Design and Integration of a 2.5 MW / 5 Mwhr Energy Storage System on the University of California, San Diego’s 42 MW Microgrid

William Torre
Center for Energy Research
University of California – San Diego

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UC San Diego Operates a 42 MW_{peak} Microgrid

Campus Quick Facts

With a daily population of over 45,000, UC San Diego is the size and complexity of a small city.

As a research and medical institution, we have TWO times the energy density of commercial buildings.

16 million sq. ft. of buildings, $200M/yr of building growth.

Self generate 85% of annual demand
• 30 MW natural gas Cogen plant
• 2.8 MW of Fuel Cells installed
• 2.2 MW of Solar PV installed
UCSD’s Energy Storage Portfolio is the World’s Largest, Most Diversified University Program

- 8 kW Sunverge at Scripps Institute of Oceanography
- 108 kW, 180 kWh BMW, demonstration of application of 2nd Life EV batteries, coupling to 330 kW PV, and Level II EV Charger
- 3.8 Million Gallon Thermal Energy Storage Tank
  - Additional 1.2 Million Gallon TES awaiting commissioning
- Formerly site hosted
  - 30 kw/30 kwh PV Integrated Storage System from Sanyo/Panasonic
  - 100 kW/ 300 kWh ZBB Flow Battery
Funded Projects To be operational 2015-16

• ARPAe CHARGES Laboratory and Microgrid Demonstration of Advanced Energy Storage Batteries ($3.3 M, 4 yr., ARPA-E)
• 2.5 MW, 5 Mwhr, Advanced Energy Storage, Lithium-ion from BYD (SGIP-CPUC)
• 28 kW, Maxwell Labs, Ultra Capacitors, Smoothing of PV intermittency, coupled with solar forecasting (CEC)
• EoS (CEC)
• Lightsail (CEC)
• MCV 35 kW, 35 kWhr Compact Li-Ion energy storage system (Industry)
• NRG 100 kWh Li-ion, PV integrated storage with EV DC Fast Charging (CPUC)
• 250 kW, 500 kwhr SGIP PV Integrated Storage (SGIP-CPUC)
UCSD – BYD 2.5 MW / 5 MWhr Lithium-ion Iron-Phosphate Energy Storage Project

• 60% Funded with CPUC Self Generation Incentive Program (SGIP)
• 40% Co-funded by UCSD and BYD
• 2.5 MW/ 5 Mwhr energy storage complements UCSD’s 2.2 MW of campus PV and off peak CHP
• Competitive Solicitation, Turn Key Design/Build
• Awarded to BYD, Lithium-ion Iron-Phosphate battery
• Site Construction started May, 2015
• System Installation started June, 2015
• System Installation completed, expected Sept. 2015
UCSD Energy Research Park

Location of 2.5 MW Energy Storage
UCSD’s Energy Research Park
EV DC Fast Charging & Energy Storage, 5 MWH Energy Storage, 2.8 MW CHP Fuel Cell, 1.2 mgal TES, Smart EV Charging
UCSD - BYD Energy Storage System
2.5 MW / 5 MWhr
UCSD – BYD Energy Storage System
UCSD – BYD Energy Storage System Details

<table>
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<th>Model</th>
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<tbody>
<tr>
<td>Appearance</td>
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<tr>
<td>Dimension /mm</td>
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<td>Nominal Capacity /Ah</td>
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<td>Nominal Voltage /V</td>
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<td>Energy Density (Wh.Kg⁻¹)</td>
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<td>Production Status</td>
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280 Cells Per string, 30 strings

Capacity Retention Vs. Time

The Curve is Based on the System Operating Without Battery Compensating

Build Your Dreams
Available Battery system in:
1) 15 min (4C rate discharge)
2) 30 min (2C rate discharge)
3) 60 min (1C rate discharge)

or more...
UCSD – BYD Dimensions and Layout

Container

Battery Cabin

Battery String

Battery String

Battery String

Gas Fire Extinguishing Device

Power Cable

Grounding Copper Bar

Communication Cable Connection

Point and Distribution Connection

Electric Unit

Air-conditioning Internal Unit

Work Door
Microgrid Master Controller Communicates With Distributed Control of DG and Energy Storage

UCSD Campus Load and Generation Requirements

BYD 2.5/5 Mwhr Energy Storage System

Sanyo 30 kW/30 kWh Energy Storage System

MCV 35 kW/35 kWh Compact Li-ion Battery

2nd Life EV Battery Test Stand

BMW B2U 108 kW/180 kWh

Maxwell 28 kW Ultra Caps

Solar Forecasting For PV Resource Prediction

Center for Energy Research
The Largest Energy Storage System of any University in the World
Thank You To Dr. Imre Gyuk DOE Energy Storage Program Manager, and Dan Borneo, Ben Schenkman for Technical Support on this UC San Diego energy storage project!
Questions or Comments?

Thank you!