Distributed Energy Resource Management System (DERMS)
EPIC Project 2.02 Overview

Alex Portilla, PG&E
EPIC Summer Workshop

June 22, 2016
Distributed Energy Resources (DERs) present both challenges and opportunities for PG&E

**Market Drivers**
Expected high DER penetration by 2025
- **Solar**: 200 – 400% growth in solar customers (400-800k)
- **EVs**: 500k additional Electric Vehicles in PG&E’s territory
- **Storage**: 290 MW of distribution connected and behind-the-meter storage

**Regulatory Drivers**
California has indicated a need for sophisticated DER management, through CPUC rulings/guidance, including the Distributed Resource Plan (DRP), energy storage mandates and CAISO’s Energy Storage and Aggregated DER (ESDER) Initiative
DERs are Driving Convergence of Traditionally Separate Utility Lines of Business Divisions

Operational realities of DERs provide opportunity to achieve “one PG&E” through a high degree of cross-organizational integration to efficiently procure, integrate, and operate.
The Need for Distributed Energy Resource Management System

*Existing grid and customer program operations platforms not sufficient to enable safe, reliable, affordable operation of the high DER grid of 2025*

**Safety:** System or process must ensure DER dispatch driven by CAISO market does not violate distribution system thermal and voltage limits – DERMS may be this system

**Affordability:** DERMS technology may be able to increase hosting capacity to accommodate DG more cost effectively than traditional wires upgrades

**Reliability:** DER coordination has the potential to provide operational flexibility and could enable microgrid islanding

---

**DMS**

*Existing, industry making incremental improvements*

**Control and optimization of utility assets:**
- Switches
- Reclosers
- Capacitors
- Voltage Regulators

**DERMS**

*Net new and emerging*

Building from concepts from DMS and DRMS

Monitor, Optimize and Dispatch DERs to meet grid and market needs:
- Energy storage
- PV (with smart inverters)
- Future Electric Vehicle charging

**DRMS**

*Existing, industry making incremental improvements*

Program management and control of DR portfolio:
- Smart AC
- Aggregated DR
Future DER Management Requires a more Dynamic System

Spectrum of DER Response

Grid Operations
- Predictable
- Day-Ahead
- Discrete
- Centralized
- Analog
- Specific Load

Timing
- Unpredictable
- Seconds
- Continuous
- Distributed
- Internet of Everything
- DER System

Response Events
Decision & Control
Platform
Response Device

DSM
Dispatchable DER
PG&E Evaluating Minimum Viable Product DERMS to Drive Operational Learning

- DERMS market nascent, California and Western Europe will be early adopters
- EPIC 2.02 DERMS Project allows learning about the people, process, and technology needed to operate the high DER penetration grid of 2025. Specifically the EPIC project will:
  - **Demonstrate up to 8 use cases, coordinating energy storage and PV-connected Smart Inverters**
  - Create, test, and iterate on DERMS requirements (e.g., communication requirements for PG&E and 3rd party owned DERs)
  - Define boundaries and integrations with other PG&E systems (DRMS, DMS, market systems)
  - Cross LOB team selected Swift Bank 1 for DERMS and other DER-related projects
    - Co-locate DER-related EPIC projects to slowly build *Grid of Things Demonstration Feeder*
Swift Bank 1 (San Jose Division) to Demonstrate the “Grid of Things Feeder”

Many DER-Related EPIC Projects coordinated geography selection to find synergies from data inputs, physical DERs, and controls technology

Data Inputs

- **FLISR**
  - SCADA on line reclosers provides line loading data

- **Smart Grid Line Sensor Pilot**
  - Potential line sensor installation to increase visibility

- **EPIC 2.04: DG Monitoring & Voltage Tracking**
  - Insight on DG impacts to the grid

- **EPIC 2.07: Real-time Loading Data for Distribution Ops. & Planning**
  - Visibility into non-SCADA loads

- **EPIC 2.14: Automatically Map Phasing Information**
  - Improve circuit model accuracy

- **EPIC 2.23 Integrate Demand Side Approaches into Utility Planning**
  - Circuit-level DER forecasting and hourly customer load shapes

Physical DERs

- **EPIC 1.01 Energy Storage for Market Operations**
  - PG&E owned 4MW battery
  - Presently participating in CAISO markets & Islanding

- **EPIC 2.03: Test Smart Inverter Enhanced Capabilities**
  - 500-1000 kW Residential PV

- **EPIC 2.19c: Enable Distributed Demand-side strategies & Technologies (Behind the Meter Battery storage)**
  - 500 kW Aggregate behind the meter storage

Control System

- **EPIC 2.02: DERMS**
  - Test up to 8 DERMS Use Cases in 2016/2017
  - Focus on coordination of PV & Storage DERs

These EPIC projects will maintain alignment with other key initiatives

- Distributed Resource Plan (DRP)
- Distribution Control Center of the Future
- Corporate Strategy Themes
- DERP Tariff Implementation
EPIC 2.02 DERMS Project Aims to Demonstrate up to 8 Use Cases

For each use case, DERs will be grouped at different levels of aggregation (e.g., substation, bank, feeder, line segment, aggregation node\textsuperscript{1})

<table>
<thead>
<tr>
<th>Potential Use Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Load Masking / Phantom Load</td>
</tr>
<tr>
<td>2. Manage Equipment Capacity Constraints</td>
</tr>
<tr>
<td>3. Mitigate Voltage Issues with Real Power Output</td>
</tr>
<tr>
<td>4. Mitigate Voltage Issues with Reactive Power</td>
</tr>
<tr>
<td>5. Economic Dispatch of DG and Energy Storage</td>
</tr>
<tr>
<td>6. Operational Flexibility</td>
</tr>
<tr>
<td>7. Mitigate Solar Resource Intermittency</td>
</tr>
<tr>
<td>8. Performance Verification and Analysis</td>
</tr>
</tbody>
</table>

\textsuperscript{1}Aggregation Node is a predefined level of aggregation based on feeder segmentation
Use Case 2: Manage Equipment Capacity Constraints - Demonstration Scenario

PG&E will be working with installers to engage customers and deploy BTM storage and PV with Smart Inverters across a limited geography.
DERMS EPIC 2.02 Project in the broader context

• DERMS EPIC Project will drive learnings applicable to industry needs
  • Near term, DERMS expected to be point solution for point challenges with DG integration (hosting capacity deficiency)
  • Longer term, DERMS may be able to enable aggregated DER participation in CAISO market, and optimize value of Distribution-connected storage

• Close alignment with California IOUs in progress
  • SCE unveiled “Grid Management System” vision in early February and issuing DERMS RFP later in 2016 – closely following industry response and next steps
  • SDG&E evolving Borrego Springs microgrid from a “point solution” to a system level DERMS – following learnings

• Project team will continue to align work on this project with DRP, other DER-related proceedings, and similar initiatives at other utilities
Questions?
Alex Portilla – Emerging Grid Technologies
a3pc@pge.com