Dispatchable Load “SmartDR” Assessment

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Background and Context

• Previous Demand Response Pilot
  • Event Based
  • Manual Operations
  • Unpredictable Participation

• New Technology
  • Better Customer Interaction
  • Predictable
  • More Opportunities for Use
Distributed Architecture

Traditional Applications

DR Control / Notification → Utility/Market

Available Products:
- Capacity Dispatch
- Energy Monitoring

DR Event Notification

DR Control

Customer

Enbala Architecture

Global Optimization, Resource Forecasting & Continuous Operation

GOFlex Control Center

Utility/Market

Bidding & Confirmation

Local Optimization & Continuous Operation Against local constraints

GOFlex EnSITE

Customer

Available Products:
- Capacity Dispatch
- Energy Monitoring
- Energy Dispatch
- Regulation Dispatch
- Continuous Commissioning

Available Products:
- Capacity Dispatch
- Energy Monitoring
- Energy Dispatch
- Regulation Dispatch
- Continuous Commissioning
Constraint Based Forecast and Control

Dynamic Operational Constraints & Control Operations

HVAC / Environmental

Process Control

Ancillary Systems

Non-Constant “Storage” Characteristics
- Power
- Energy
- Reactive Power
- Voltage
- Power Factor
- Ramp In/Out Rates
- Electric Rate
- ..and more
Multi-Layer Optimization Technology

**Grid Level** Optimization for Grid/Service level objectives (i.e. Grid Regulation, Capacity)

**Collection of Networks** Optimizing for the Network Scale objectives (i.e. Substation or Region)

**Collection of Local Resources** into a Network Level Optimization (i.e. Campus, Feeder etc.)

**Local Constraint** Based Optimization of the Objective based on Local Conditions and Operations (i.e. DER, Load, System)
Water Treatment, High Lift Pump

Range: 600 kW

Operation:
Direct control of pump speed setpoint observing discharge pressure constraints (75 to 85 psi).
Elevated tanks and system piping act as storage for pumping DSM sites.

District Chilled Water, Chiller

Range: 300 kW per chiller
1000 kW aggregated

Operation:
Leaving chilled water setpoint reset within site-defined constraints (39 to 46F). This chiller is one of five chillers integrated at the same site.
Secondary loop and building thermal mass acts as storage for chilled water DSM sites.
Assessment Workstreams

1. Qualification of Value  
2. Dispatchable Load Potential  
3. Enablement at Customer Sites  
4. Integration with PSE’s Energy Management System  
5. Final Report and Pilot Design
Internal Stakeholder Process

- Energy Management System IT
- Energy Supply
- Resource Planning
- Rates and Regulatory
- Energy Efficiency
- Business Services
- Smart Grid
- Operations
Value Qualification

Primary use cases:
1. Contingency Reserves (Spinning and Non-Spinning Reserves)
2. System Capacity

Secondary use cases:
1. Substation Upgrade Deferral
2. Balancing (Automatic Generation Control)
3. Over Supply
4. Energy Arbitrage

<table>
<thead>
<tr>
<th>Use Case Ranking</th>
<th>Use Case</th>
<th>Value ($/kW-yr)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Spinning Reserve Capacity</td>
<td>111</td>
</tr>
<tr>
<td>2</td>
<td>Non-Spinning Reserve Capacity</td>
<td>108</td>
</tr>
<tr>
<td>3</td>
<td>System Capacity (Starting 2021)</td>
<td>156*</td>
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</tbody>
</table>

**Leveraged modeling from battery analysis**
Load Potential – large C&I

Methodology:
1. Define customer sectors, market segments and applicable end uses
2. Estimate potential based on sector, segment and end-use
3. Screen segments for eligibility
4. Estimate technical potential
5. Estimate market potential

- Total technical potential found to be 125 MW Across 803 sites
- Cut-off at 200kW average demand
- Assuming 20% participation rate
  25MW of market potential identified
Customer Engagement

- **High Load**
  - Top 100 Demand Customers

- **Control System**
  - Automate Dispatch

- **Load Flexibility**
  - Process Storage and/or Variable Load

- **Load Diversity**
  - Different Customer Types
Customer Engagement

Cold Storage

Wastewater Treatment

High School

Industrial Gas Manufacturing
Contact Information

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