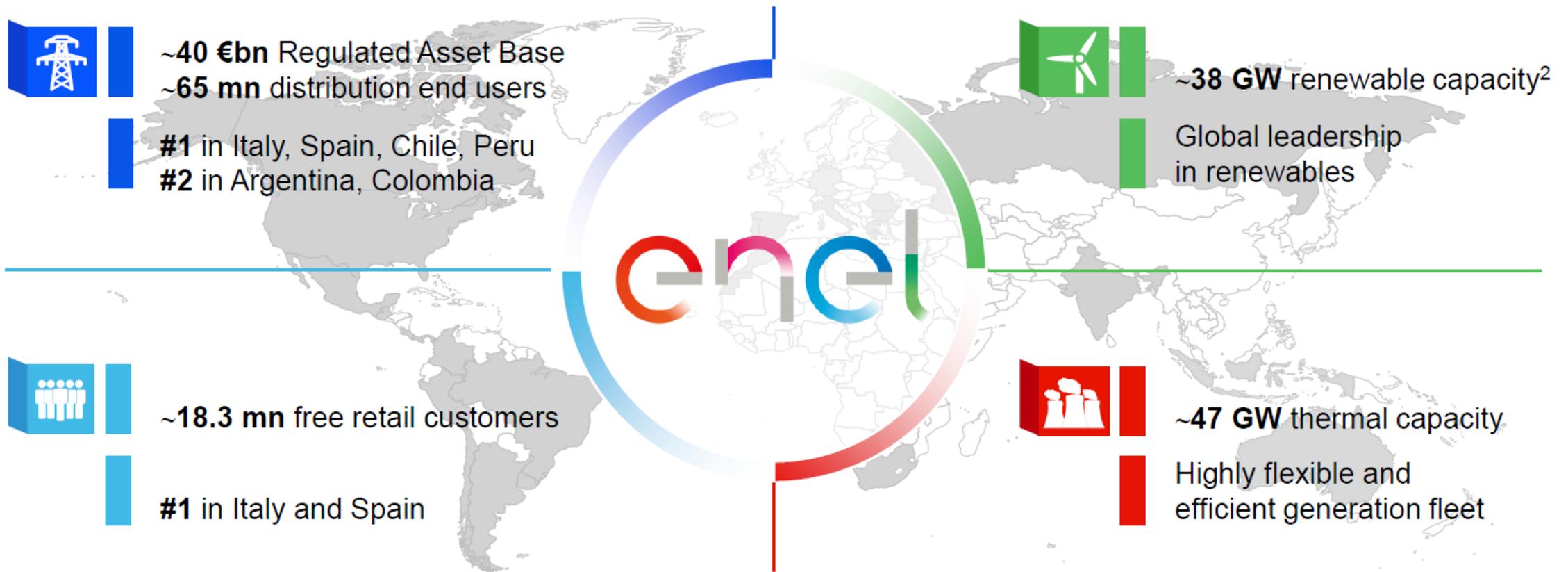




**Microgrids:
Delivering A Smarter, Cleaner And More
Resilient Grid Infrastructure**

Enel Group today¹



Global and diversified operator

1.As of 2016

2.Consolidated (35.9 GW) and managed (1.9 GW) capacity including 24.9 GW of large hydro

3.Presence with operating assets

■ Countries of presence³

Industry Perspective



“The electric industry is in a period of momentous change. The innovative potential of the digital economy has not yet been accommodated within the electric distribution system.

Information technology, electronic controls, distributed generation, and energy storage are advancing faster than the ability of utilities and regulators to adopt them, or to adapt to them.

At the same time, electricity demands of the digital economy are increasingly expressed in terms of reliability, choice, value, and security.”

Opening Paragraph:

*ORDER ADOPTING REGULATORY POLICY FRAMEWORK AND
IMPLEMENTATION PLAN*

New York Public Service Commission- February 26, 2015

Resiliency 2017



The Washington Post

Hurricane Harvey reinforces need for cities to plan for disaster resiliency



San Francisco Chronicle

Mexico 8.0 Earthquake



OPINION

Post-fire rebuilding offers a chance for microgrids

By Edward Church | on October 31, 2017



Critical Power Benefits



- **Use of storage during an outage**
 - Support water pump system for supply
 - Provide a single elevator for limited access and food delivery
 - Emergency lighting
 - Ability to recharge the battery system with installed solar

Marcus Garvey Village Redevelopment Project

2013

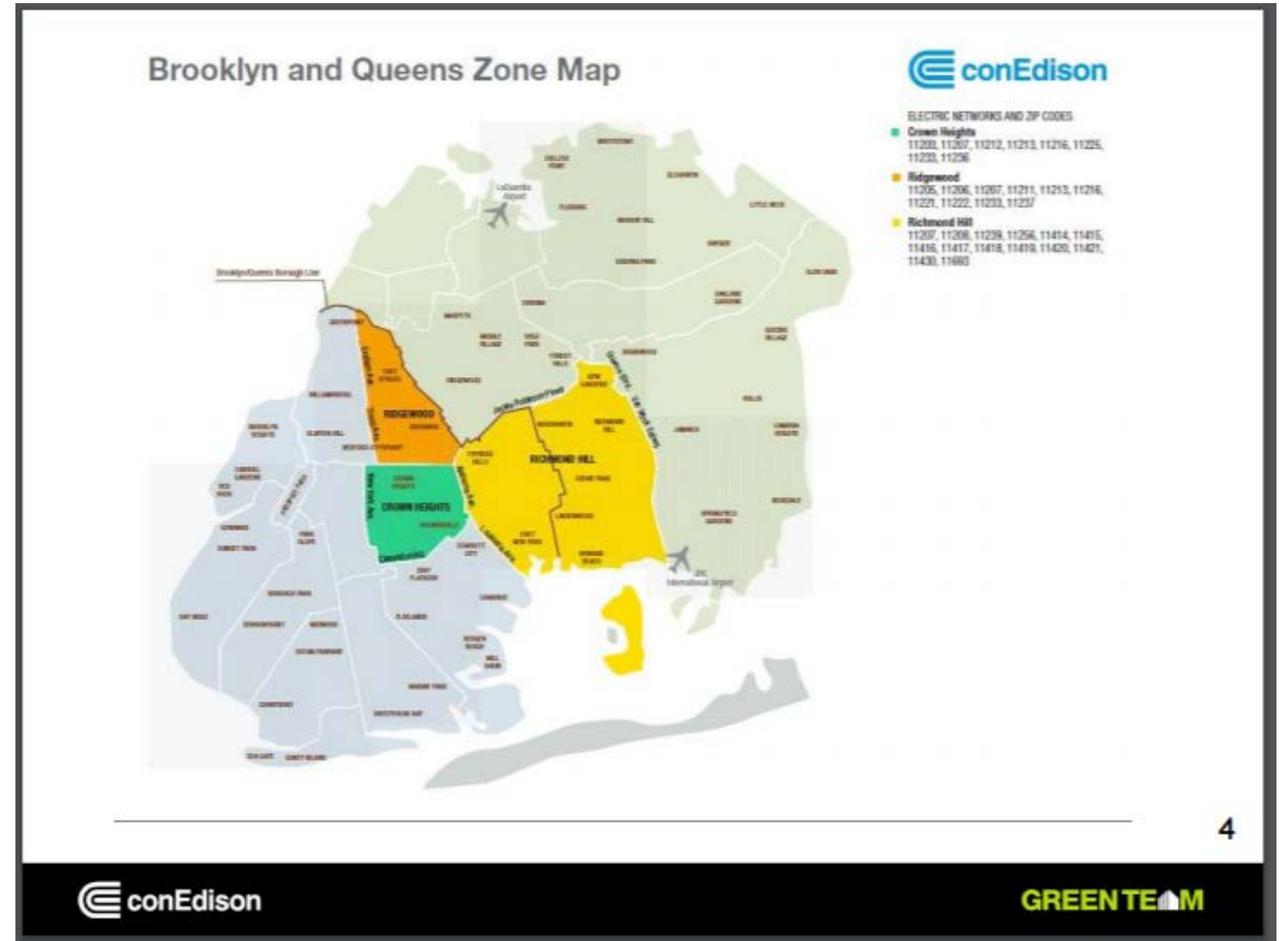
2017



Doing the Right Thing... Is Always the Right Thing to Do

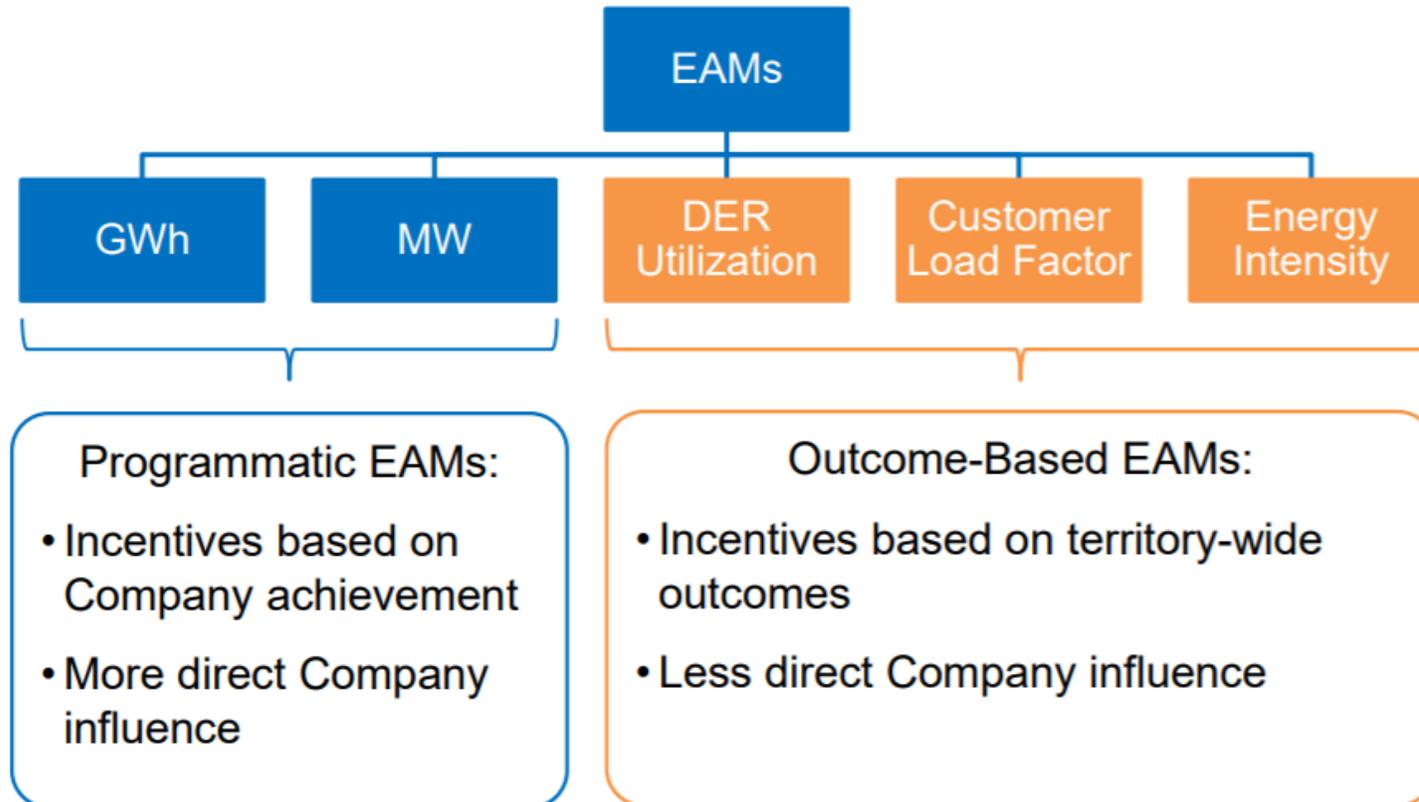
Brooklyn Queens Demand Management (BQDM)

- Substation upgrade deferment = \$1.2 billion
- PSC approved \$200 million Non-Wires Alternative (NWA)
- Program cost allowed in rate base
- Reverse auction drove market-based response > \$1992/kW - 2 year program
- Drives better system utilization
- Framework for future market-based ***Non-Wire Solutions***



PSC/REV Earnings Adjustment Mechanism

Company Financial Motivations Earnings Adjustment Mechanisms



Specific Programs

- BQDM -Brooklyn Queens Demand Management
- NWA – Non-Wire Alternatives
- DMP II - Demand Management Program

Microgrid Solution

DEN  TM

- ❑ 375 kW/ 1.565 MW Battery Storage System



BRIGHT POWER 

- ❑ 400kW Distributed PV Power



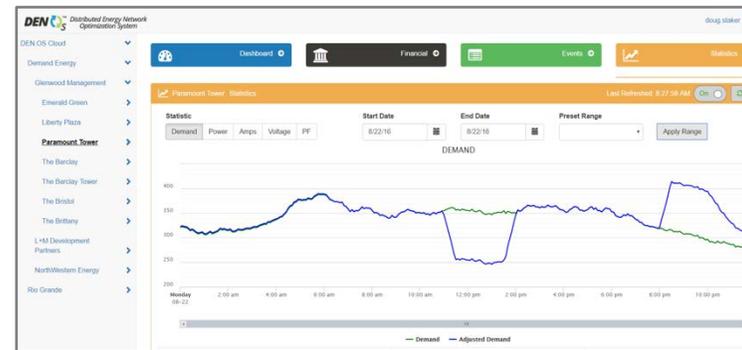
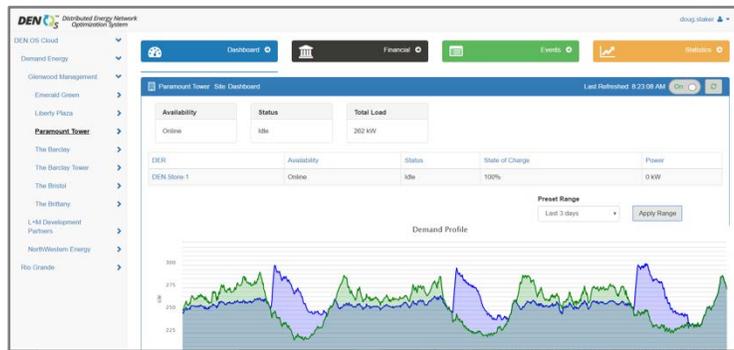
Bloomenergy [®]

- ❑ 400 kW Energy Server Fuel Cell



A Blend of DERs - Enhances Success

Shared Savings Revenue Streams



		Day Ahead Market Zonal LBMP																																			
		---LBMP---												---Marginal Cost of Genes---												---Marginal Cost of Congestion---											
Zone	PTED	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00											
CAPITL	81727	19.58	13.18	17.39	16.58	17.65	20.19	32.83	35.96	28.59	20.22	15.15	12.13	11.22	26.50	26.78	23.88	27.04	24.62	21.55	21.08	16.75	27.37	23.87	21.55	11.74											
CENTEL	81724	0.18	0.35	0.35	0.33	0.34	0.21	0.37	0.48	0.58	0.68	0.45	0.35	0.51	0.47	0.33	0.31	0.26	0.22	0.23	0.43	1.04	0.54	0.29	0.10	0.10											
DUNVOY	81760	1.55	1.50	1.43	1.43	1.40	1.71	2.20	2.63	3.18	3.89	3.32	3.85	2.93	2.78	2.35	2.37	2.57	2.68	2.78	3.09	4.39	3.13	2.68	1.82	0.00											
GENESE	81753	-0.29	-0.33	-0.28	-0.33	-0.35	-0.31	-0.44	-0.45	-0.48	-0.48	-0.56	-0.43	-0.39	-0.33	-0.35	-0.39	-0.39	-0.39	-0.40	-0.35	-0.52	-0.14	-0.44	-0.41	-0.16											
NY	81544	15.00	14.79	14.42	14.37	15.02	16.10	20.21	22.84	24.74	24.83	25.76	24.13	23.24	21.94	18.84	18.98	20.81	21.91	21.70	21.12	19.22	19.22	21.04	21.90	16.64											

DEMAND CHARGE MANAGEMENT

- Optimized load management from the combined Solar + Fuel Cell + Building Load + Battery Operations

BQDM LOAD RELIEF COMPLIANCE

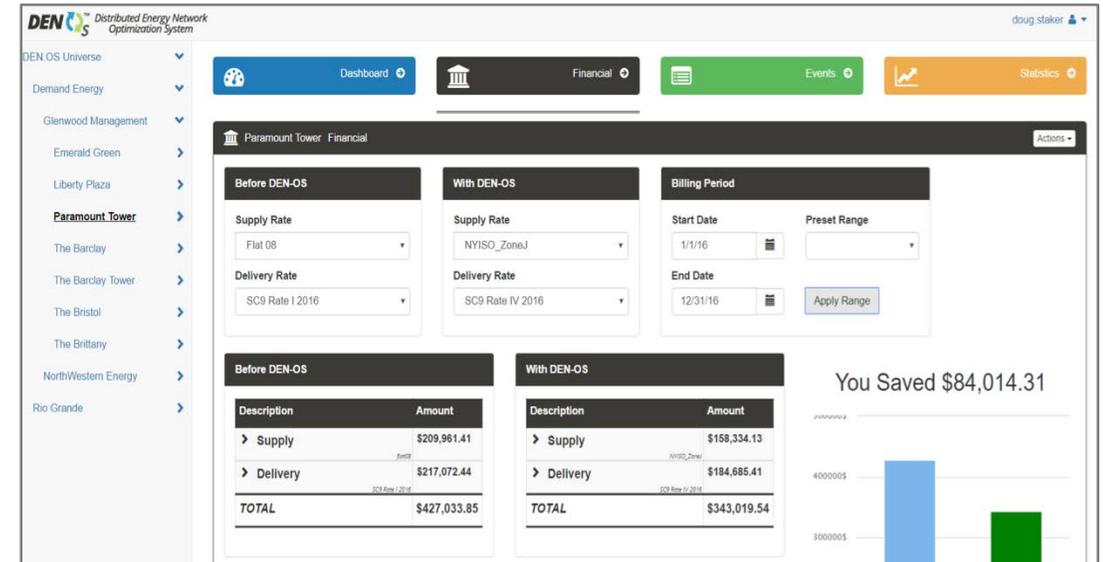
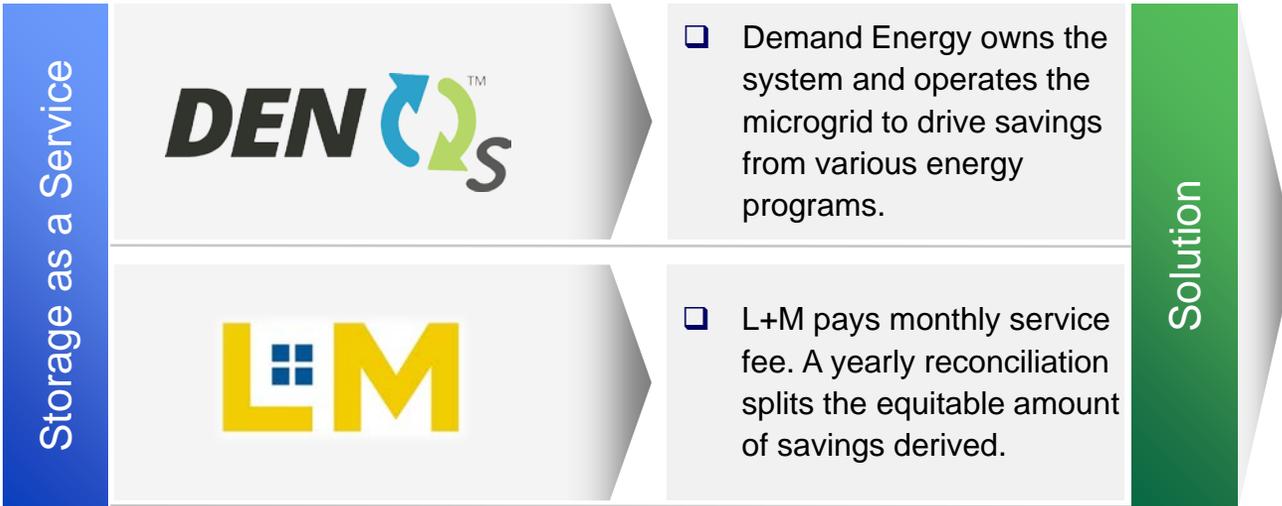
- Called when the day-ahead forecast is projected to be 93% of the summer forecasted peak

MARKET PARTICIPATION

- Day-ahead hourly pricing
- NYISO winter DR
- Con Edison DLRP program

It's All About Deriving Value!

Shared Savings Model



Shared Savings Model Built on a Win/Win Commitment

Resiliency

Backup Power

- Provides backup power for management and security office
- Community room power for extended outages

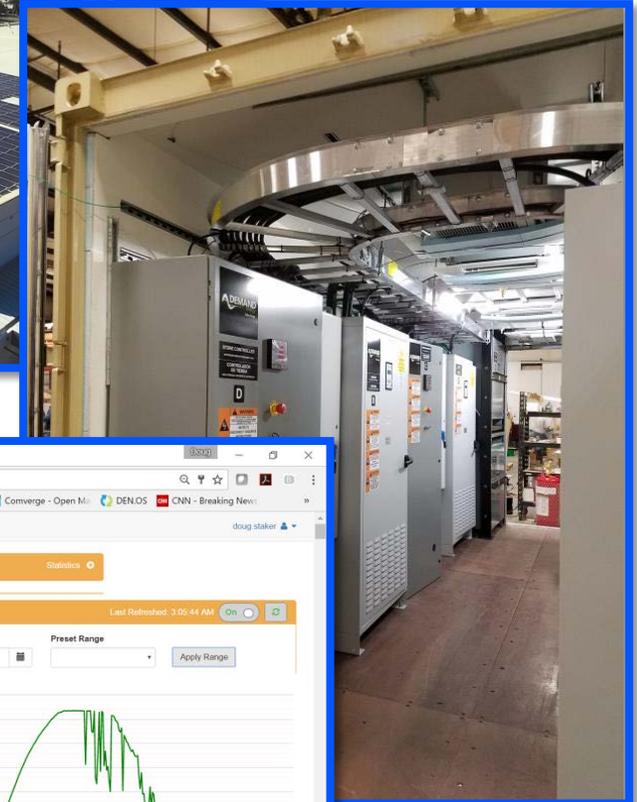


Establishment
LABS

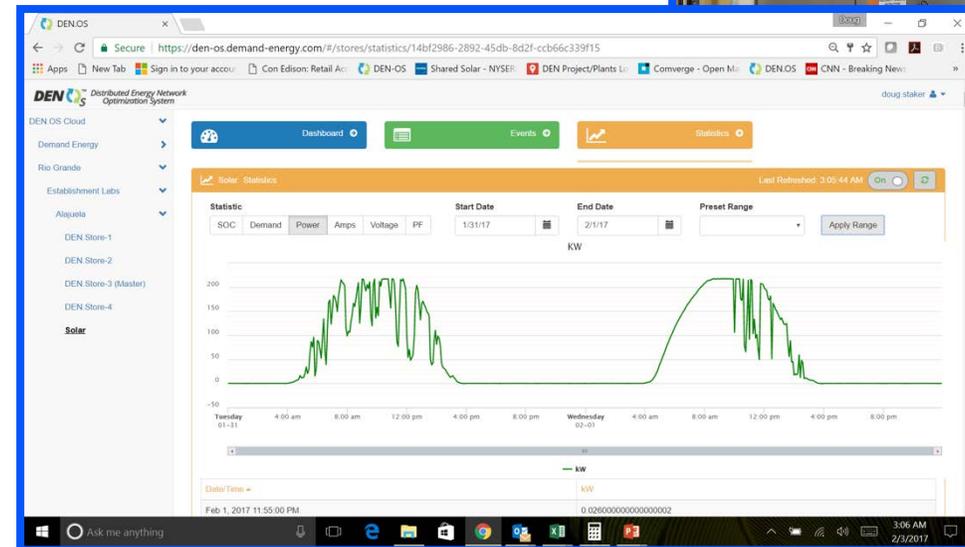


Establishment Labs – Costa Rica

Establishment Labs	
Site	San Jose, Costa Rica
Load Profile	~1.4 MW peak load
Configuration	Storage - 500 kW/1000 KWh Solar - 272 kW
Applications	Multi-DER Aggregation Critical Load Backup Power TOU Energy Arbitrage TOU Demand Charge Reduction



- **Storage + Solar + Back-Up Power/Microgrid for critical loads for this biomedical company**
- **Solar + Storage system designed to support critical loads in the medical manufacturing clean room. Maintains all systems to ensure room stays “clean” during extended outage**



Performance During Central America Blackout

1.4M homes & businesses in Costa Rica without power for 5 hours (July 2017)



Cause

- 500 MW transmission overload in Panama which impacted the entire region

Countries affected

- Costa Rica, Panama, Guatemala, Mexico, Honduras, El Salvador, Nicaragua

DEN's Storage + Solar system

- Seamlessly transitioned to back-up power without interruption and provided full power to support the critical clean room for the entire duration of the blackout; saving Establishment Labs high-value work-in-process inventory
- Once grid power was re-established, the DEN system transitioned back to normal operation
- The combined solar + storage system was designed and could have operated for longer periods if needed

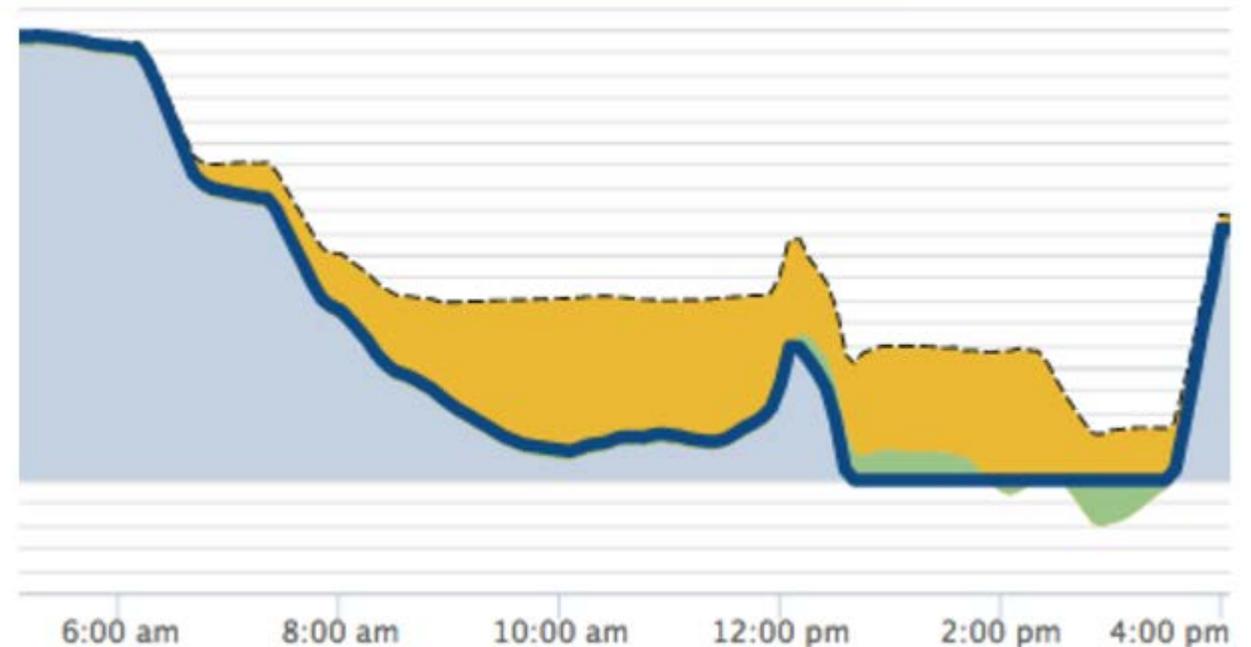
E-Labs Outage Operation

On July 1st, E-Labs experienced a Central America-wide blackout

DEN.OS seamlessly switched to backup mode and supported critical loads until the grid returned – automatically without intervention

Blackout took place from 1:50 to 4:35 pm (CT), approximately 2:45 hours

- Dotted line is original building load
- Thick blue line is what the utility sees; the utility meter
- Gray area supplied by the utility
- Yellow area supplied by solar
- Green area supplied by battery storage



How to Drive the Microgrid Market

- Develop utility rate structures that recognize that the cost of electricity has a locational and time-of-use (TOU) component.
- Utilities embrace and adopt non-wire solutions to address the changing grid
- Regulators begin to allow these approaches into their strategic grid planning
- Passage of an ITC for energy storage
- Policy support to help reduce regulatory and merchant risk associated with the deployment of microgrids and energy storage on an “as-a-service” model



Summary

Utilities are catching on to microgrid value

- More sensible than building to the peak
- Adds flexibility and resiliency
- Enables DERs w/aggregated control
- Cost-effective non-wire solution

C&I users can realize major benefits

- Provide resiliency
- Improve supply quality
- Boost sustainability
- Reduce delivery cost
- Scalable solution
- Simplified operation

