

## Highlights of UC San Diego's Microgrid

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UC San Diego has a 42 MW microgrid with a master controller and optimization system that self generates 92% of its own annual electricity load and 95% of its heating and cooling load. UCSD owns and maintains a 69 kV substation, ninety-six 12kV underground feeder circuits and four 12kV distribution substations throughout the 1200 acre campus. Three PMU synchphasers have been installed by SDG&E on the utility side of the substation meters, and three similar units are in the process of being procured on the UCSD side of the substation meter in order to provide expanded operational and research capabilities. The CAISO, DOE, CEC and SDG&E will be collaboratively engaged in 2012-13 to utilize the microgrid to improve management and efficiencies of the utility's and statewide grid operations such as demand response, excess generation, renewable supply load balancing and power outages.

The campus recently commissioned, under DOE/NREL funding, four bay stations for the endurance testing of 2nd Life EV batteries in stationary applications. Since July 2011, UCSD has served as the site host to a 30 kW/30 kWh PV integrated storage system from Panasonic/Sanyo. UCSD has approximately \$5M in CA Self Generation Incentive Program (SGIP) and other funding. This funding will be utilized in August 2012 to procure 2.5 MW/5 MWh of stand alone electric energy storage and 1.3/2.6 MWh of PV integrated storage. The SGIP program requires that the energy storage be for early commercial purposes, and the vendors need to provide a ten year warranty on the equipment.

The University currently has 1.5 MW of PV installed on campus, .8 MW off campus, and an RFP for additional 800 kW of PV on campus will be issued in August 2012. The 5.5 kW Soitec/Concentrix Concentrating PV system integrated into the microgrid in July 2009 continues to operate exceptionally well. Based upon the 5.5 kW performance and the upgraded 22 kW prototype installed on campus, Soitec/Concentrix has entered into a 305 MW of Power Purchase Agreements (PPA) with SDG&E that was approved by the CPUC in November 2011. Soitec, a French Company, dedicated its new San Diego manufacturing facility on December 15, 2011, and it will provide 450 new high tech jobs and 1000 indirect jobs. Soitec was recently issued a \$25M manufacturing grant under the DOE SUNPATH program, and it is in the final round for ESTCP funding by the DOD.

Additional demonstration projects with UCSD as a site host are possible to be "CEQA Ready" in terms of local permitting since UCSD is a self regulated entity within California. Also, prototypes and research demonstrations can be installed on the UCSD microgrid with UL listings as long as adequate public and worker safety is provided. The highly instrumented microgrid currently monitors 84,000 data streams per second and is designed for expeditious integration of distributed energy resources (DER). These three unique features of UCSD as a "Living Laboratory" will save the project significant schedule and expense in demonstrating the GENI prototypes.

The CEC's 2011 Annual Report to the California Legislature provided a status update on the Public Interest Energy Research Program (PIER). <http://www.energy.ca.gov/2012publications/CEC-500-2012-003/CEC-500-2012-003-CMF.pdf>. UC San Diego is exclusively featured in a two page section entitled "Turning a California University Campus Into a Premier Microgrid Technology Demonstration Platform" starting on page 43. Highlighted quotes include,

- The UCSD microgrid continually demonstrates the value of integrating a wide range of diverse energy generation resources to meet the needs of critical customer load. This microgrid provides insight into how the future California smart grid can operate with

higher penetrations of renewables, more distributed resources, and higher levels of energy efficiency (including demand response).

- Using a “lab to market” strategy through public-private partnerships, UCSD has demonstrated two generations of concentrating PV systems. UCSD has been the launching pad to bring new renewable technology manufacturing capability into California.
- UCSD has also promoted other highly successful technology transfer activities at other institutions by hosting the DOE’s Microgrid Planning Workshop and the DOE-CPUC’s Solar Forecasting and PV Integration Workshop.

The UCSD microgrid in 2011 was estimated to be 273 g of CO<sub>2</sub>/kWh, or 28% lower than the CA marginal generation mix. The UCSD microgrid in 2012 is forecasted to be 266 g of CO<sub>2</sub>/kWh, or 29% lower than the CA marginal generation mix, due to the commissioning of a 2.8 MW base load, directed biogas fuel cell on campus.

UCSD joined with SDG&E, Mayor of San Diego, GE and CleanTech San Diego to form Smart City San Diego to collaboratively work on Smart Grid and sustainability issues. (Jan 2011)

Major Awards and Recognitions:

- [EPA Energy Star Award](#) for achieving 66% efficiency for combined cooling, heating and natural gas power plant, 2010
- [1st Annual Climate Leadership Award for Institutional Excellence](#) from the American College & University Presidents' Climate Commitment Group, 2009
- [Gold STARS Rating from AASHE](#) and being the first CA university and 10<sup>th</sup> in the nation to receive it, 2011

The microgrid at UCSD that was enhanced via RESCO funding received a significant amount of notoriety in 2011-2012 including being the site host for the DOE Microgrid Planning Workshop and being named Sierra Magazine’s 3<sup>rd</sup> ranked “Coolest School” in their annual college review. Both the Rocky Mountain Institute (<http://www.youtube.com/watch?v=TEEx4gm3523I>) and the CEC/Navy (<http://www.youtube.com/watch?v=8XksxOZSJOU>) have posted short videos touting the UCSD microgrid as “best in class”.

Publicity wise, the UCSD microgrid enjoyed the following favorable quotes in mainstream and industry media.

*“First light for what the new smart grid architecture will look like is already visible... the ARPAnet moment for the Electrinet is arguably at University of California at San Diego where the 40 megawatt campus is the first fully operational smart microgrid.” Forbes*

*“Big picture thinking: lab to market! University of California San Diego takes microgrids to the world” Intelligent Utility (7/20/11)*

*“The University of California San Diego has fast become the very model of a microgrid community living with little need for utility power.” Smart Grid Today, (3/2/2010)*

*“The University of California, San Diego has been accumulating awards for its savvy use of a constellation of power generation and energy-saving technologies. The campus already controls a fully functioning microgrid—including a cogeneration plant—and, as befits a research institution, is constantly looking for new ways to make its energy system smarter. This “living laboratory,” as campus leaders like to call it, demonstrates what it takes to build a smarter grid and why the effort is worth it. “ Power Magazine (Nov, 2010)*

*“That’s because the university that is a leader in climate change research is also home to what is likely the most advanced microgrid in North America. As such, it aims to highlight how small, semi-independent power grids could help solve the problem of how to reliably integrate renewable energy into distribution systems, boost grid security and even make money for their owners, operators and developers.” Sustainable Industries (3/2/2011)*