

CALIFORNIA ENERGY COMMISSION

Load Management Standards Workshop on Enabling Technologies
JUNE 19, 2008

Case Study

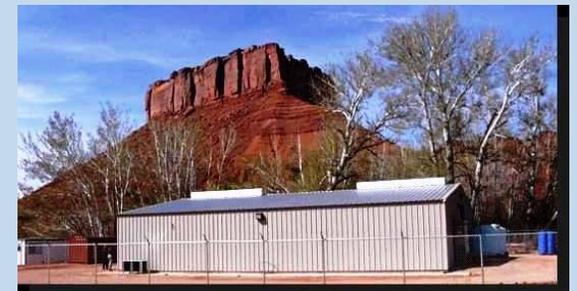
Energy Storage Installation at Industrial Energy User for UPS,
Emergency Power and Demand Response

US&R Power Grid Partners

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Problem

- Semiconductor Manufacturer – 7.5 MW Peak, 24/7
- Dedicated 33 kV line from utility substation
- Unable to provide demand response, *however*,
- Experiences 7 – 9 significant power quality events per year. Costs can exceed \$500,000 per hour.
- 2 hour interruption Friday afternoon, May 2008
- \$1.6 million to install pad for rental generators in 2001
- Corporate priority – Environment and GHG Reduction

Solution

- Install 5 MW, 8 hour VRB energy storage system (ESS)
 - 40 MWhr
- UPS for entire facility – Power Quality
- Emergency Power to capacity of storage
- Subsidize cost by ancillary service sales to CAISO –
Frequency Regulation under MRTU Release 1A
- Demand Response programs of Utility / CAISO

VRB Battery

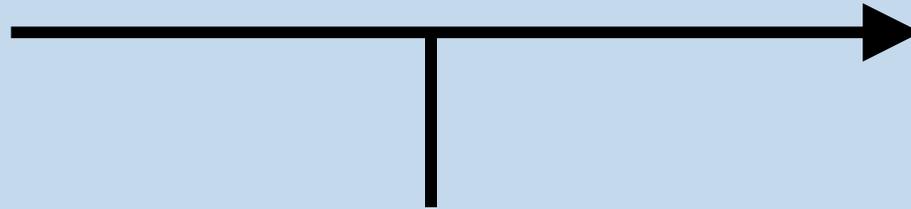
- **VRB Power Systems (TSX-V:VRB)**
 - **“Vanadium Redox Flow Battery”**
 - *25 year life or longer with minimal maintenance*
 - *Unlimited Charge – Discharge cycles*
 - *No emissions, easy to permit*
 - *“Green” – no hazardous metals like lead or cadmium.*
 - **Installations in the USA, Japan, Australia, Ireland and Europe.**



- [Movie about USA installation](http://www.vrbpower.com/publications/corporate-video.html)
 - <http://www.vrbpower.com/publications/corporate-video.html>

ESS Resting

7.5 MW



0.0 MW

7.5 MW



ESS standing by under control of CAISO AGC

ESS monitors power quality to host and maintains voltage, absorbs swells, spikes, etc.

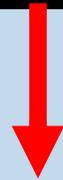


ESS Charging - RegDown

12.5 MW



5.0 MW



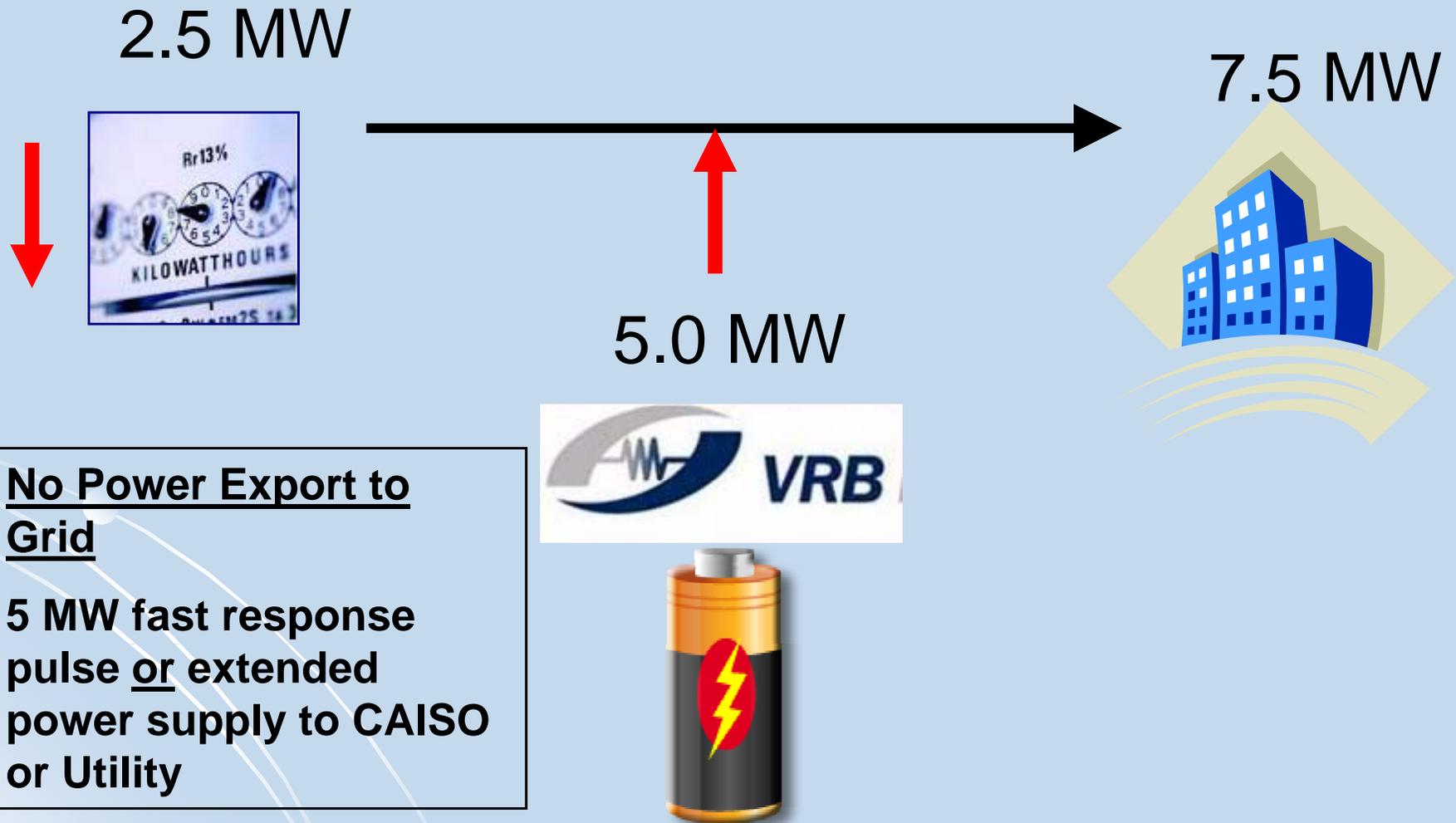
7.5 MW



Host power not affected
Fast response pulse to CAISO to balance generation, including wind



ESS Discharge – RegUp / DR



No Power Export to Grid
5 MW fast response pulse or extended power supply to CAISO or Utility

ESS Discharge – UPS

0 MW



7.5 MW



7.5 MW



**ESS Provides Full UPS
for up to 10 Minutes.**

**Emergency Power while
host conducts orderly
load shed and shut
down.**



Benefits to Host

1. Uninterruptible Power Supply and Power Conditioning (UPS) for the entire facility.
2. Emergency Back-up Power to the capacity of the ESS.
3. Environmental and Social Benefits Related to no Diesel BUG, Renewable Energy Integration, Power Grid Reliability and Reduced Greenhouse Gas Emissions.
4. Cost of Power Security subsidized by sales of A/S to CAISO – Demand Response incentives.

Figure 3a: Electrical Modular design showing stacks and PCS connections to grid

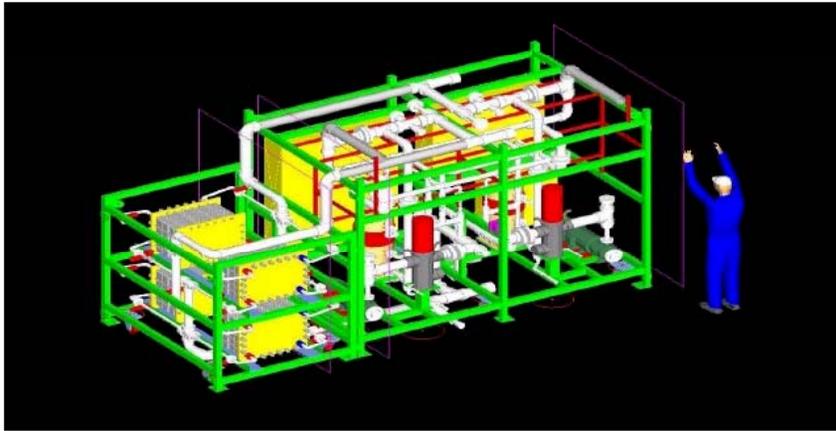
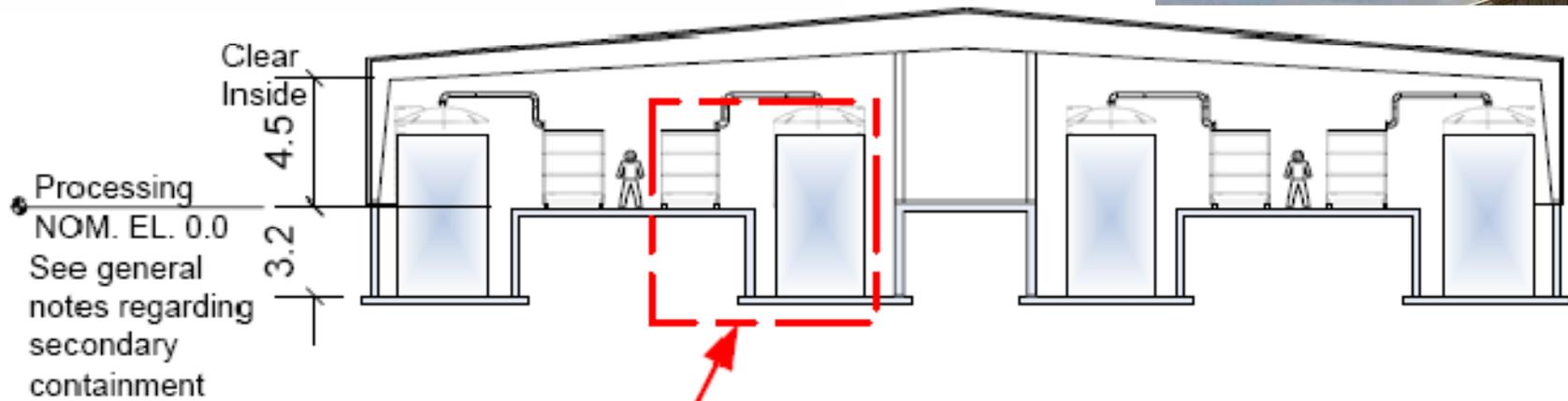
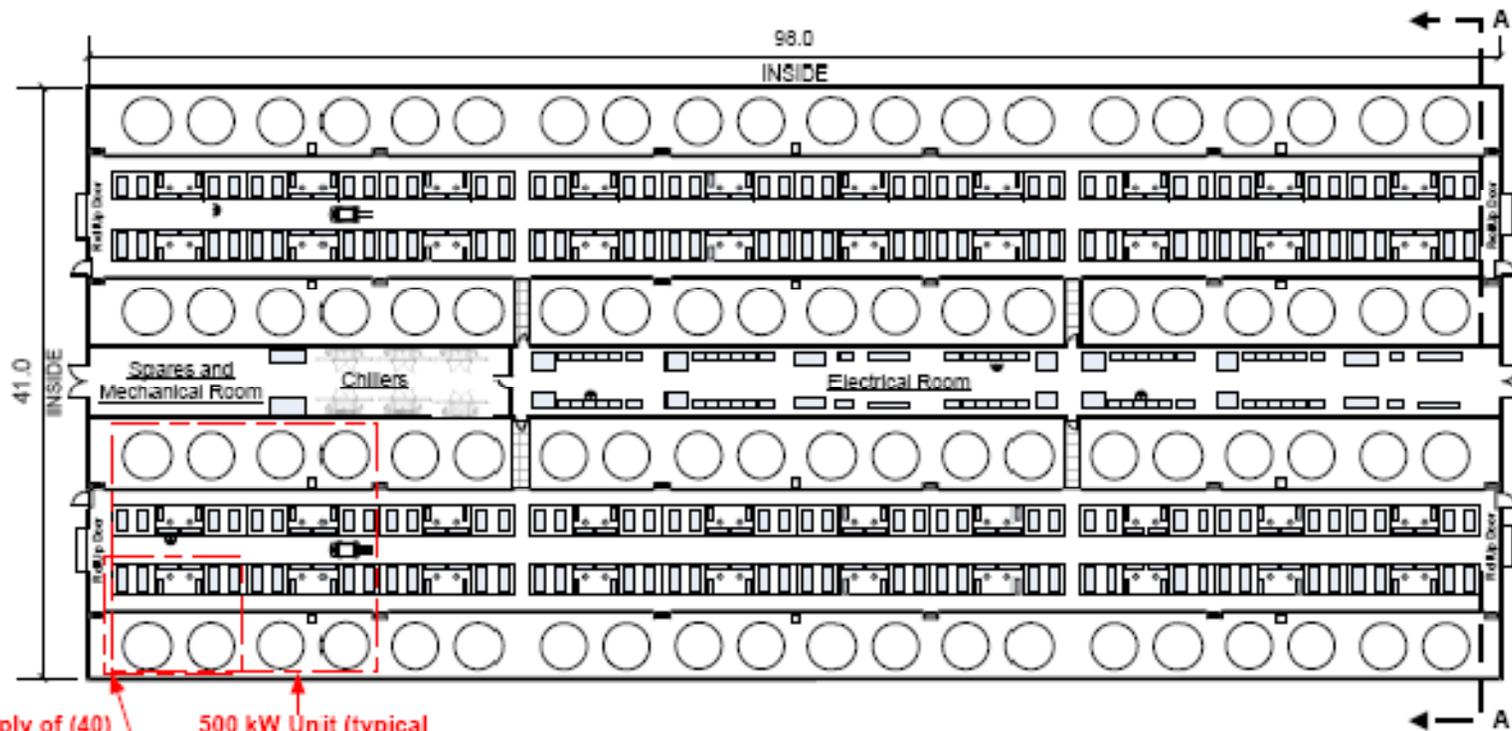


Figure 3b: Modular stack unit building block with pumps and controls



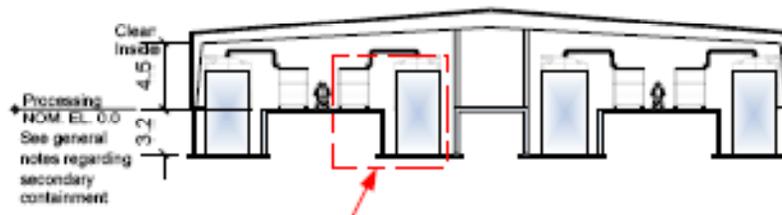
**VRB Supply of (40)
Process Modules and
(80) Storage Tanks**

ELEVATION 1
4101



VRB Supply of (40)
Process Modules and
(80) Storage Tanks

500 kW Unit (typical
for (20))



VRB Supply of (40)
Process Modules and
(80) Storage Tanks



Grid Partners Plant



Sample Installations

