Microgrids: Delivering A Smarter, Cleaner And More Resilient Grid Infrastructure
Enel Group today

- ~40 €bn Regulated Asset Base
- ~65 mn distribution end users
  #1 in Italy, Spain, Chile, Peru
  #2 in Argentina, Colombia

- ~38 GW renewable capacity
  Global leadership in renewables

- ~18.3 mn free retail customers
  #1 in Italy and Spain

- ~47 GW thermal capacity
  Highly flexible and efficient generation fleet

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 hydrop
3. Presence with operating assets
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

Mexico 8.0 Earthquake

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

- 375 kW/ 1.565 MW Battery Storage System
- 400 kW Distributed PV Power
- 400 kW Energy Server Fuel Cell

A Blend of DERs - Enhances Success
**Shared Savings Revenue Streams**

**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

- Demand Energy owns the system and operates the microgrid to drive savings from various energy programs.

- L+M pays monthly service fee. A yearly reconciliation splits the equitable amount of savings derived.

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 – Costa Rica

<table>
<thead>
<tr>
<th>Establishment Labs</th>
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<tbody>
<tr>
<td>Site</td>
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<tr>
<td>Load Profile</td>
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</table>
| 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
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