Role of Energy Storage at SDG&E

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How Storage Fits Within SDG&E’s Mission

Our Mission

We improve lives and communities by building the cleanest, safest and most reliable energy company in America.
Recent events surpass previous forecasts of net load and afternoon ramp with high solar PV on the system.
Rising Solar Generation and Negative Pricing


Note: Distributed solar generation is estimated based on December 2016 installed net-metered capacity as reported in form EIA-826, Monthly Electric Utility Sales and Revenue Report with State Distributions.
Energy Imbalance Market

[Map of energy imbalance market with various regions and companies marked.]

- Market Operator:
  - California ISO
  - EIM entity
  - Active participant
  - Planned EIM entry 2016
  - Planned EIM entry 2017
  - Planned EIM entry 2018
Integration of DER
Solar & Electric Vehicle Customers
Regulatory Drivers

• CPUC Mandate AB 2514
  – Initial energy deployment targets in California for utilities
  – Storage goals split between Transmission, Distribution and Customer domains

    | Procurement Targets and Current Progress | Transmission | Distribution | Customer | Total |
    |----------------------------------------|--------------|--------------|----------|-------|
    | Established Target                     | 80 MW        | 55 MW        | 30 MW    | 165 MW|

  – Deployment can be shifted between domains within limits

• AB 2868
  – Further deployment of 167 MW of energy storage
  – Programs and investments targeted toward public sector and low-income customers will be prioritized by the CPUC

• Distribution Resource Plan/Integrated Distributed Energy Resources
  – Provides the foundation for further valuation and deployment of DER in California
  – Changes utility systems and processes to establish DER hosting capacity and benefit streams
**Energy Storage Use Cases**

- **Likely Use Cases for the Distribution System**
  - Renewables integration
  - Capital upgrade deferral/elimination
  - Reliability (islanding/grid forming/blackstart)

*Source: DOE/EPRI Electricity Storage Handbook*
Existing & Planned Energy Storage Deployments at SDG&E

Substation Energy Storage
- deployed adjacent to the substation interconnecting at either distribution or transmission level

Community Energy Storage
- deployed on the secondary side of a distribution transformer

Market Energy Storage Systems
- deployed SES that participate in the CAISO marketplace

Distributed Energy Resource Aggregations
- collections of SES and CES aggregations bundled for market participation
Modeling - Solutions

With and without dynamic VAr device

With and without energy storage

With and without storage and 4 quadrant control

Red = With  Blue = Without
**SDG&E Energy Storage Projects**

- Ortega Hwy 1: MW/3 MWh & Ortega Hwy 2: 1 MW/3 MWh
- Pala 1: 500 kW/1500 kWh & Pala 2: 1 MW/2 MWh
- Borrego MG: 500 kW/1500 kWh & Borrego AES: 1 MW/3 MWh
- Carmel Valley: 1 MW/3 MWh
- Bonita: 2 MW/8 MWh
Borrego Springs Microgrid – 1.5 MW / 4.5 MWh

Multiple Modes of Operation

- Constant Output
- Peak Shaving
- Arbitrage
- PV Smoothing
- VAr Dispatch
• Units capable of smoothing intermittency caused by fluctuating power output

• Operational variables can be user-defined, i.e. ramp rate control, time constant
Borrego Springs Power Outage

- No outage seen at St. Vincent CES unit site
Ortega Highway – 2 MW / 6 MWh

Site selected for overload conditions on circuit

- Distribution upgrade delays due to permit issues
- Large, sensitive customer load on the circuit
Ortega Highway Energy Storage Operations

Energy Discharged: 2825(kWh)

Energy Charged: 3500(kWh)

Peak Output: 500 kW
Bonita Vanadium Redox Flow Battery

- Connected feeder line:
  - 12kV, from the nearest substation
  - High PV penetration (20%), duck curve
  - Increasing load, needs for deferral
- Battery Size: 2MW x 4hr (PCS: 3MVA)
  - two battery banks
- Functions: frequency & voltage regulation, capacity firming, peak shaving, SOC management.

April, 2015

Graph showing load (MW) vs time:
- Without PV
- 2.5MW peak

The image shows a layout of the battery system with components labeled as Tank, Tank, Battery container (40ft w/ heat exchanger).
Market Energy Storage Systems

Escondido1,2,3: 10 MW/40 MWh
Total 30 MW/120 MWh

EL Cajon: 7.5 MW/30 MWh
Escondido Lithium-Ion Battery Storage Facility
Overcoming Challenges

- Procurement
  - Turnkey, warranties, capabilities

- Design/Engineering
  - Size, weight, standards, noise, safety, permitting

- Construction/Installation
  - Physical, electrical, IT

- Operations
  - Integration, communications, scaling, fire protection/suppression
Current and Planned Activities

• Improve and refine design standards
  – Standard points list
  – Interconnection design

• Improve engineering and acquisition
  – Battery system performance
  – O&M performance
  – Identify new storage application
  – Implement a CAISO Distributed Energy Resource Aggregation (DERA)

• Streamline integration and operations
  – CAISO
  – DERMS evolution
  – Develop mixed usage scenarios (market & reliability)

• Track cost developments and capabilities related to energy storage technologies/solutions
Summary of Lessons Learned

Immediate Need
- Mitigate intermittency of PV

Near-Term Need
- Store excess renewables
- Ramp support

Customers
- Bill control
- Outage mitigation

Use Case Drives Technology Choice
- Power vs. energy
- Technology cost
- Technology safety

Challenges & Barriers Exist
Thank you! Questions?

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