



BROWN PLEDGES TO REDUCE CAMPUS GREENHOUSE GAS EMISSIONS TO NET-ZERO BY 2040

by Kevin Stacey

The goal to eliminate campus greenhouse gas emissions over the next two decades includes taking immediate steps to reduce emissions by 75 percent below 2017-18 levels by 2025.





To create a more sustainable campus and confront what scientists have declared an increasingly dire threat posed by global climate change, Brown University has set an aggressive goal to cut its campus greenhouse gas emissions by 75 percent by 2025, and to achieve net-zero no later than 2040.

On Saturday, February 9, 2019, the Corporation of Brown University approved the goals, based on the strength of a phased plan that reflects the technical and financial realities of global energy markets, while also ensuring the flexibility demanded to respond to changes in technology and energy prices over the next two decades.

The University has established four phases of achievable actions that include a series of immediate steps that will enable the majority of greenhouse gas reductions—75 percent below 2017-18 levels—to be realized by 2025. A central aspect of the efforts will be to embed the work into Brown's teaching and research to engage students in the intergenerational work of finding solutions.

"The best available science tells us that the world needs to cut its emissions dramatically by mid-century or sooner to avert the most catastrophic effects of climate change," said Brown President Christina Paxson. "With our pledge to reach net-zero, and with a plan that is

A large green Mean Green electric lawn mower with a clear canopy and a black frame. It is parked on a grassy field. The company logo "MEAN GREEN ELECTRIC MOWERS" is printed on the side of the machine. The background shows a clear blue sky and some trees.

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Brown University continued

ambitious, yet technically and financially feasible, Brown will be a leader in addressing a defining challenge of the 21st century.”

The net-zero goal builds on efforts that began more than a decade ago to reduce Brown’s greenhouse gas emissions. In 2008, the University committed to cut emissions nearly in half from 2007 levels by 2020. Based on a conversion of Brown’s central heating plant from oil to natural gas, a thermal efficiency upgrade that enables the plant to circulate hot water instead of steam, and a variety of campus energy efficiency projects, Brown is approaching that goal and working to move beyond it.

In 2018, Brown began exploring a new set of even more ambitious greenhouse goals. That undertaking — led by a committee chaired by Stephen Porder, assistant provost for sustainability and an associate professor of ecology and evolutionary biology, and Leah VanWey, associate provost for academic space and a professor of sociology and environment and society — included engaging the campus community in devising action steps to reach net-zero.

“From the start, we agreed that it was essential to create a path to net-zero with meaningful changes to our infrastructure, rather than relying too heavily on buying carbon offsets and other indirect measures,” Porder said. “We’ve carefully studied our buildings, our heating infrastructure and our budget. We’ve looked at logistics on how best to maintain campus operations while infrastructure improvements are being made. And we emerged with an ambitious, tractable plan for reaching the goal of net-zero emissions.”

VanWey said the plan reflects Brown’s commitment to integrating research, education and practice to address complex challenges.

“Brown is a place where knowledge becomes action,” VanWey said. “We know that climate change is one of the primary challenges humanity faces, so it’s critical for us to lead by example in taking truly substantive action to cut our emissions to zero. This is a plan that is financially responsible, integrates with ongoing campus facilities projects, and provides the flexibility needed to take advantage of future improvements in technology.”

Head Start on a Four-phase Plan

A critical component of the University’s plan is that it will be continuously reassessed to ensure that Brown is making use of the best available technologies.

The net-zero plan’s first phase—two renewable energy agreements with providers of solar and wind power to offset 100 percent of Brown’s on-campus electricity use—is already in motion. Last month, Brown finalized a partnership to create a 50-megawatt (DC) solar facility in a former gravel pit in North Kingstown, R.I., expected to offset 70 percent of campus electricity use. The remaining 30 percent will be offset by an agreement with a Texas-based wind farm.

Those projects, along with a thermal efficiency project already underway, will cut campus greenhouse gas emissions by approximately 27,000 metric tons per year by the early 2020s. That reduction is the equivalent of taking 5,800 cars off the road and is expected to result in total emissions cuts of 67 percent relative to 2007, when Brown’s original greenhouse gas reduction goals were developed, Porder said.

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The second phase, scheduled for 2022, will convert the central heating plant to post-consumer bio-oil as a primary fuel, with natural gas remaining as a backup. While not a permanent solution, recycled bio-oil, which is derived from waste cooking oil discarded after food preparation, enables a large decrease in emissions in the near term, as steps are taken to prepare for a more permanent fuel solution that relies on renewable electricity. The bio-oil conversion is expected to eliminate an additional 10,000 metric tons of greenhouse emissions per year, according to Porder and VanWey.

"With recycled bio-oil, we're utilizing carbon that recently came out of the atmosphere and would be going back to the atmosphere anyway," Porder said. "And since the oil was purchased for cooking, rather than fuel, we are not diverting food or cropland for energy production. With Brown's current infrastructure, the conversion can be done inexpensively, which makes it a great bridge solution while we implement the infrastructure modifications necessary for a more permanent, scalable solution."

The project's third phase involves further upgrades to the University's central heating loop and buildings connected to it, enabling lower-temperature water to meet the heating needs of the campus. That work is projected to take place between 2021 and 2038.

"This will be the most time-intensive phase of the project," VanWey said. "We want to do this with minimal disruption to our academic operations, which requires us to do most of the work in summers when heating isn't needed. Extending it over time also will allow us to strategically schedule these upgrades when renovation or renewal work would have happened anyway."

The final phase, scheduled for 2038, calls for the conversion of Brown's heating plant to renewable electricity, with bio-oil as a secondary fuel. Currently, the plan envisions air-source heat pumps as the heat-generation technology—the best available technology to serve Brown's heating needs. But it's possible, VanWey and Porder say, that better technology may emerge in the intervening years. This is part of the University's planned continual assessment of the most effective and efficient approaches to reach the net-zero goal.

The plan currently provides future solutions for buildings not served by the central heating loop. These will include upgrades to heating systems that rely on renewable electricity, some of which will occur in conjunction with regular renovation cycles for those buildings. For facilities where retrofitting isn't possible or for buildings that Brown does not plan to own in the long term, offsets can be purchased to mitigate emissions. Yet because the vast majority of emissions will be eliminated through infrastructure enhancements, the need for offsets is expected to be relatively small, Porder said.

Taking into account money saved through the purchase of lower-cost electricity and efficiency improvements in the central heating plant, the net-zero plan is expected to cost less than \$1.43 million per year in additional expenditures from 2020 to 2038. Those expenditures can be embedded into the University's operating budget without redirecting funds from key academic priorities, and the University expects that fundraising in support of campus sustainability can help offset costs.

The costs of the final stage of actions to be taken between 2038 to 2040 are less certain at this point, given the difficulty in predicting what technologies might be available to aid in the final electricity conversion of the central heating plant, VanWey said. But even with current technologies, she expects final electricity conversion to be economically feasible and an important investment.

VanWey said she hopes that Brown students will take lessons from what has been accomplished in setting Brown's new emissions goals, and that they will contribute to the important work ahead. The University expects to develop new coursework and opportunities for research to engage students and faculty in achieving net-zero, and finding global solutions.

"It's not an easy thing for a large, complex organization like a university to dramatically change the way it operates," she said. "Our students are going to be leading the large, complex organizations of tomorrow, and our next step is to integrate this plan with course and co-curricular activities so they can take our lessons here and make change elsewhere."



ABOUT THE AUTHOR: Kevin Stacey is Senior Writer for Physical Sciences at Brown University.