The Illinois Institute of Technology microgrid helps to avoid blackouts in labs containing important research.

Microgrids and Energy Storage

Moving Toward 100% Clean, Renewable Energy on Campus

Installing microgrids and energy storage systems on campus allows America's colleges and universities to help pave the way to a future of 100 percent clean and renewable energy, developing pioneering solutions that can later be adopted by other institutions and the electric grid at large. Thanks to microgrids and energy storage systems, college campuses have the capacity to integrate renewable energy in new and creative ways to increase their use of clean energy and ensure reliable access to electricity.

What Are Microgrids?

Microgrids are self-contained electric grids that can operate as an "island" independent of the central power grid. This allows a campus to keep the lights on even if there is an outage on the main grid. But microgrids powered by renewable energy come with challenges:

- **Intermittent electricity generation:** Wind and solar power generation is variable, depends on weather conditions, and may not be available at the same time as energy is used during the day.
- **Distribution protection:** The presence of generation within the distribution system means energy flows both ways, which can make it hard to regulate voltage.

To address these issues, colleges can combine microgrids with:

- Energy storage to save excess clean energy for periods when production is low, and
- Smart technology to match renewable energy supply and demand.

For example, the Illinois Institute of Technology microgrid stores excess power in batteries and uses smart software to avoid blackouts in labs containing important research.

Colleges and Universities Are Uniquely Placed to Benefit from Microgrids

College campuses are well suited to develop microgrids:

- **Islanding:** The already self-contained nature of many campuses makes colleges perfect candidates for developing microgrids.
- **Increased Reliability:** Microgrids can continue to function even during central grid outages. This resiliency can be an important benefit to colleges concerned about power outages affecting the function of research facilities.
- **Expert Knowledge:** Schools can benefit from expert faculty knowledge and motivated student bodies to manage both energy supply and demand within a microgrid.
- **Living Labs:** Colleges may also use smart technology at the building level, analyzing sensor data to predict and smooth energy consumption to better meet supply. Universities equipped with meteorological stations, like Santa Clara University, may use weather reports to optimize clean power generation.

Deploying microgrids allows universities to demonstrate the practicability of high penetrations of variable renewable energy sources like wind and solar power, while improving overall reliability.

After Hurricane Sandy, SUNY New Paltz began to develop a state-of-the-art microgrid that incorporates solar power and battery storage to make its campus more resilient.

SUNY New Paltz Combines Clean Energy and Energy Storage to Avoid Blackouts

After universities like Princeton and Rutgers lost power during Hurricane Sandy, colleges were motivated to secure their campus power supply to be more resilient in the face of central grid power outages.

The State University of New York (SUNY) New Paltz has partnered with state agencies and utilities to build a state-of-the-art hybrid solar panel and battery storage energy system on a microgrid. The new system will generate clean energy from 217 kilowatts of solar panels installed on a campus gym and library. The hybrid microgrid's battery storage system will be in the gym's basement, and will help mitigate the variability of solar power production. Thus, the hybrid solar energy system will act as a reliable back-up energy source for emergency use, keeping the 7,800-student campus safe from weather-induced blackouts or cyber-attacks.

SUNY's hybrid microgrid will also test a smart technology that manages the complexity of having power being both used and produced locally. This technology helps SUNY to better deal with intermittent power production and successfully incorporate the solar energy into its grid.

Las Positas Community College's Microgrid

Las Positas Community College, located in Livermore, California, used a $15 million grant from the California Energy Commission to establish a campus-wide microgrid, combining solar generation, battery and thermal storage systems, net metering, and energy management applications.

The microgrid relies on existing solar arrays that supply 55 percent of campus electricity. Adding storage capability will allow Las Positas to store excess solar energy for use in the evening and at night. By optimizing the value of solar energy throughout the day and improving the microgrid's reliability, Las Positas anticipates the microgrid will help reduce its annual energy costs by $100,000.

The Las Positas microgrid rolls out a new concept of the "Internet of Energy," integrating numerous sources of power generation and a variety of applications to smoothly manage intermittent energy flows and variable energy loads. The Las Positas Community College microgrid automation project aspires to be a blueprint for campus microgrids across the country.

This factsheet is one of an 11-piece series. For citations, and to read the other factsheets, please visit EnvironmentAmericaCenter.org/Campus101

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List of Resources

To start your campus on the path to energy resiliency:

- Read the U.S. Department of Defense's report, Feasibility and Guidelines for the Development of Microgrids in Campus-Type Facilities (April 2012), available here: http://www.dtic.mil/dtic/tr/fulltext/u2/a579064.pdf
- The Microgrid Institute provides project development support and advisory services: www.microgridinstitute.org
- Find a microgrid close to your campus: microgridprojects.com