EVs, Storage and Microgrids - What's the Current State?

Doug Staker, Vice President of Utility Business Development, Enel X
Enel X in USA: Flexibility Solutions and Energy Advisory

Focus on grid optimization, using flexible solutions
- Front-of-meter and Behind-the-meter
- Use technology-enabled solutions
  - Goals: (1) increase customer satisfaction
  - (2) drive down energy costs

Advise on energy procurement
- Wholesale supply
- Active risk management strategies planning, & strategy implementation

Enel: multi-local company
- ~45GW of thermal generation capacity; ~43GW renewables capacity
- Big Data: ~64,000,000 customers in 30+ utilities; ~1.3 million miles of lines
- USA: green Independent Power Producer: 2200+ MW managed installed capacity (wind; solar; hydro); ~100 projects

Source: Bloomberg New Energy Finance
Note: Prices are an average of BEV and PHEV batteries and include both cell and pack costs. Cell costs alone will be lower. Historical prices are nominal, future ones are in real 2016 U.S. dollars.
Perspective: Tremendous change, faster than you think

“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
Trend: Electrification of Transportation is Inevitable

Diesel bans & ZEV mandate
- China
- Norway
- France
- Spain
- Netherlands
- Italy (Rome)
- Canada (British Columbia)

Auto EV Investment $$$
- Tesla
- Volvo
- Nissan
- General Motors
- Honda
- Volkswagen
- Daimler
- Kia

Expected Volume
BNEF forecasts more than 20 million EV sales by 2030.
Trend: Falling Li-ion Prices Drive EV Market Growth

Falling battery prices are expected to **undercut gasoline cars by mid-2020s**

Source: Bloomberg New Energy Finance

Note: Prices are an average of BEV and PHEV batteries and include both cell and pack costs. Cell costs alone will be lower. Historical prices are nominal, future ones are in real 2016 U.S. dollars.
Why Does e-Mobility Matters for you?

Potential to drive value across your system!

Renewable Energy Systems

RES are **irregular and intermittent**

- e-Mobility can contribute to **stabilize the system and provide flexibility**

Infrastructure & Networks

I&N are affected by **power congestion**

- e-Mobility can avoid power congestion by **balancing the grid, sharing infrastructures** with many users connected to multiple networks and **decentralizing control and management**

Retail

Customers are getting more power

- e-Mobility can drive the retail in the energy transition, **enabling the breaking of the boundaries among sectors** thanks to new **ancillary services** to the grid such as supplying energy if needed in change of remuneration.
EV Charging: Large (& Growing), Highly Flexible Load

- **Fridge**: ~0.5 kW
- **Dishwasher**: ~0.75 kW
- **Washer**: ~1 kW
- **Microwave**: ~0.7 kW
- **Pool - Summer**: ~1.5 kW
- **Pool - Winter**: ~3 kW
- **AC**: ~3 kW
- **Electric Heat**: ~4 kW
- **Electric Oven**: ~4 kW
- **Electric Water Heater**: ~5 kW
- **Electric Dryer**: ~5 kW
- **Electric Vehicle**: 6-10 kW

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**Load Size (kW)**

**Flexibility**
Residential Load Profile With EV Charging

- 400% demand increase
- 2-7 kW flex load

8.0 kWh

Weather (F°)  Electricity
Use Case: utility scale renewables balanced w EV platform

WHAT does a good platform do?
- Coordinate w/ grid to modulate EVSE* rate, optimizing against selected goal(s), like:
  - wholesale/retail costs,
  - T&D balancing
- Balance Intermittency of solar and wind

Outcomes
- Stabilize cost-of-service, by enabling "more" solar & wind capacity
- Improve grid reliability and resilience
- Avoid costs assoc. w/ peak generation

* EVSE: Electric Vehicle Supply Equipment
Real Results: A Virtual Battery In Action

Day Ahead Prices & Demand Response Events
SCE West Zone

- 3 CAISO Flex Alert Days
- No Maintenance Days
- Day Ahead $$$ @ Price Cap
- All eMotorWerks’ CAISO Resources dispatched for multiple hours
- Dispatched EVSE network to shift demand to lowest cost intervals

Data based on five-day period, July 2018
Manage EV load and demand-side flexibility in real time

**Grid services**
Support grid reliability and decarbonization with demand-side flexibility programs, lower operational cost with market participation

**Data storage & security**
Collect and store up to 90 days of 15 min interval data on EVSE, leverage EVSE smart metering capabilities, and best-in-class data security

**EV-smart facilities**
Give employees access to smart EVSEs, manage EV load and reduce operational costs with JuiceNet Enterprise

**Residential customers**
Support smart EVSE adoption with rebates, increase enrollment and participation in TOU and DR programs with targeted incentives, control and dispatch EV loads in real time

**C&I customer**
Support smart EVSE adoption with rebates, increase enrollment and participation in TOU and DR programs with targeted incentives, control and dispatch EV loads in real time
Managing load at the edge of the grid helps optimize the entire energy supply chain.
Macro Challenge - Peak Load

CECONY Service Area Load Duration Curve

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New Projected Peak of 13.7 GW
2 GW Peak/ 3.2 GW Renewable/ 2 GW Indian Point
Locational Value of Storage

VALUE PROPOSITION:
- Reduces Transmission Congestion
- Substation Overloading
- Power Quality
- Ramping
- Spinning Reserve
- Supports Wind Farm Integration
- Frequency Control
- Black Start

VALUE PROPOSITION:
- Leverages TOU Pricing
- Demand Charge Reduction
- Demand Response
- Firms Distributed Solar
- Critical Load support

Centralized Storeage

Substation

Community

Commercial & Industrial

Storage Value

Centralized

Distributed
**Shared Value**

**UTILITIES**
- Conversion of variable generation to base load generation
- Better utilization of Transmission & Distribution resources
- Integration of Renewable Generation
- Better solution to Demand Response
- System balancing-Load, Frequency-Voltage
- Lessen the impact of EV Charging integration

**CUSTOMER SIDE**
- Take Advantage of Market Price Incentives- TOU & Demand
- Demand Response w/o load reduction
- Overall Load management
- Renewable Integrations- Net Zero
- Disaster Response Services
- Minimize EV Demand Charges
Here Comes the Sun

Solar Peak

Grid Peak

Ramping loads increase

Potential Over-generation
Building Solar Peakers

Solar Power

- Solar Production - Time shifted to period of highest benefit
- All intermittent performance removed
- Increased Value should receive a higher FIT price/kWh
Performance Based Rates

Company Financial Motivations
Earnings Adjustment Mechanisms

Specific Programs
- BQDM-Brooklyn Queens Demand Management
- NWA-Non Wire Alternatives
- DMP II- Demand Management Program.
Value Stacking Revenue Streams

**Demand Charge Management**
- Optimized load management from the combined Battery Operations

**Utility/ISO 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
- ISO winter DR
- Emergency Load Relief Program

**Plus: Emergency Back-Up Power**
- Critical loads for management and building security
- Community emergency response facility for extended outages
Demand Charge Management

Load shaping for improving grid performance and lower energy costs
Building Savings 2016
System Control
Optimization

Cloud-based platform enables real-time optimization engine to produce predictable financial returns from any combination of DER assets across any market and timeframe.

**Utility & Market Interfaces**
- Utility tariffs
- Electricity prices
- Demand response

**Cloud-Based Platform**
- Network Optimization Engine
  - Intelligent aggregation
  - Global modeling and analytics

**User Interface**
- View real-time performance
- View value streams
- View historical information

**Site Awareness**
- Demand profile
- Weather
- Time of day

**Site-Level Controls**
- Site Optimization Engine
- Real-time demand management
- Connection to site utility meter

**Distributed Energy Resources**
- Battery Storage
- Solar PV
- Generator
- Fuel Cell
- E-Vehicle
- Etc.
Questions?

Doug Staker, Vice President, Utility Business Development  
M 509 995 5076  --  douglas.staker@enel.com

Raphael Herz, Wholesale Advisory Team  
M 617 997 1884  --  raphael.herz@enel.com
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The Enel Group Worldwide

- A multinational power company and leading integrated player in the world's power and gas markets

- Publicly Committed to UN Sustainable Development Goals

- $84 B Annual Revenue

- 65,000 Employees

- 31 Countries in 5 continents

- 42 GW Renewable Capacity

- 50+ Yrs Experience

- No. 20 Fortune’s Change the World List
We are integrating and aligning...

To optimize grid and retail “flexibility services”...

Using all types of distributed energy assets

- Real-time Variable Loads
- PV & Other Distributed Generation
- EV Charging
- Energy Storage