

RESEARCH
BRIEF

Strategies for Replacing Natural Gas to Decarbonize the University of California

Background

The University of California has pledged to achieve net-zero carbon emissions from on-campus operations and purchased energy by 2025 through its Carbon Neutrality Initiative. A critical measure will be replacing the use of natural gas, a fossil fuel that accounts for two-thirds of the greenhouse gas emissions from all UC operations, with climate-friendlier options at all ten UC campuses and five medical centers.

To address this need, a team of researchers, facilities staff, sustainability officers, and students from across UC campuses investigated ways to phase out natural gas used in on-campus combustion (Scope 1 emissions). The team was convened by the UC Santa Barbara Institute for Energy Efficiency and National Center for Ecological Analysis and Synthesis as part of the TomKat UC Carbon Neutrality Project, which was an independent activity in support of the Carbon Neutrality Initiative.

Research Design

The research team analyzed new and existing approaches by UC and other leading organizations.

Three-Part Strategy

In light of important differences between the campuses, the following strategies should be viewed as a set of options that campuses may draw upon to assemble their individualized plans. There is no central blueprint for reducing reliance on natural gas. Moreover, energy storage could create synergies among all three approaches.

Reduce energy demand via improved efficiency

All technically and economically realistic pathways to the carbon neutrality goal start with deep reductions in energy use, particularly in campus buildings, because

energy efficiency investments pay for themselves through lower operating costs and energy cost avoidance. Money saved can, in turn, be re-invested in other emission control efforts. For new buildings, deep energy efficiency will be critical, alongside all-electric or nearly all-electric design. Just as critical will be aggressively retrofitting existing buildings, which often have inefficient energy-using systems.

Substitute natural gas with renewable biogas

A “drop-in” option to help wean campuses off of remaining natural gas usage is to replace it with biogas, or energy derived from organic materials such as food and agricultural waste, certain crops, and biosolids from wastewater treatment plants. While chemically identical to natural gas, biogas is climate friendlier because it is renewable. However, biogas should be seen as a stepping stone to carbon neutrality for the UC, rather than a long-term solution. Like natural gas, biogas is mostly methane, a greenhouse gas, which means carbon emissions from leaky gas infrastructure would still be an issue. Moreover, the nationwide availability of biogas is limited, preventing it from being a scalable replacement for all current natural gas use.

Electrify all end uses of energy

The third major action is to replace conventional natural gas with carbon-free electricity, such as solar and wind. In tandem with UC- and California-wide efforts to reduce emissions from purchased electricity, electrification has already begun on several campuses, and UC has committed to increasing green energy production, including its opening of an 80-megawatt solar power installation to supply roughly 10% of the total UC system’s electricity usage and 20% of direct purchases. To pursue electrification incrementally, the first step is to migrate away from natural gas and toward all-electric end-uses in new buildings.

Key Insights for Moving Forward

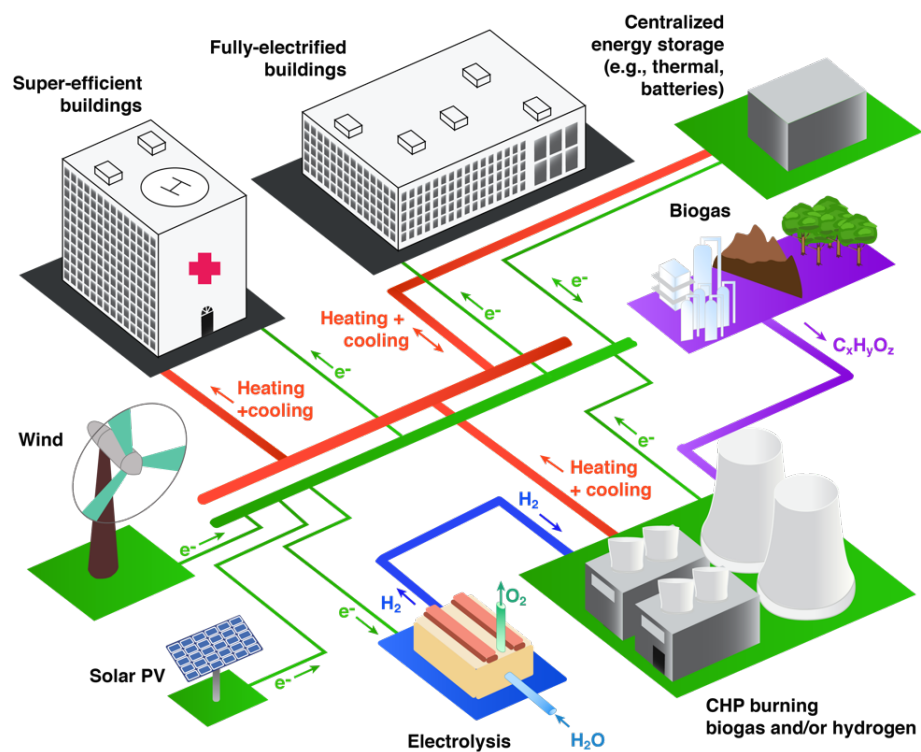
To achieve carbon neutrality, campuses and UCOP should embrace the challenge of transformation and pursue scalable solutions. The following insights can guide these pursuits:

1. There is no universal solution, but there are three key building blocks.
2. Efficiency, biogas, and electrification are complementary.
3. Uncertainty remains but can be managed.

4. UC represents a living laboratory for climate innovation and action, and its experiments in transitioning away from natural gas should be shared broadly.

Read the full report with detailed findings and recommendations at [this link](#).

Figure: The diagram below portrays the three approaches that could be implemented on a campus. Chilled water thermal storage, which is already common on UC campuses, will likely be supplemented with emerging battery technologies, plus hot water and hydrogen as other possible ways to store energy. Wind facilities would be located off campus and power purchased via the grid; solar facilities could be on or off campus; and biogas facilities would be off campus.



Source

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Research sponsor

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TomKat UC Carbon Neutrality Project

The TomKat UC Carbon Neutrality Project was established in 2016 to fund expert teams from the UC community to develop solutions to two of the biggest challenges to achieving carbon neutrality: phasing out natural gas and communications to build support within UC. The project was initiated by UC Santa Barbara's Institute for Energy Efficiency and hosted by the National Center for Ecological Analysis and Synthesis.

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