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EOS

SCIENCE NEWS BY AGU

When PG&E Turns Out
the Lights on Science

A Dream Spacecraft for Neptune

Welcome to the Chibanian Age
(770,000 Years Ago)

SCIENCE FROM THE SPILL

Ten years after the
Deepwater Horizon
blowout dumped millions of
barrels of oil into the Gulf,
a massive investment
in science has been
the silver lining.

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solar panels and storage batteries. During the PG&E shutoff, the tribe served more than 10,000 people, inviting nearby residents to pump gas, set up a makeshift newsroom, and house critically ill patients, according to the *Washington Post*.

Borrego Springs in Southern California can go off San Diego Gas and Electric Company's grid during outages, thanks to its mix of energy from renewable and other sources. The rural community draws power from solar panels, energy storage, and diesel generators, as well as from the grid.

The independence that microgrids offer is enticing: The Santa Barbara school district is assessing the feasibility of solar power and batteries to get off the grid, reports the *Santa Barbara Independent*. The district is interested in part due to the public safety shutoffs becoming the "new norm."

University of California, Berkeley has the ability to provide power in-house, though its capacity can't meet the campus's full electrical demand. The university's cogeneration plant produces steam for its buildings and burns fuel—mostly natural gas—to provide a portion of the campus's power needs. During the shutoffs, the university used the plant to keep the lights on in student dorms and power some essential buildings. The Space Sciences Laboratory successfully launched the satellite, thanks in part to the university's power plant.

But the cogeneration plant will need to be replaced in the next 10 years. The university declined to comment on future plans for the cogeneration plant but said that a task force has been assembled to "create a plan for Berkeley that works for students, faculty, and staff."

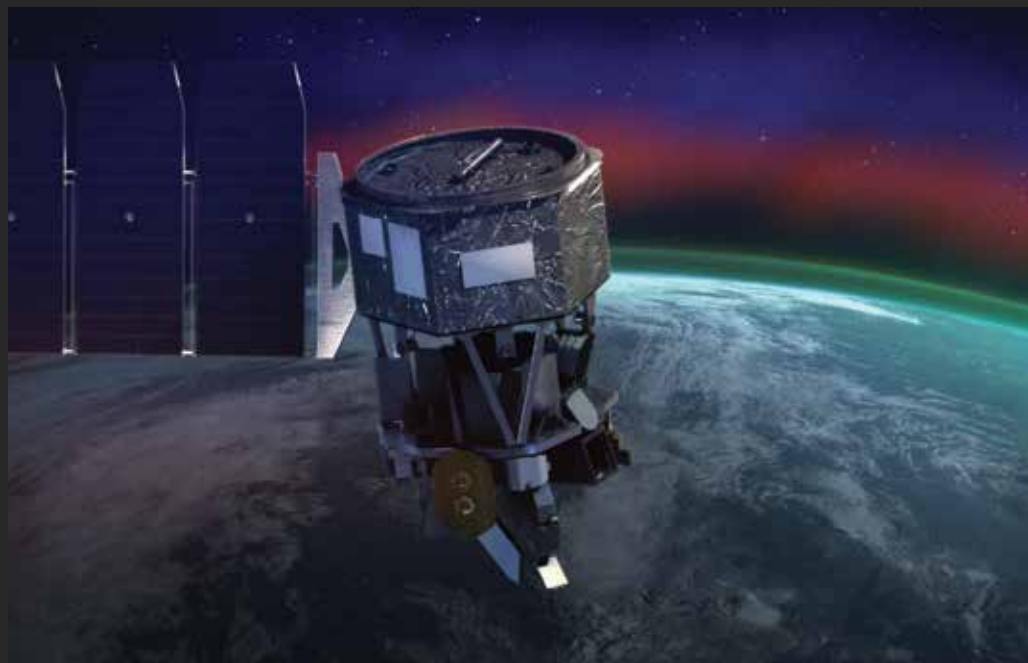
For Berkeley Ph.D. student Whitney Loo, going through the shutoffs "just put everything into perspective."

"Anything can come and disrupt your research plan at this point, is what we've learned," Loo said. "I don't think anyone who said, 'I'm going to go to Berkeley and get my Ph.D. in chemical engineering,' was expecting to have to deal with the power going out."

Loo urged the university to find solutions for the upcoming year. "Fire season is coming. We can't push that back," Loo said. "If they don't come up with an alternative solution for what they did last year, we'll be back at the same place before we know it."

By **Jenessa Duncombe** (@jrdscience), Staff Writer

How to Launch a Satellite During a Blackout



NASA's ICON satellite is helping scientists study the effects of Earth and space weather on the ionosphere.
Credit: NASA Goddard's Conceptual Image Lab/B. Monroe

The same week that scientists at the Space Sciences Laboratory at the University of California (UC), Berkeley planned to launch a satellite with NASA, lab director Steve Beckwith got news that the power might go out.

California was in the midst of its fall fire season, and the utility that delivers power to UC Berkeley's campus, Pacific Gas and Electric Company (PG&E), feared that high winds, hot air, and dated equipment could spark a fire. Just in case, the utility sent out word: They'd preemptively cut power to 800,000 customers the following day, Wednesday, 9 October 2019. The outage would be the largest in the state's history.

Beckwith knew his team had a problem. The spacecraft carrying the Ionospheric Connection Explorer (ICON) satellite was scheduled to launch from Cape Canaveral, Fla., that week, and Beckwith's lab needed to be online to act as mission control when the spacecraft deployed the instrument in orbit. To do that, the lab would need not only power but also a viable source of backup power. "At first, I didn't think we could do it," Beckwith said.

The power shutoffs were a Hail Mary from a utility plagued by a laundry list of safety issues. PG&E provides power to 16 million household customers across central and Northern California, but its low-tech infrastructure, long transmission lines, limited personnel, and a myriad of other problems have left it vulnerable. The investor-owned utility sparked the Camp Fire in 2018, which left 85 dead and destroyed the town of Paradise. In January 2019, a judge suggested the utility preemptively cut power to customers during high winds as a stopgap measure while the company fixes its larger, more systemic safety concerns.

Ten months later, California residents in 34 counties felt the consequences when the utility shut off power. Those living or working in the footprint of PG&E's grid had to answer new questions about how to be resilient: How long could they go without power? What backup power did they have? Beckwith needed something more concrete: extension cords. High-capacity, heavy-duty, 50- to 100-foot extension cords. And he needed them immediately.

Time to Improvise

The Space Sciences Laboratory sits on a hill in the Silver Lab Addition Building, on the north-eastern corner of UC Berkeley's main campus. The lab had emergency power outlets, located in each floor's clean rooms. The trick would be connecting the emergency outlets with workstations in the building's library, where scientists would crunch numbers in real time as the satellite made its first pass over California. After dropping about a thousand dollars on extension cords from Home Depot, Beckwith said, they had the library powered.

The next step was determining where the power would come from. The team members had one backup generator, but they ordered a second and lined up a contact in San Jose with a truckload of diesel fuel ready to drive their way at a moment's notice. "We were confident we could pull it off on generators if we had to," Beckwith said. But they had another option, a backup power source that could become a lifeline for UC Berkeley in years to come: the school's cogeneration plant.

The plant originally had a boiler that sent steam to the campus's buildings, but the university expanded it to burn natural gas for electricity. The plant operates around the clock but can supply only part of the campus's electricity demand.

Fortunately for Beckwith's team, the Space Sciences Laboratory was on the shortlist of emergency labs that stayed on power. Once PG&E shut off power Wednesday night—after delaying much of the day—the campus's cogeneration plant picked up the slack.

Replacing natural gas is the "hardest nut to crack to achieve carbon neutrality."

As the makeshift mission control at the Space Sciences Laboratory counted down to deployment on Thursday night, fueled by Costco snacks and 400-gallon water tanks, the team could rest easy with two sources of power to rely on: the cogeneration plant and their extra generators. Under a watchful team of electricians, "we were able to acquire the satellite that night and verify [its] health and safety," said Beckwith.

Pulling off the launch was "like watching a choreographed performance turn into a jazz improvisation as problems came up and the individual team members solved them in real time feeding off one another's talent and energy," said Beckwith.

Future Questions

The launch's success relied in part on the campus's cogeneration plant, which has an uncertain future. (See "Power Outages, PG&E, and Science's Flickering Future," p. 12)

University chancellor Carol Christ said at a graduate student assembly meeting in 2019 that the aging facility needs to be replaced in the next 10 years. PG&E has said the power shutoffs are likely to occur over that time period.

In addition, the cogeneration plant burns natural gas, and the University of California system is just 5 years away from reaching its sustainability pledge of carbon neutrality.

The sustainability plan, announced in 2013, declares that UC buildings and vehicles must have net zero greenhouse gas emissions by 2025. Presently, three quarters of UC Berkeley's emissions come from powering the campus's buildings, according to the university's Office of Sustainability. For the university to reach carbon-neutral levels, it will need to reduce total emissions by 80%.

Replacements for natural gas are expensive and hard to come by. As E&E News reported, the university's sustainability director, Matthew St. Clair, called replacing natural gas the "hardest nut to crack to achieve carbon neutrality."

UC Berkeley spokesperson Janet Gilmore said that the university has convened a task force for addressing future power shutoffs. UC Berkeley declined to comment on long-term plans for the cogeneration plant or the impacts of burning natural gas on the 2025 carbon-neutral pledge.

Beckwith said that the experience made him and his team more resilient. "If we had another blackout," he said, "I don't think [working through it is] going to take an enormous effort on my part."

As to the launch? "We never had a power glitch," Beckwith said.

By **Jenessa Duncombe** (@jrdscience), Staff Writer

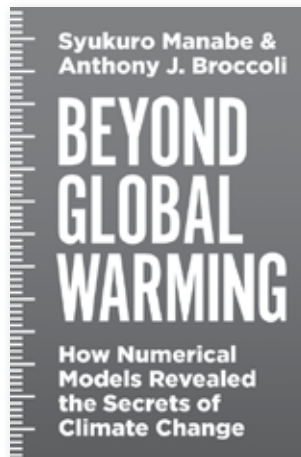


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