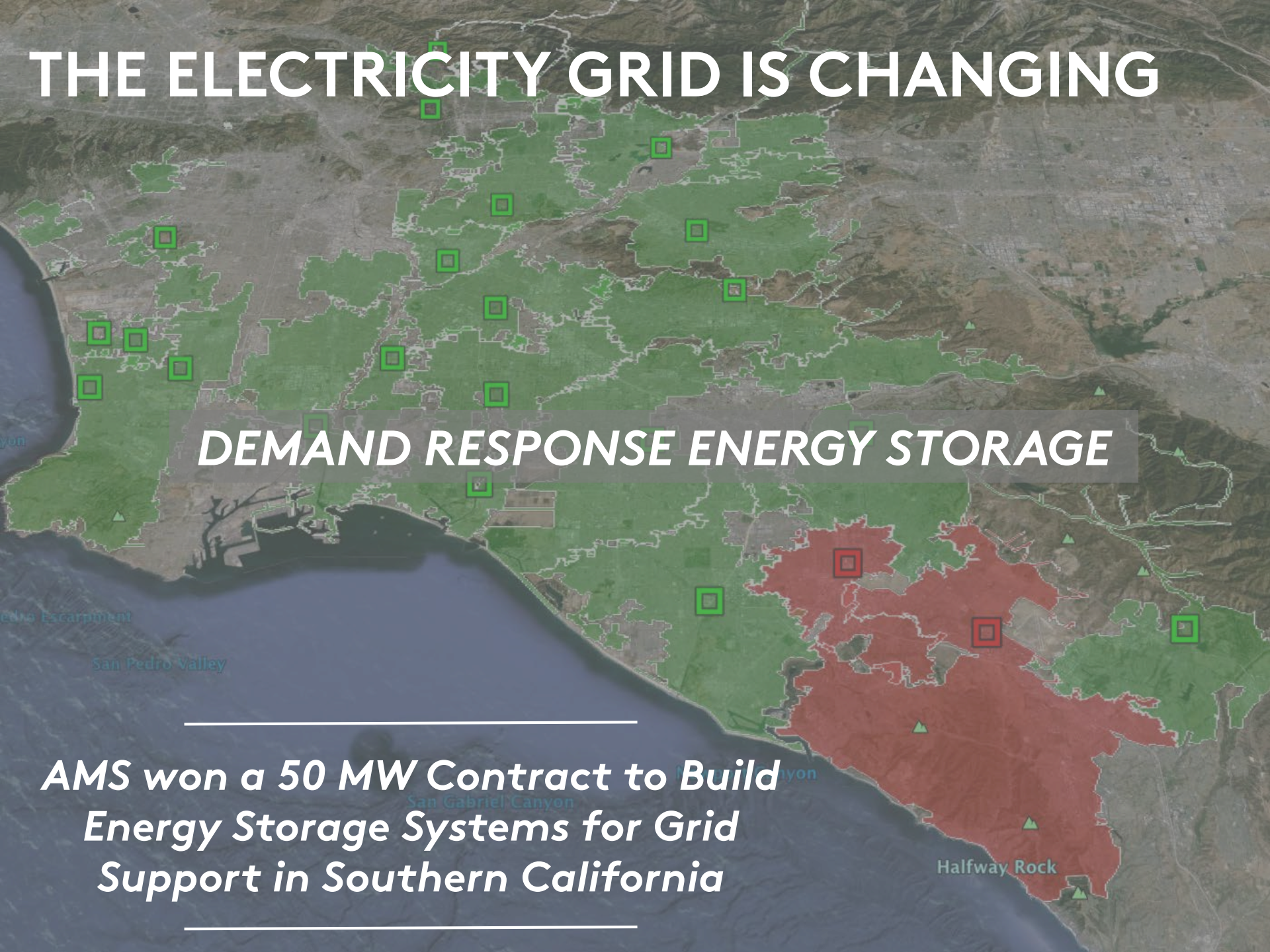
- Chris Gould, Exelon

WHO IS **ADVANCED MICROGRID SOLUTIONS**?

AMS INSTALLS ADVANCED ENERGY STORAGE SYSTEMS THAT **LOWER ENERGY EXPENSES** FOR HOST CUSTOMERS AND PROVIDE CLEAN, DISPATCHABLE **LOAD REDUCTION** TO ELECTRIC UTILITIES

- Owner and operator of onsite energy storage
- Purveyor of **Storage-as-a-Service** – zero upfront cost plus guaranteed energy bill savings
- Developer of **Hybrid Electric Building**™ hardware/software platform
- Technology partnership with Tesla to procure 500 MWh of Powerpacks

THE ELECTRICITY GRID IS CHANGING



AMS won a 50 MW Contract to Build Energy Storage Systems for Grid Support in Southern California

SOUTHERN CALIFORNIA EDISON®

An *EDISON INTERNATIONAL*® Company

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.

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

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 reliability and affordability needs of electricity customers."

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

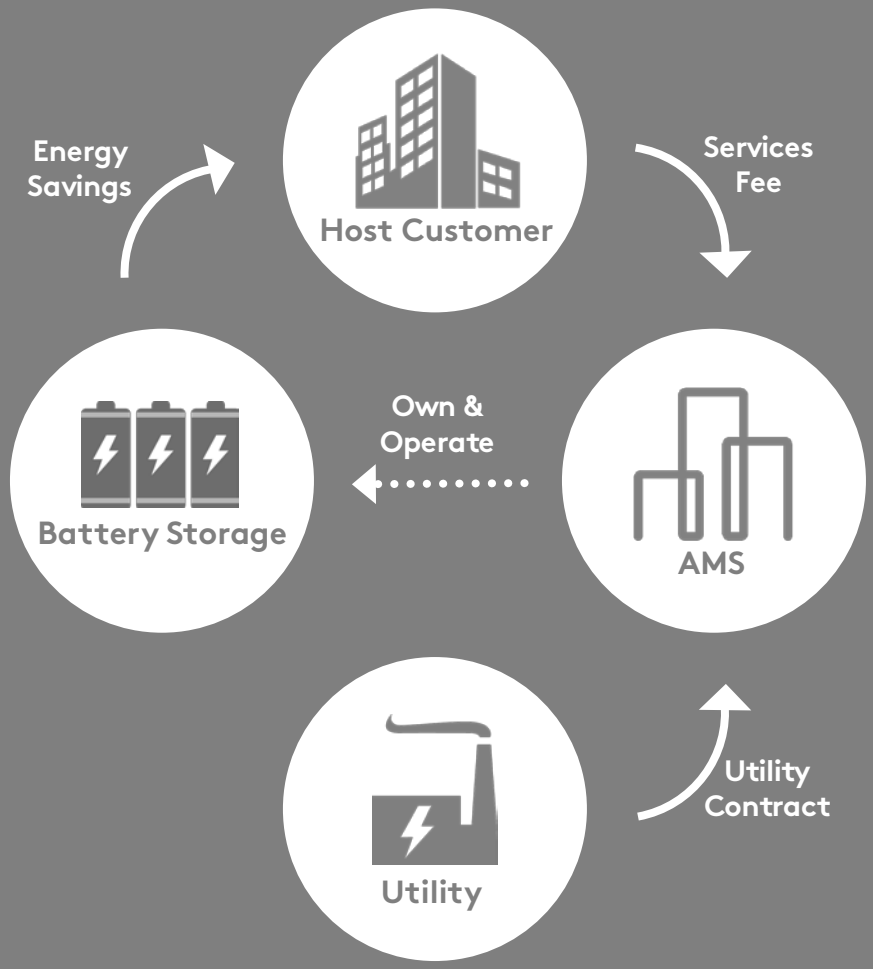
STORAGE AS A SERVICE

AMS INSTALLS, OWNS AND OPERATES ENERGY STORAGE SYSTEMS AT HOST CUSTOMER SITES

HOST CUSTOMERS RECEIVE ENERGY AND DEMAND CHARGE SAVINGS ON THEIR BILLS IN ADDITION TO OPERATIONAL EFFICIENCIES

AMS FINANCES THE SYSTEMS WITH A COMBINATION OF SHARED SAVINGS, UTILITY REVENUES AND INCENTIVES

HOST CUSTOMERS CAPTURE ADDITIONAL BENEFITS INCLUDING ENHANCED BRANDING, REDUCED GHG EMISSIONS, BACKUP POWER CAPABILITIES AND ENHANCED DEMAND RESPONSE PARTICIPATION

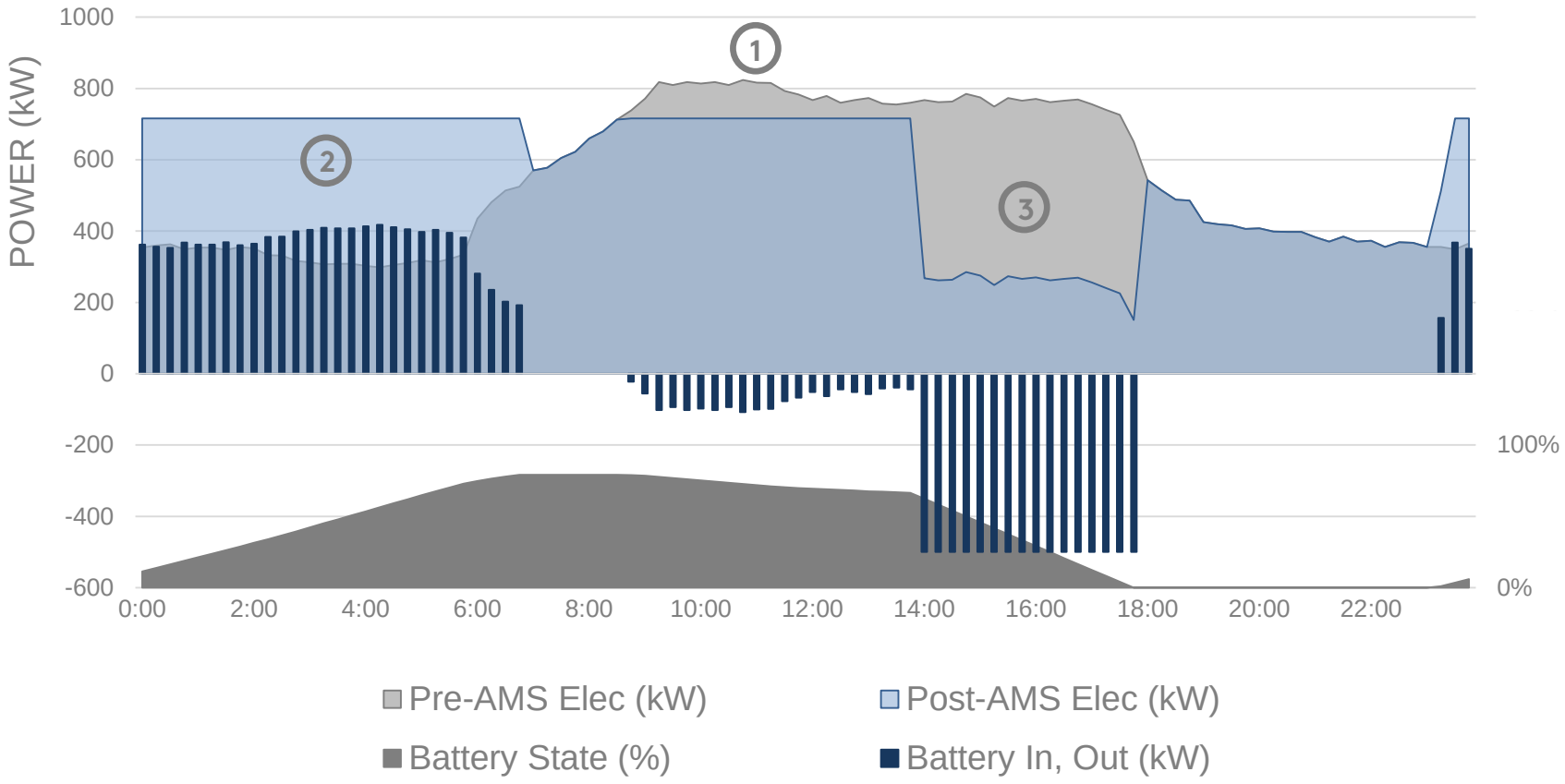


ECONOMIC MODEL

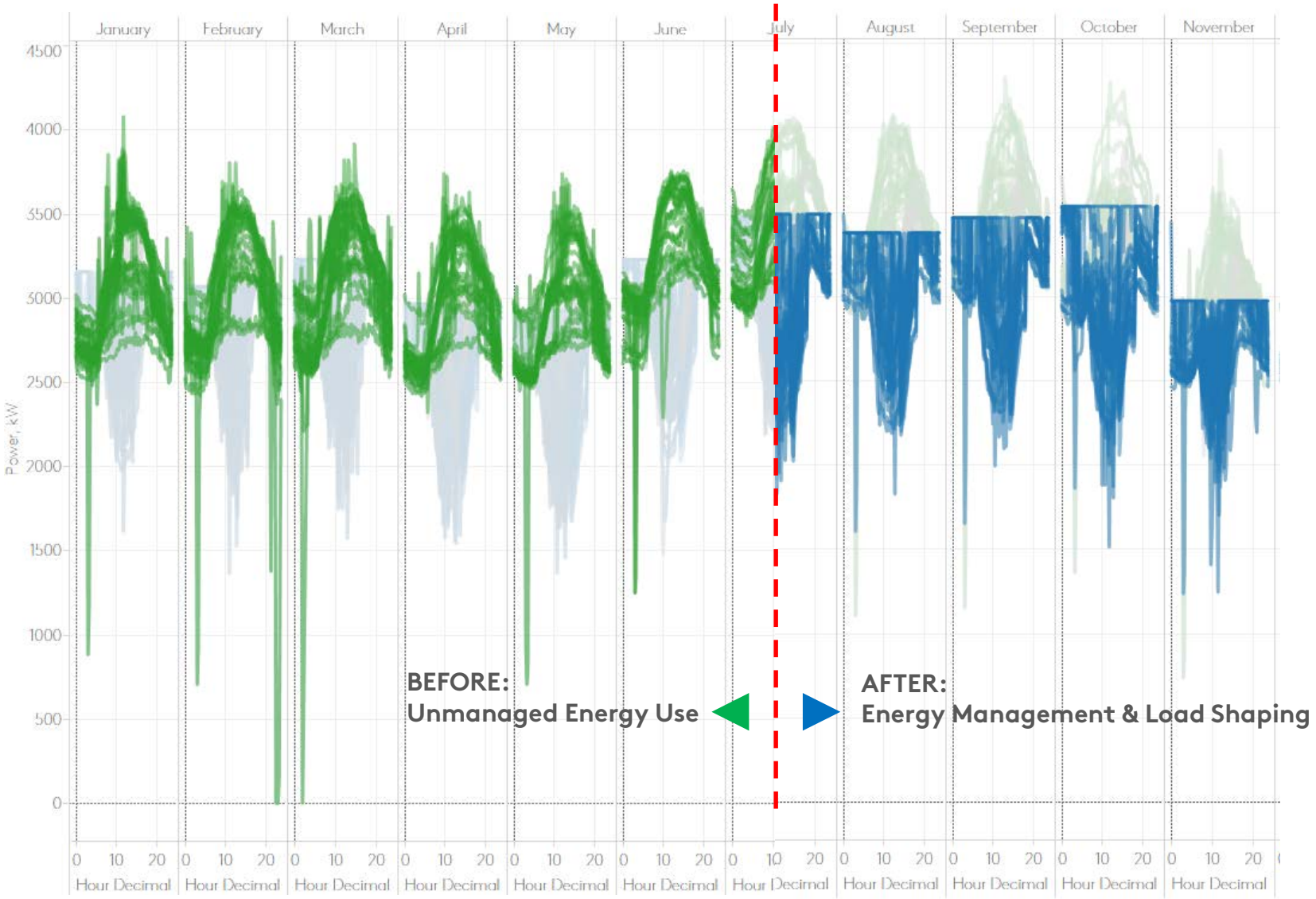
AUTOMATED DISPATCHABLE LOAD REDUCTION

OPTIMIZED DEMAND MANAGEMENT

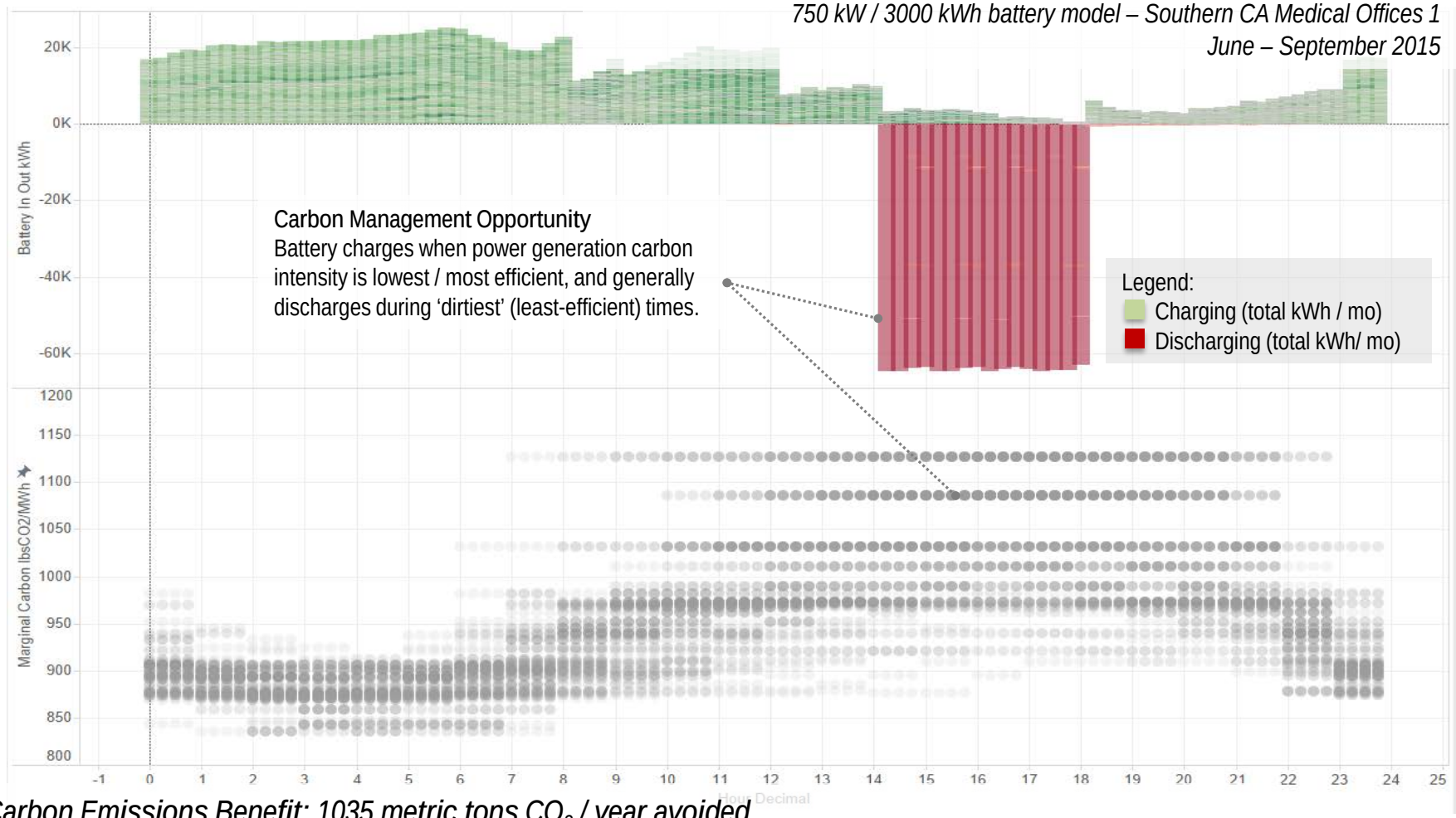
1. DEMAND CHARGE REDUCTION
2. LOAD SHIFTING
3. UTILITY SERVICES



ADVANCED ANALYTICS



GREENHOUSE GAS MANAGEMENT



Carbon Emissions Benefit: 1035 metric tons CO_2 / year avoided

Carbon intensity mapped using WattTime data for marginal carbon emissions in the California Independent System Operator (CAISO)
CVR Methodology: for every % of line loss efficiency achieved on a 10,000 kW circuit using distributed storage = 136 metric tons CO2 / year avoided
Adapted from Application of Automated Controls for Voltage and Reactive Power Management – Initial Results. DOE – Smart Grid Investment Grant Program, December 2012

BATTERY TECHNOLOGY SPECIFICATIONS

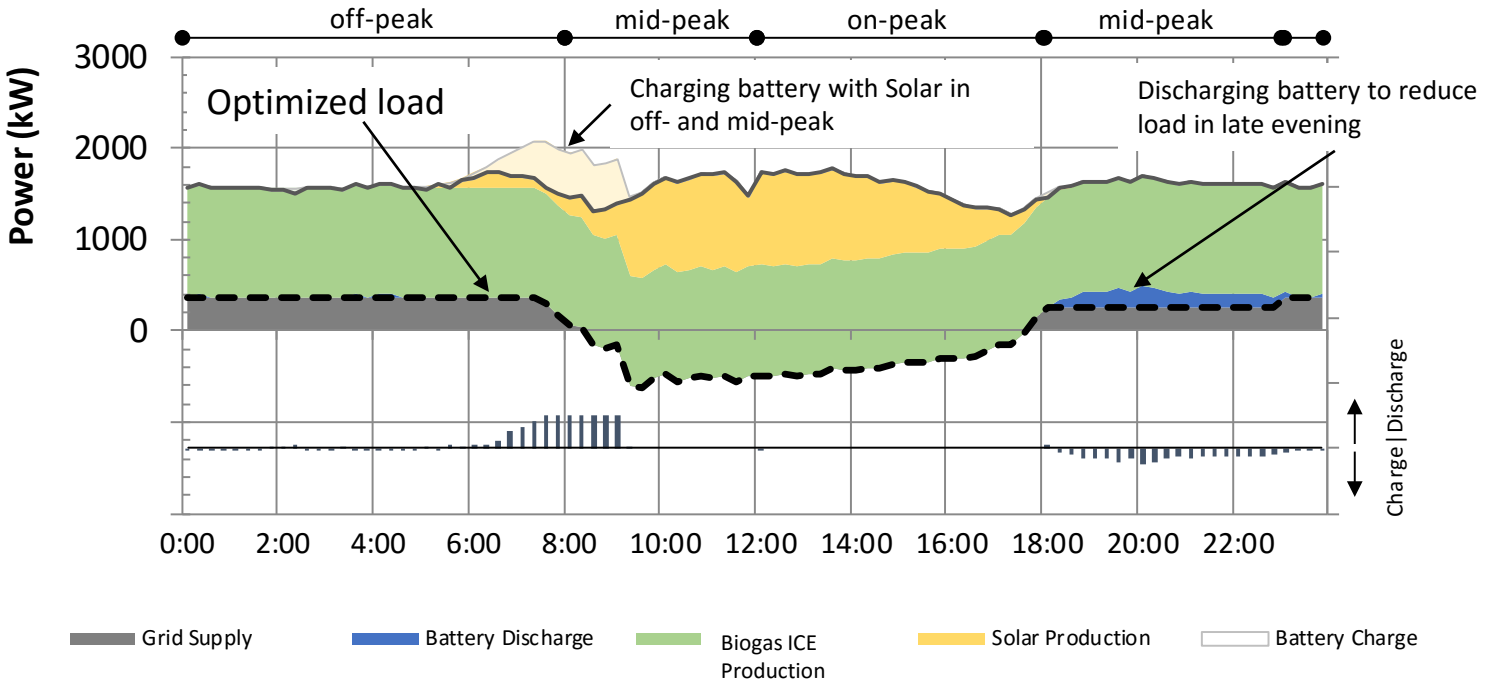
TECHNOLOGY	Tesla Powerpack
BATTERY TYPE	Lithium Ion
CAPACITY	200 kWh (per Powerpack)
SYSTEM SIZE	250 kW - 10 MW+
DURATION	2-6 hrs (total system)
DIMENSIONS	52”(l) x 38”(w) x 86”(h)
WEIGHT	4,300 lbs
SITING	Ground-mounted externally
INVERTER	Tesla 500 kW inverter

CASE STUDY 01
INLAND EMPIRE UTILITIES AGENCY

- 6 water recycling, pumping facilities
- Powered from the grid and onsite generation assets
  - 3.75 MW energy storage (AMS)
  - 3.5 MW solar
  - 3 MW biogas
  - 1 MW wind
  - 2.8 MW fuel cell
- **5-10% reduction in annual energy costs (~$550,000)**
- Complex existing tariffs: RES-BCT, Standby, Direct Access, NEM
- Custom designed

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

SOLUTION DESIGN, OPTIMIZATION



- 500 kW / 1 MWh Energy Storage
- 1 MW Solar
- 1.5 MW Biogas Digester
- RES-BCT, SCE-TOU-8B tariff

CASE STUDY 02
IRVINE COMPANY

- 22 commercial office buildings
- **25% peak demand reduction**
- 10 MW of firm, dispatchable capacity to the utility
- **8% reduction in energy costs to the building owner (~$900,000 annually)**
- Zero emissions
- **No distribution upgrades**

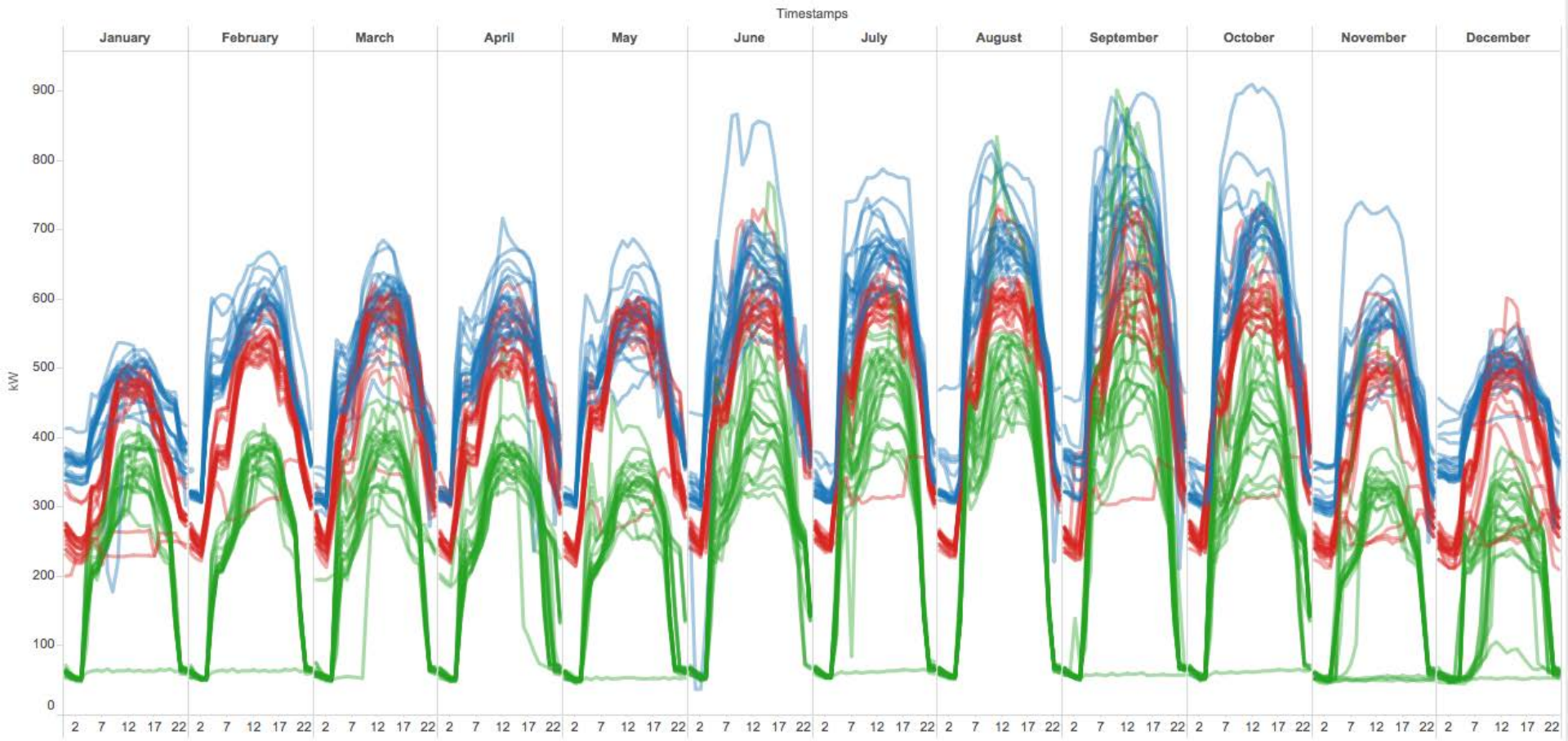
IRVINE COMPANY
Since 1864

AMS CUSTOMER SITES RECEIVE THE

HYBRID ELECTRIC BUILDING™

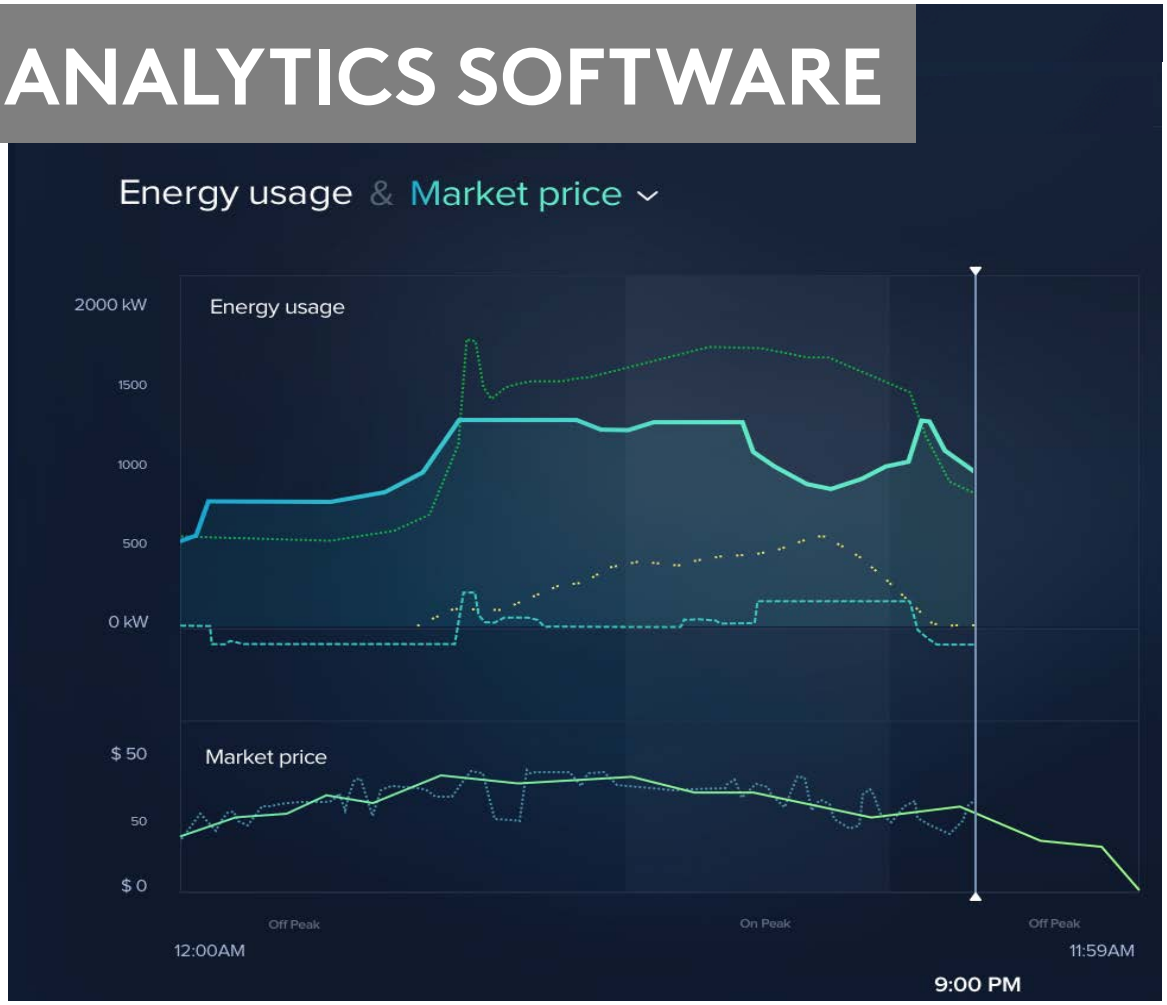
DESIGNATION, HIGHLIGHTING THEIR COMMITMENT
TO IMPROVED ENERGY MANAGEMENT, SUSTAINABILITY
AND GRID SUPPORT THROUGH ADVANCED TECHNOLOGY

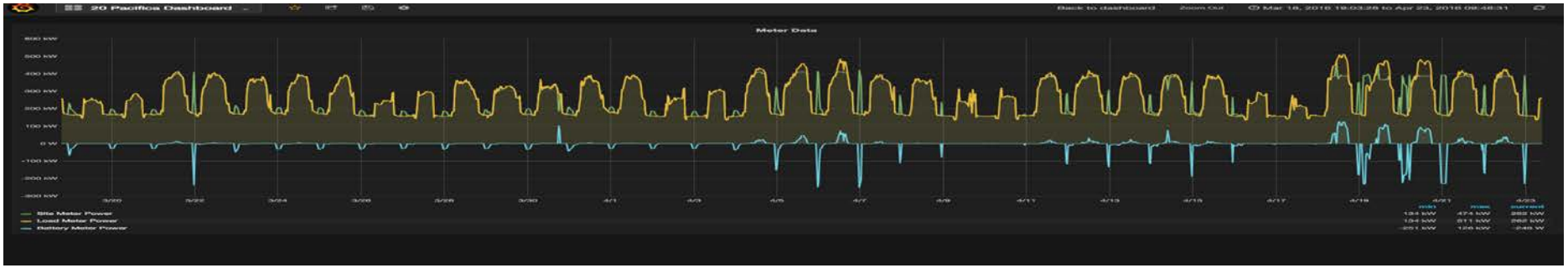
CASE STUDY 03
CITY HALL

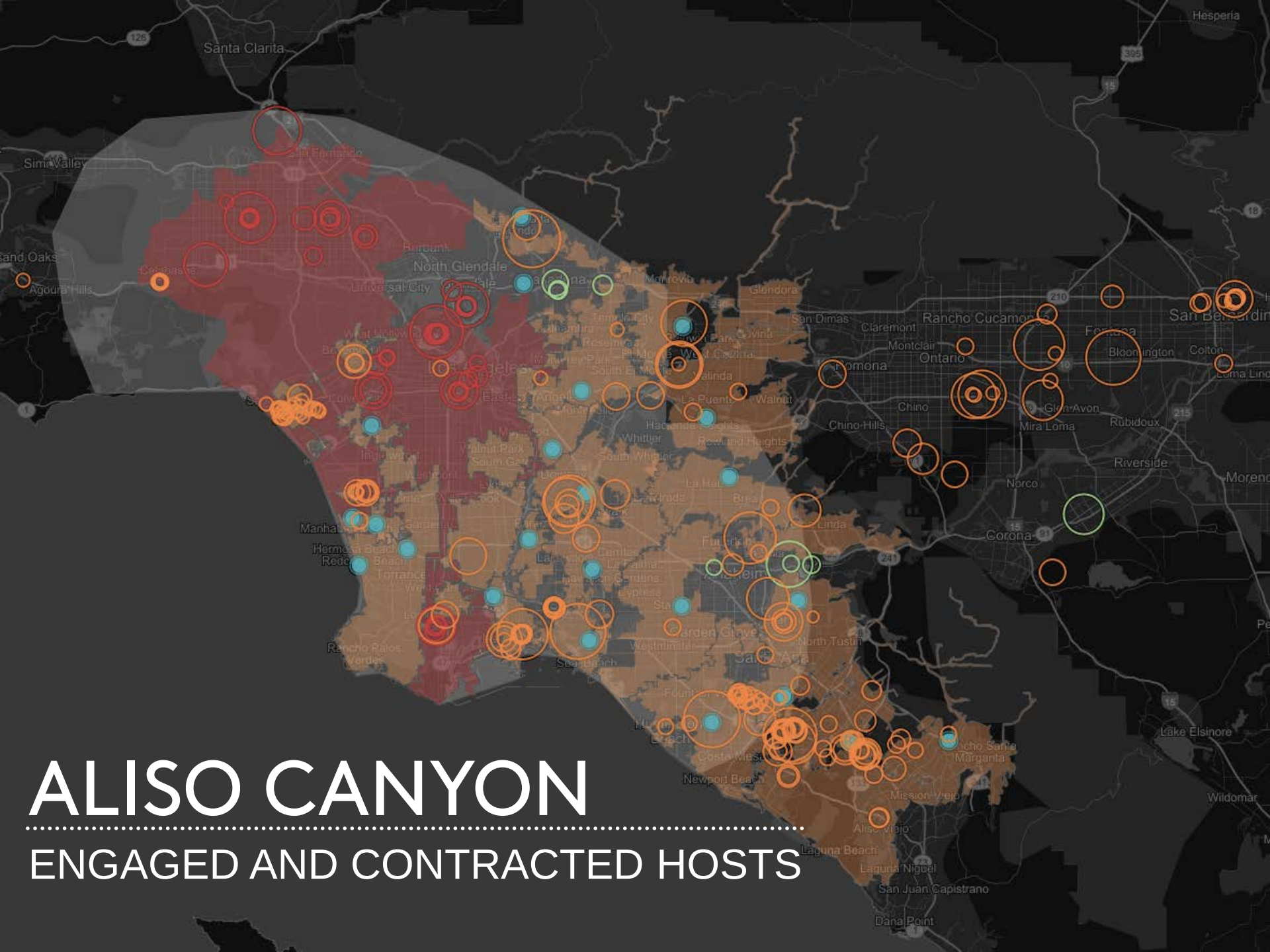


- Typical Office Space
- Active 5 AM to 9 PM
- 3 Meters
- Time-of-use energy and demand charge

ANALYTICS SOFTWARE







ALISO CANYON

ENGAGED AND CONTRACTED HOSTS

ENERGY STORAGE, SOLAR PV AND SMART GRID TECHNOLOGIES EXPERIENCED **INCREDIBLE GROWTH IN 2015**, AND WE EXPECT THAT THEY WILL PLAY AN INCREASINGLY **IMPORTANT ROLE** IN REACHING THE NATION'S CLIMATE AND CLEAN ENERGY GOALS IN THE COMING YEARS.

DAVID DANIELSON
US DEPARTMENT OF ENERGY

TIP OF THE SPEAR FOR MULTI-USE

UTILITY/GRID OPERATORS

DISTRIBUTION LEVEL SERVICES

Firm Dispatchable Capacity

Dynamic Load Mgmt.

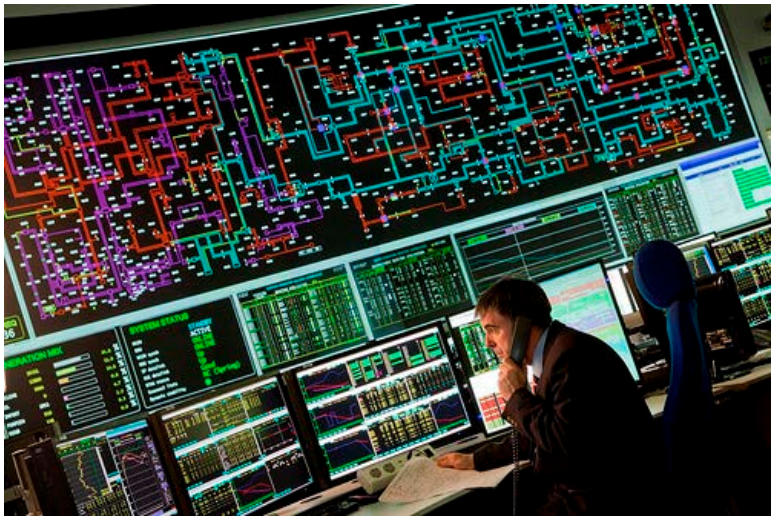
Volt/VAR Optimization

Conservation Voltage Reduction

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

DISTRIBUTED RESOURCE AGGREGATOR

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



END USE CUSTOMER

GRID EDGE SERVICES

Demand Management (GHG Reduction)

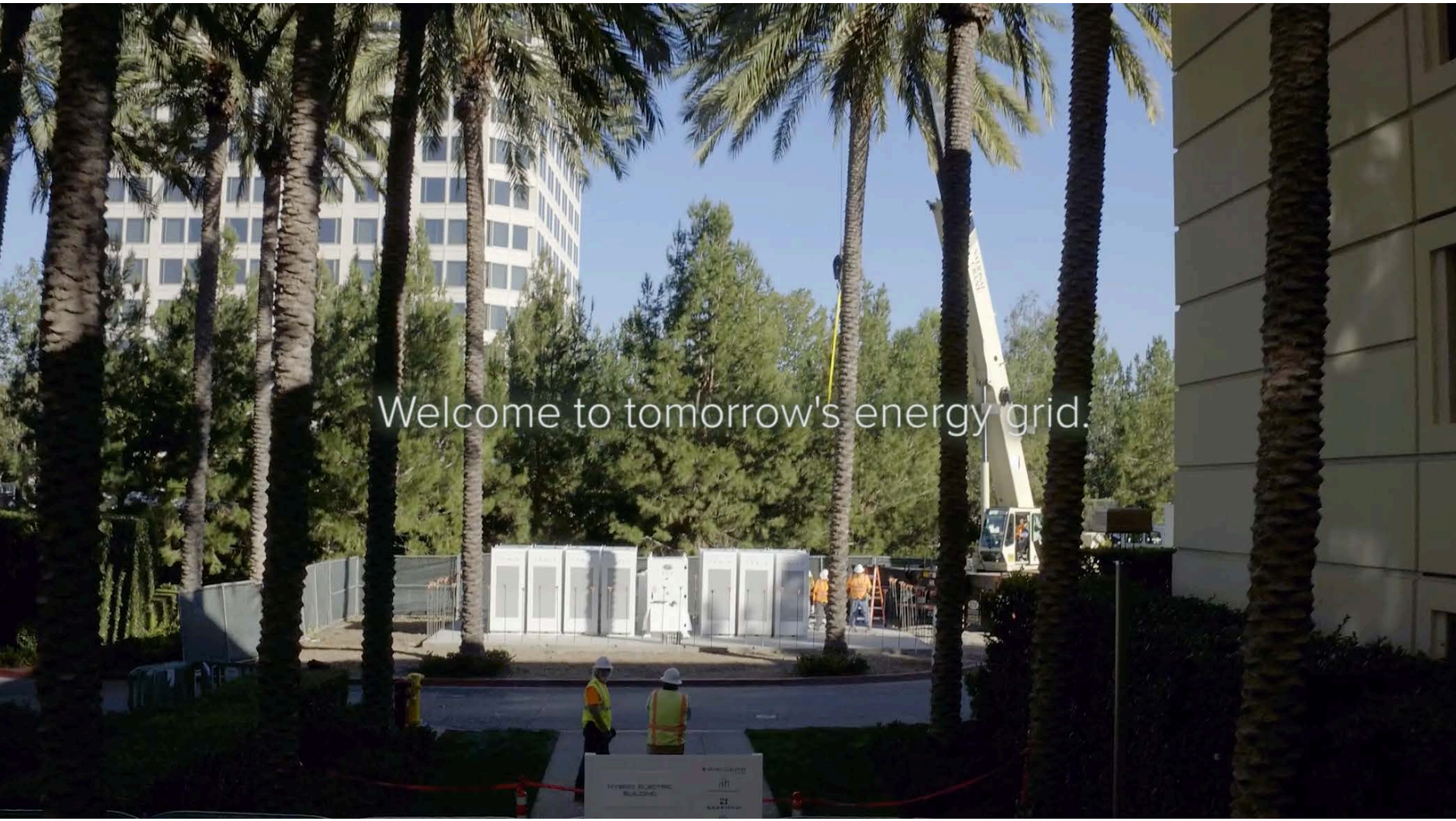
Energy Cost Reduction

Energy Islanding/ Critical Loads

Demand Response Revenue Generation

Solar Integration

EV Charging Integration



Advanced Microgrid Solutions