Back Up Power for Sochi

May 6th, 2014
Outline

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Who We Are

- Manufacturer of high-energy and high-power, large format, lithium-ion battery packs and energy storage systems
- Provide off-the-shelf and custom solutions for integration across diverse applications, including on- and off-grid energy storage, heavy-duty transportation and industrial
- Two manufacturing facilities in the Indianapolis area, as well as one in Korea
EnerDel develops and manufactures 80% of the value chain for large-format, prismatic lithium-ion powered energy storage solutions.

Partnerships with local and global Integrators.
Project Background

• In October 2010, ENERDEL was awarded a contract to supply two identical BESS into Russia
• The systems were to be identical and deployed to FSK substations in St. Petersburg and Sochi, Russia to supply backup power
Project Background

• The Sochi BESS project was part of a regional electrical infrastructure upgrade to support the 2014 Winter Olympics

• The remote nature of many of the sites and the fragile infrastructure left the regional susceptible to outages
Problem Statement

A solution is needed to protect substation critical loads against supply interruptions.

It is desired for the UPS to provide ancillary services to the load due to frequency and voltage inconsistencies in the normal supply.
Development Partners

Prime Contractor and Battery Provider

PCS and Cooling Systems Provider

Transformer and Switchgear Provider

Controls and Automation Provider
Solution Concept

• Primary Function: UPS
  – Using Line Interactive UPS Topology
  – Operating in a Microgrid as an “Island”

• Secondary Function: Ancillary Services
  – Provide Frequency Control Based on Dispatch
  – Provide Peak Shaving Based on Dispatch
Solution Overview

**PCS**
(1.5MW per 40ft Container)

**Energy Module**
(1MWh per 40ft Container)
## Solution Specification

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Value</th>
<th>Remark</th>
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</thead>
<tbody>
<tr>
<td>Rated Energy</td>
<td>MWh</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Rated Power</td>
<td>MW</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Rated Output Voltage</td>
<td>V</td>
<td>400</td>
<td>3 Phase, 50 Hz</td>
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<tr>
<td>Round Trip Efficiency</td>
<td>%</td>
<td>88</td>
<td></td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>°C</td>
<td>-45 to 50</td>
<td>External Ambient Condition</td>
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</table>
Solution Architecture

ENERDEL BESS : EM + PCS

Energy Module, 1050VDC, NOM

Bidirectional Inverter

V, I, P sense

Fast Control

P, Q, Start/Stop

Critical Substation Loads

GRID, 400V, 50Hz

Sub Station Breaker

AC LOAD BUS

SF3

UCC
Site Overview – Psou Substation

- Battery Modules
- Switchgear
- PCS and Transformers
Site Overview – Psou Substation

Substation Control Building

ESS Control Room

PCS and Battery
## Results

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Target</th>
<th>Actual</th>
<th>Compliance</th>
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<tbody>
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<td>3.0</td>
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</tr>
<tr>
<td>Rated Power</td>
<td>MW</td>
<td>1.5</td>
<td>1.5</td>
<td>OK</td>
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</tr>
</tbody>
</table>

- All Ancillary Services Successfully Certified by KEMA During Factory Testing and Demonstrated On-Site with Utility Interconnection Prior to Customer Acceptance
Conclusion

• Lithium Ion BESS is a viable solution for Backup Power (UPS) in areas where the electrical infrastructure is fragile or unstable

• Ancillary Services such as Frequency Control and Peak Shaving can be “layered” on to a UPS System to enhance value

• Care must be taken when designing the Battery - PCS power system to ensure efficiency of auxiliary systems does not impact overall efficiency

• Site and PCS control is a technical challenge when changing from “Grid Connected” to “Island” modes of operation
The Rest of the Story …

• The Sochi BESS was fully operational during the 2014 Sochi Winter Olympics
• The “twin” system in St. Petersburg has also been in operation for over 1 year
• Work continues to roll out additional BESS in FSK substations, including another installation in Sochi and others in the Moscow region
Thank You!