UC San Diego

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

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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**

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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 kWh 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**

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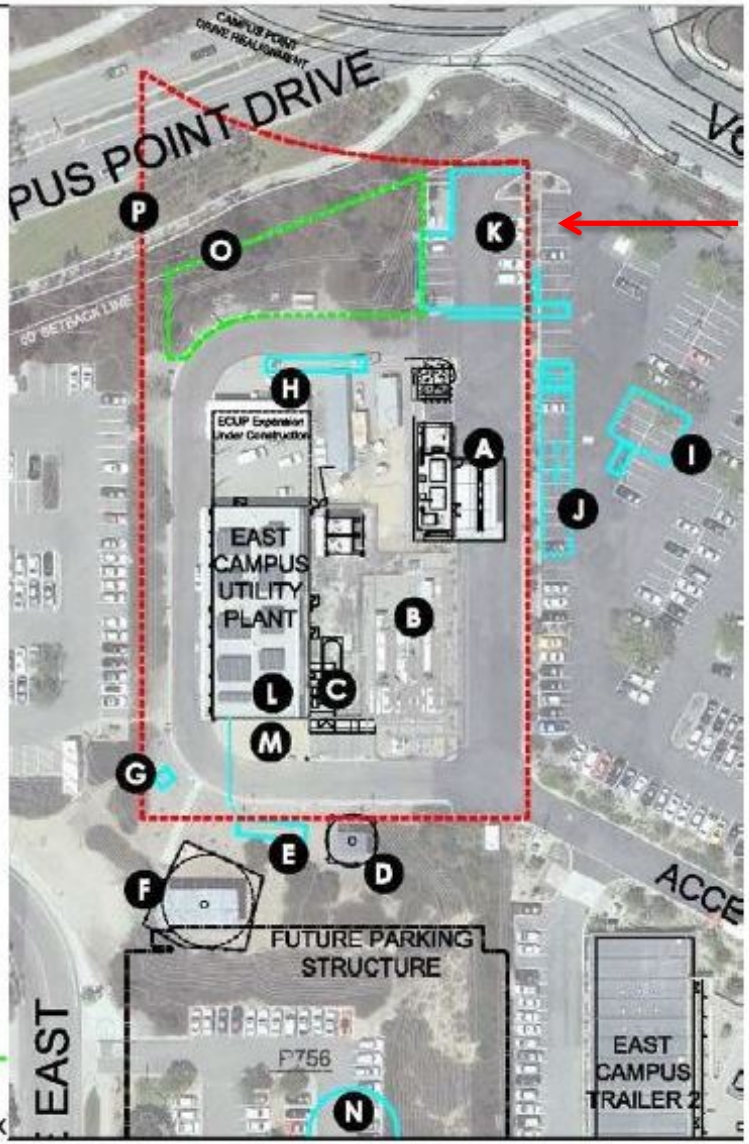
UCSD Energy Research Park

LEGEND

- A Compressed Natural Gas Facility (CNG)
- B Fuel Cell
- C Absorption Chiller
- D 5kW Solar Panel
- E ZBB/Sunpower Energy Storage
- F Soitech Solar Panel
- G MCV Energy Storage
- H Concrete Pads for future energy storage: (1) 40'x8', (1) 20'x8'
- I NRG Solar Canopy Fast Charge Station
- J RWE Electric Vehicle Charging Station
- K Advanced Energy Storage: 2.5MW
- L 30kW Fixed Photovoltaics on Roof
- M Future Interpretive Center
- N Thermal Energy Storage
- O Energy Park Temporary Expansion Site
- P Energy Park Future Expansion Site (Approx



Location of 2.5 MW Energy Storage

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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

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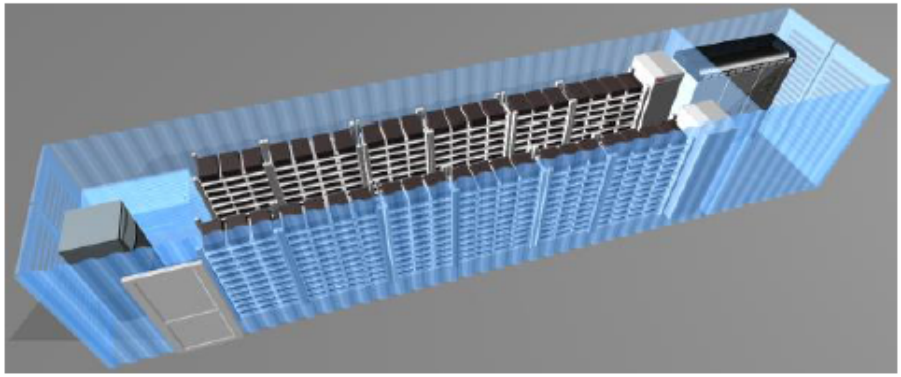
UCSD - BYD Energy Storage System
2.5 MW / 5 MWhr

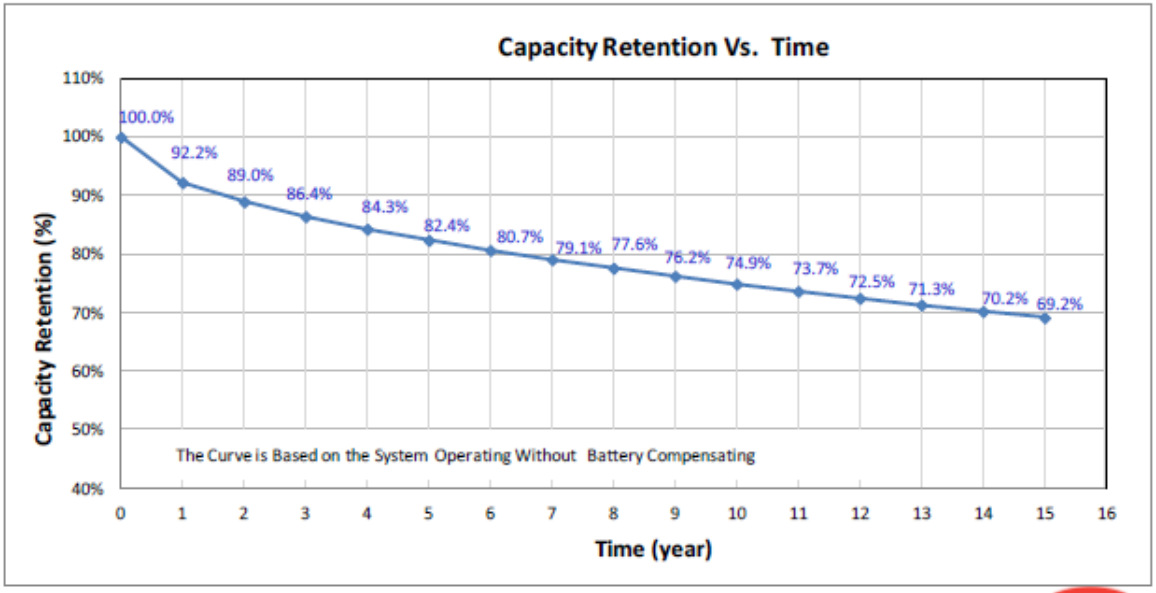
UCSD – BYD Energy Storage System

UCSD – BYD Energy Storage System Details

Model	C12
Appearance	
Dimension /mm	58*146*410
Nominal Capacity /Ah	**230**
Nominal Voltage /V	3.2
Energy Density ($Wh \cdot Kg^{-1}$)	120
Power Density ($W \cdot Kg^{-1}$)	2500
Weight /Kg	6.10
Can Material	Aluminum
Production Status	Mass Production



280 Cells Per string, 30 strings

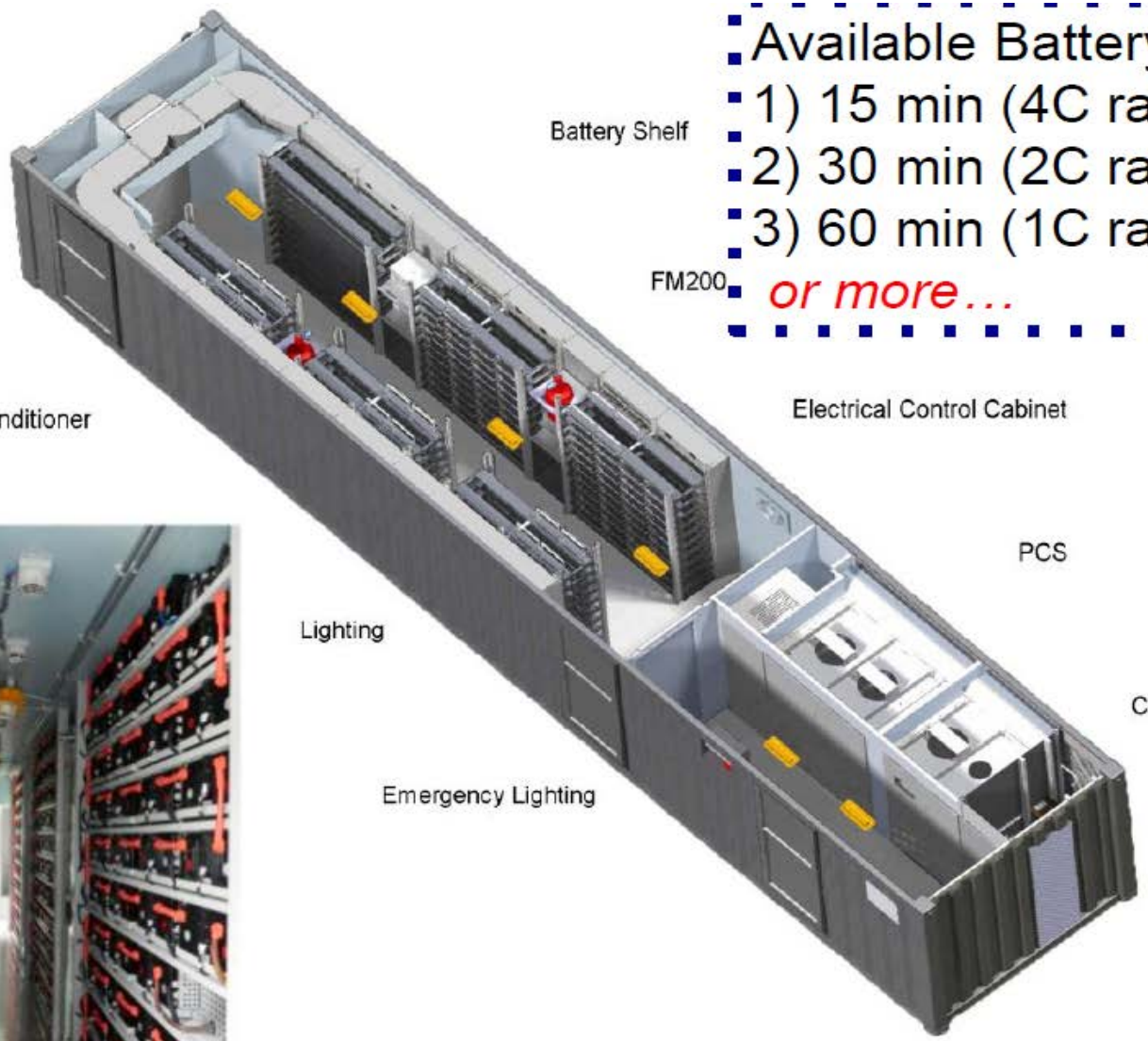


Build Your Dreams

Available Battery system in:

1) 15 min (4C rate discharge)
2) 30 min (2C rate discharge)
3) 60 min (1C rate discharge)

or more…



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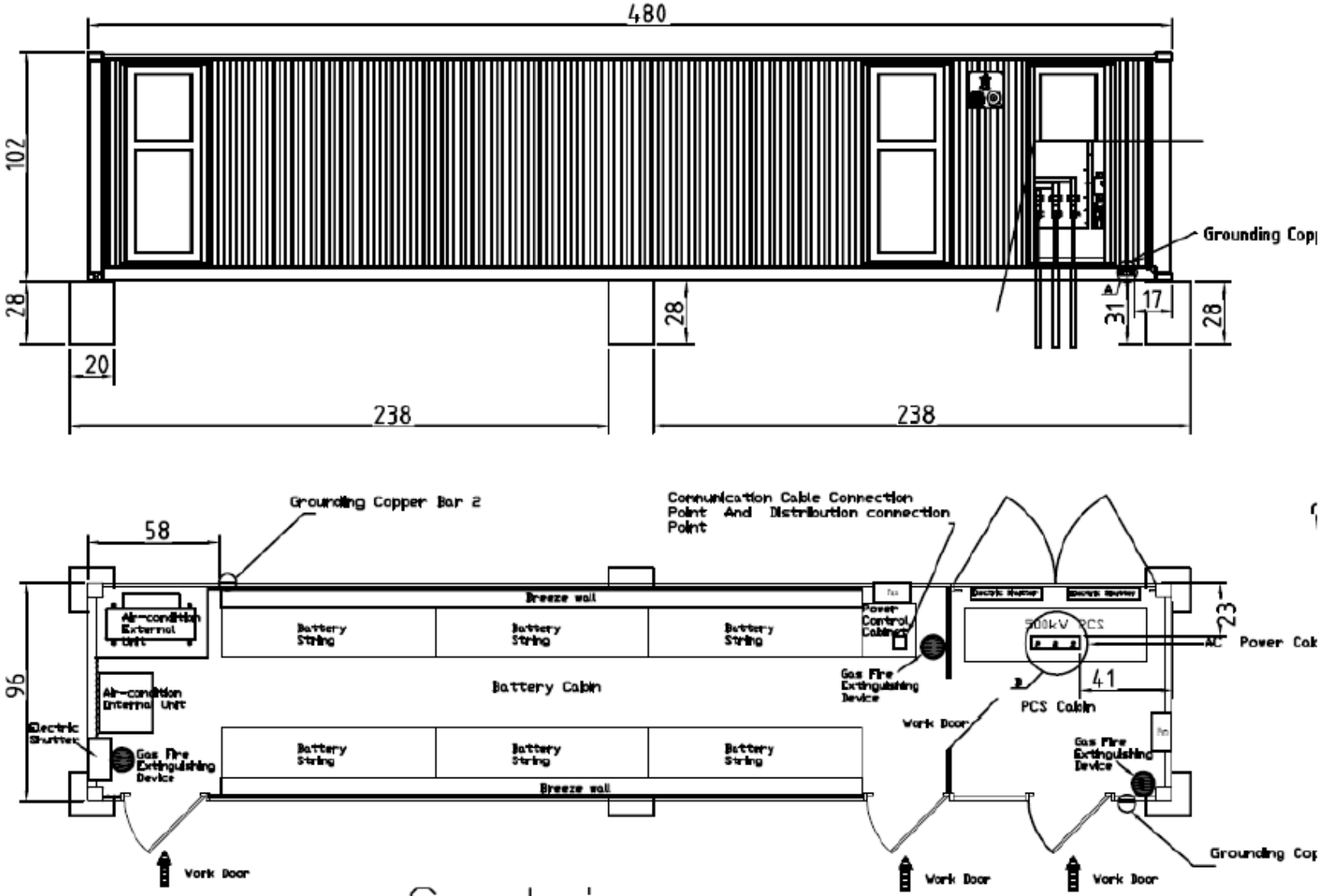
UCSD – BYD Dimensions and Layout



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

UCSD Campus Load and Generation Requirements

BYD 2.5/ 5 Mwhr EnergyStorage System

2nd Life EV Battery Test Stand

Sanyo 30 kW/ 30 kWh Energy Storage

Master Microgrid Controller

BMW B2U 108 kW/ 180 kWh

MCV 35 kW/ 35 kWh Compact Li-ion Battery

Solar Forecasting For PV Resource Prediction

Maxwell 28 kW Ultra Caps

The Largest Energy Storage System of any University in the World

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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 !

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Questions or Comments?

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