Colleges and Universities as Resilience Hubs

Princeton University campus
Photo: Office of Communications, Princeton

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Why college and university campuses are so well suited to resilience

- Common ownership of facilities
- Ability to take a longer view of economic return
- Legal responsibility for the well-being of students
- Often a commitment to sustainability
- Density that is well-suited to CHP and district heat
- Often a desire to strengthen relations with community

Harvard University – photo: Wallpapers-HD

Secondary effects, such as blackouts

New York City on October 29, 2012 – photo: Eric Chang

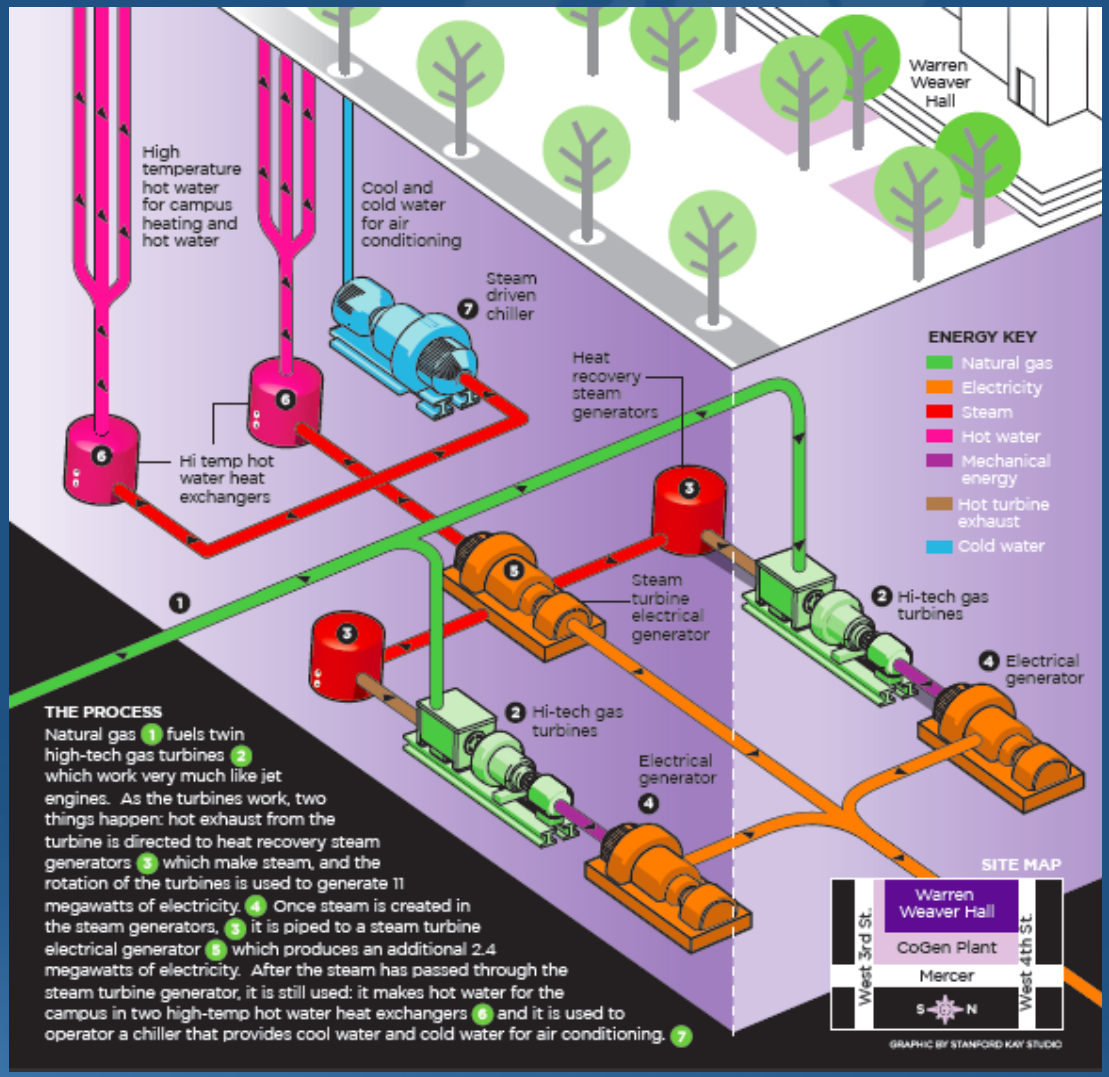
New York University

- University of 38,000 students in Lower Manhattan
- CHP plant completed in 2010 supplies electricity to 22 bldgs.
- Also 100% of the heating, cooling, and water heating to 37 campus buildings
- Islanding capability put to the test after Hurricane Sandy in 2012
- City was able to set up a command post there

New York University – photo: NYU Photo Bureau

New York University

- CHP plant produces 13.4 MW from from two 5.5 MW gas turbines and one 2.4 MW steam turbine
- 90,000 lbs steam per hour
- Approaching 90% combined efficiency
- $5-7 million energy savings per year for NYU
- Winner of 2013 EPA Energy Star CHP Award



New York University

Rendering of Mercer Plaza, which is on top of NYU's CHP plant – photo: New York University

New York University

CHP plant being built under what will be Mercer Plaza – photo: New York University

New York University

Energy recovery unit
Photo: NYU

Steam recovery unit
Photo: NYU

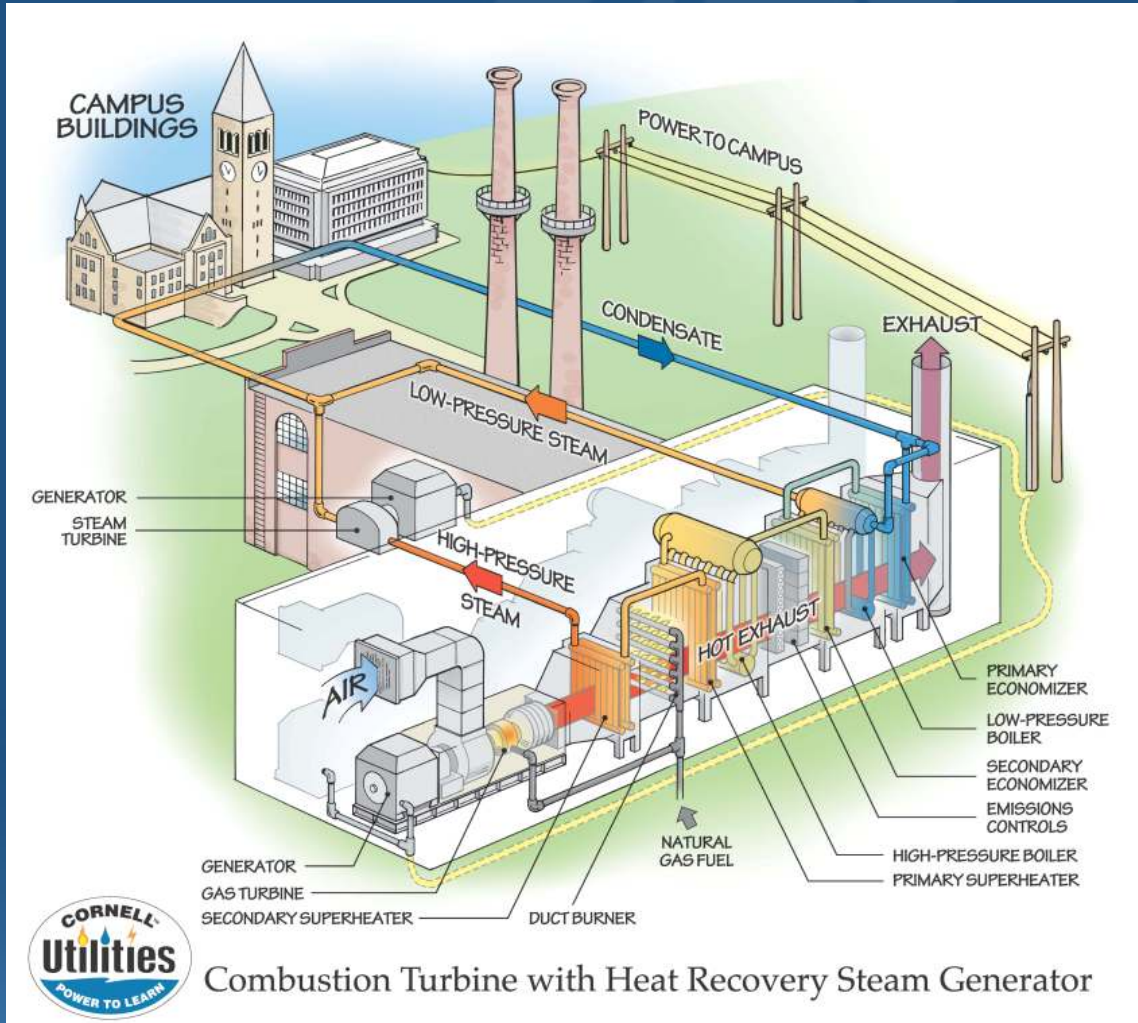
Control room
Photo: NYU

New York University

Tree plantings on Mercer Plaza, immediately above the CHP plant - photo: NYU

Cornell University

- Two 15 MW combustion turbines coupled with heat-recovery steam generators
- Natural-gas-fired
- Provides majority of campus power
- 25 miles of piping
- Heat to 150 bldgs.
- 80% combined efficiency
- Full islanding capability if regional grid goes down



Cornell Combined Heat & Power Plant – graphic: Cornel University

Cornell CHP Plant

Cornell Combined Heat & Power Plant – photos: Cornell

Cornell's water system

- Cornell maintains its own water system
- Provides potable water to 35,000 people – 1.7 million gallons per day
- Water drawn from Fall Creek
- Water consumption has dropped by half since the 1970s
- Able to tie into Ithaca's municipal system

Cornell water filtration plant
Photo: Cornell

Princeton University

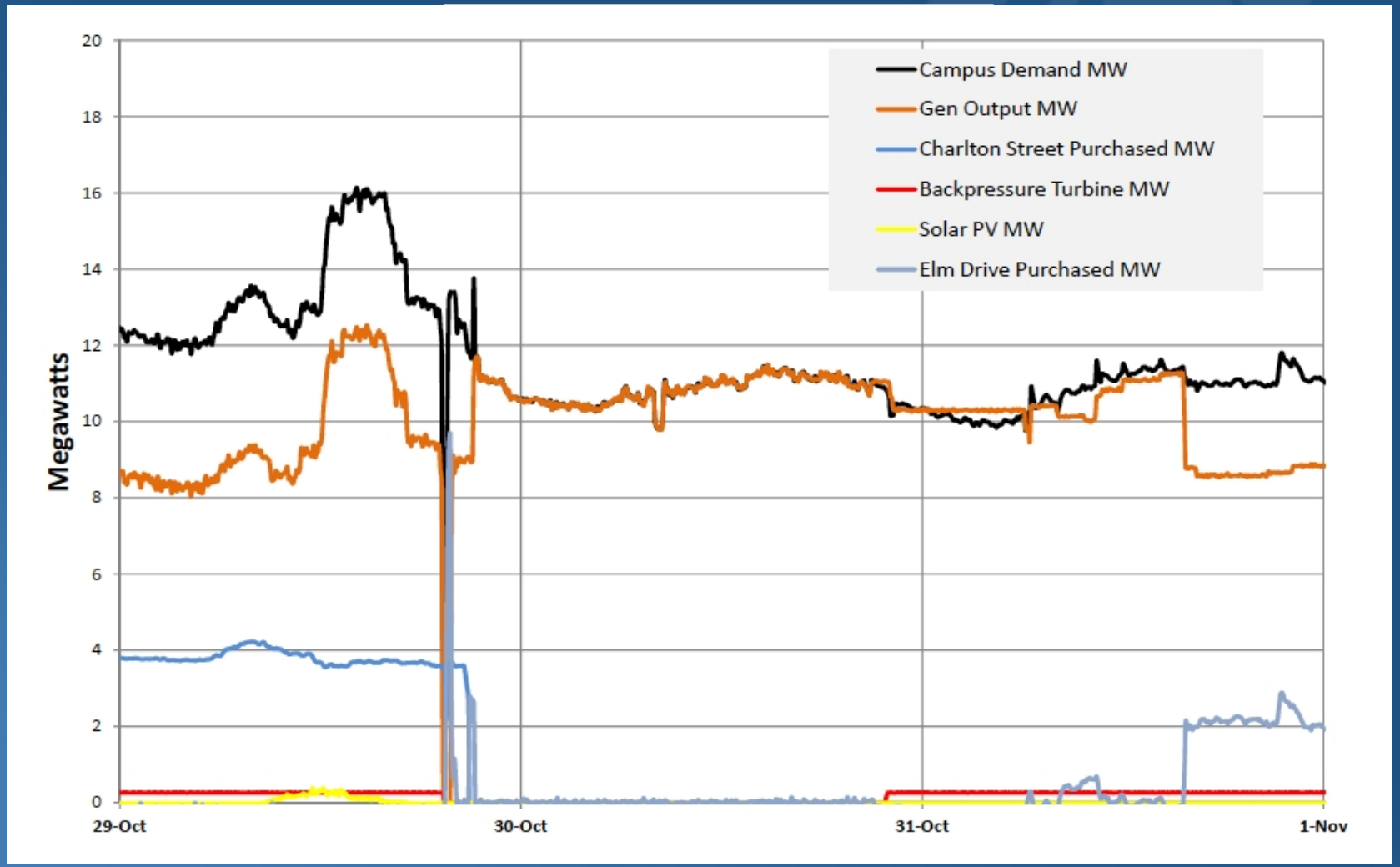
- 12,000 students and faculty
- 40 MW CHP plant that typically supplies all of the heat and hot water and half its electricity
- Sandy knocked out power lines coming into Princeton, but the campus switched to islanding mode
- Campus operated in island mode for 2 days
- Some students even began organizing help to the surrounding town

Princeton University CHP plant showing 2.6-gallon chilled water tank – photo: Martin Griff, The Times of Trenton

Princeton University

James Thompson of Princeton University Facilities synchronizing the power output from the CHP plant to the PSE&G utility grid – photo: Martin Griff, The Times of Trenton

Power production and consumption following Sandy - Princeton University



Thomas Nyquist, P.E., Princeton University

University of California San Diego

- 45,000 students, faculty, and staff
- 12.5 million sq ft of buildings on 1200 acres
- 30 MW CHP plant provides 92% of university's power and 95% of heating and cooling
- 3.8 million gallon chilled water tank
- Also 2.8 MW fuel cell, 1.5 MW photovoltaic system, 300 kW solar water heating system

University of California San Diego campus – photo: UCSD

University of California San Diego

- Capability to function in islanding mode
- Also able to help out SDG&E
- Tested in October 2009 when wildfires had damaged utility distribution lines and SDG&E needed help
- UC San Diego was able to reduce its own power consumption and send enough power to the grid to keep it from collapsing

CHP plant serving the UC San Diego campus – photo: Rhett S. Miller, UC Regents

University of Missouri - Columbia

- 66 MW CHP plant
- 2 MW diesel generator that can be used to start other energy systems for "black start" capability
- New generator in 2012 that is biofuel-fire
- Operates its own water system that can be connected to City of Columbia's system as back-up

CHP plant serving the Univ. of Missouri, Columbia – photo: Assassi Productions

Opportunities looking ahead

- Campuses can provide emergency shelter to nearby residents
- Centrally controlled water systems could become critically important in drought emergency
- Storage and even production of food can enhance food security

Princeton University – photo: Office of Communications, Princeton

Information and Resources

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Debevois Hall at Vermont Law School – photo: Alex Wilson

Selected sources

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