Scenario Planning for Carbon Neutrality

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UCLA

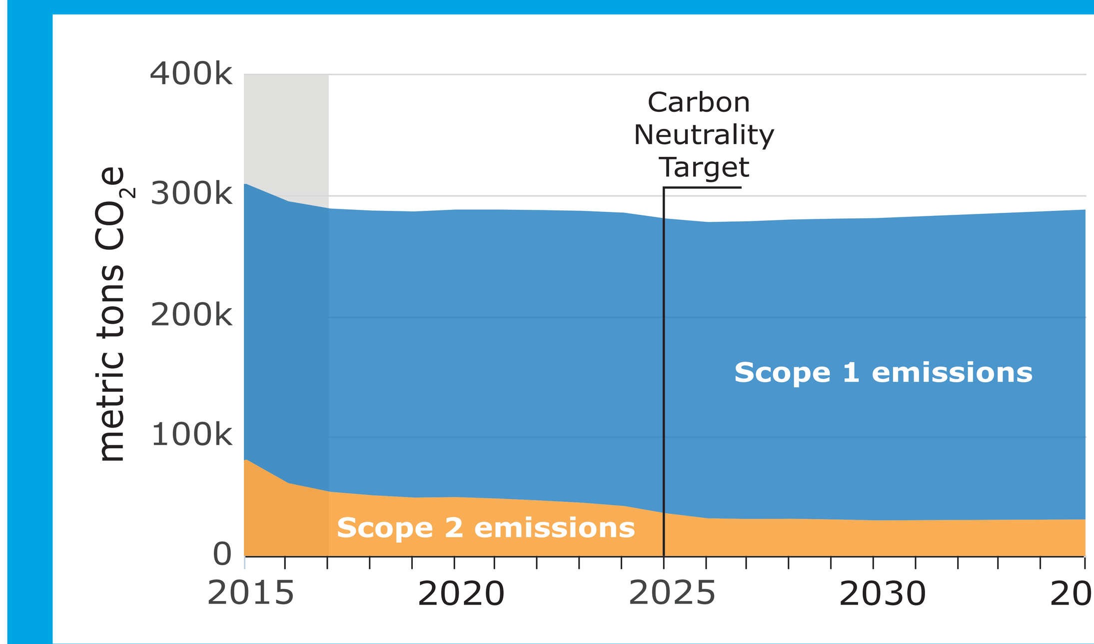
This project addresses the broad goals of UC carbon neutrality at UCLA by providing decision-making guidance to UCLA campus management and administrators for short and long-range energy planning.

UCLA faces specific challenges and constraints as it approaches carbon neutrality. It is the most populous and population-dense campus in the UC system, with a commensurate energy demand. Furthermore, UCLA's medical campus requires a substantial and reliable supply of energy.

To supply its energy demand UCLA, uses a natural gas cogeneration central utility plant. Without major infrastructure overhaul, UCLA will continue to rely on methane to supply the campus with energy. Moreover, the cogeneration plant is operating near thermal capacity, putting UCLA in the position of relying on more utility-purchased Energy and potentially the need for an additional steam boiler or utility plant.

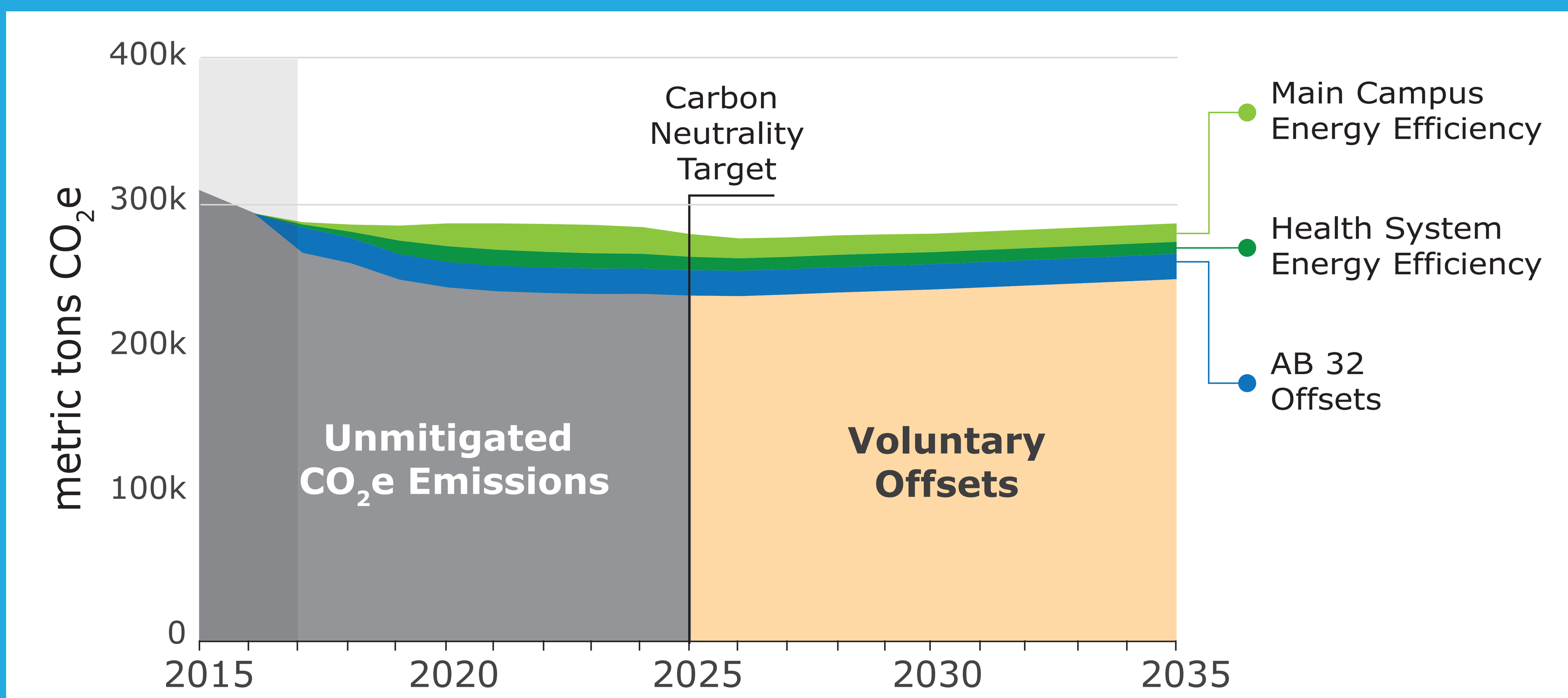
In addition to these constraints, UCLA's student population and campus square footage continues to grow, adding new demands onto strained campus energy resources.

Business As Usual Carbon Emissions



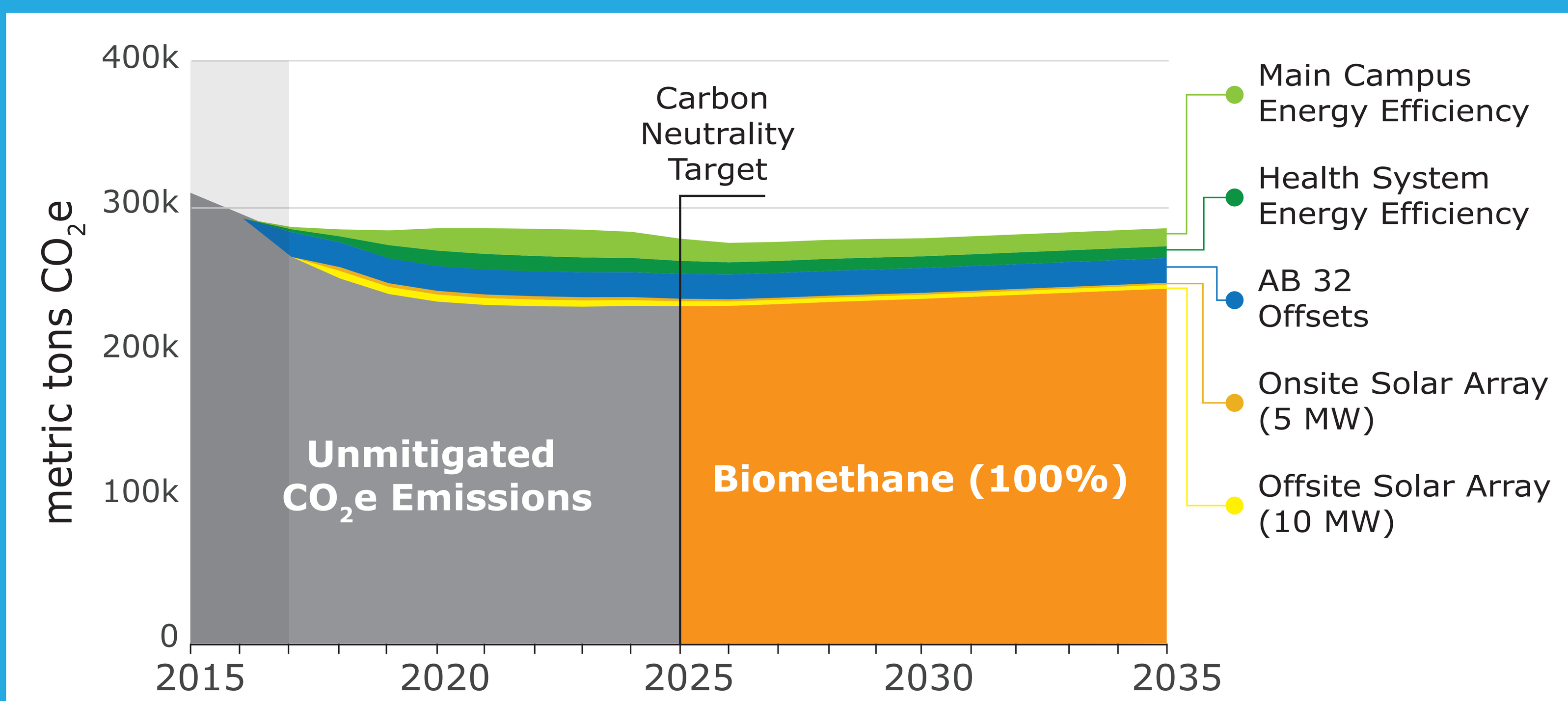
To forecast business as usual (BAU) energy use we use a scenario planning tool developed by FOVEA Consulting that models future energy use as a function of historical energy intensity and forecasted building square footage and campus population growth.

Scenario 1: Purchased Decarbonization



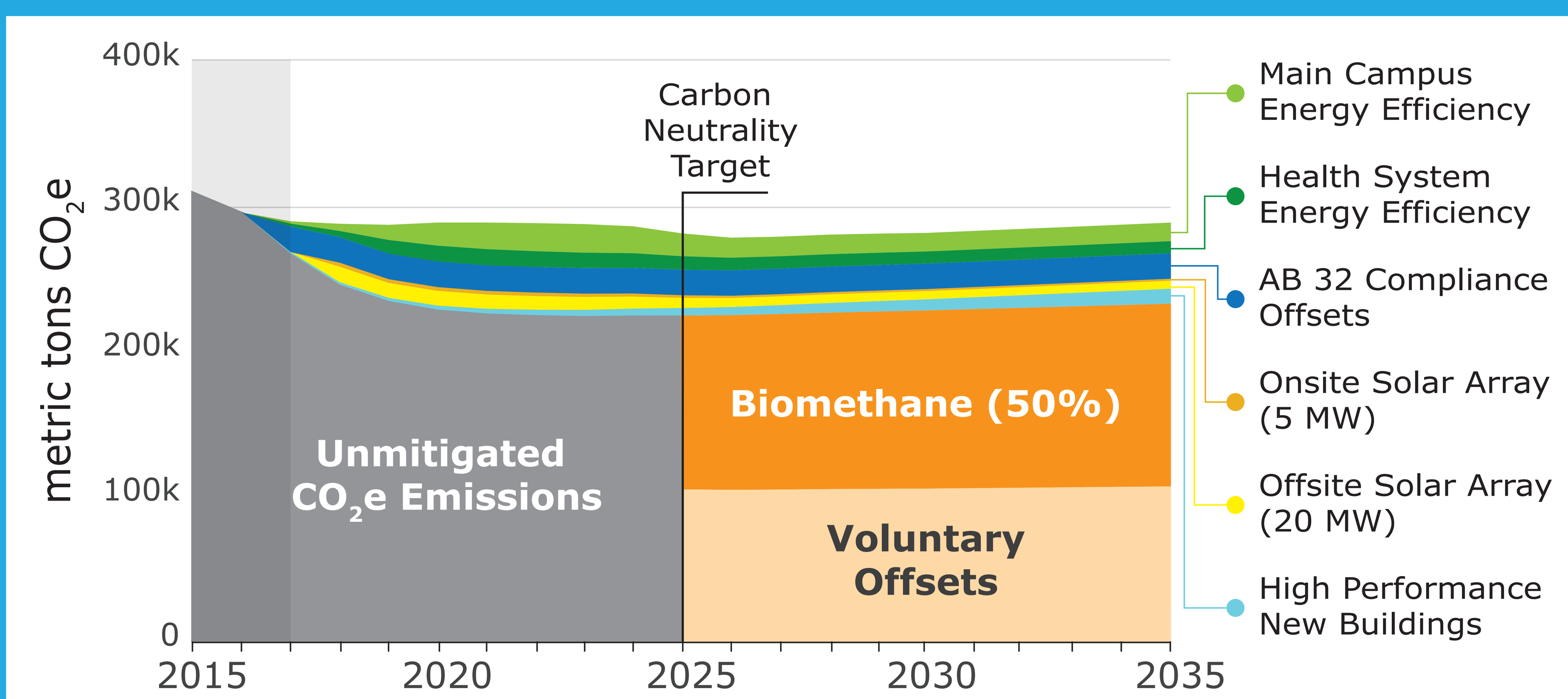
This scenario achieves carbon neutrality with the lowest short-run cost by purchasing offsets to cover all of UCLA's emissions. Because it exposes UCLA both to the regulatory and voluntary carbon markets, this scenario is also the most sensitive to future carbon price volatility, continuing reliance on high-carbon energy systems which may become stranded assets in future regulatory environments. Apart from economic liabilities, debate among UC stakeholders over the continued use of fossil fuels and the efficacy of offsets make this option politically fraught.

Scenario 2: High-Biomethane Option



This scenario achieves carbon neutrality by sourcing biomethane to power the cogeneration plant. The present price premium on biomethane exceeds the cost of voluntary carbon offsets; however, it ensures carbon reductions are achieved on campus. While operational costs are exposed to uncertain energy markets, contracts for biomethane can smooth year-to-year price volatility. The feasibility of securing necessary quantities of biomethane is uncertain; however, the UCOP is in the process of developing biomethane resources for UC use.

Scenario 2: Mixed Portfolio Option



This scenario balances exposure to potentially volatile carbon markets and variance in the supply of biomethane. The exact quantity of biomethane used can be easily adjusted, as neither it nor offsets require operational or infrastructural changes for use. This strategy also employs highly visible on-site solar photovoltaic and efficient off-site purchased power agreements which deliver power at a predictable price. High-efficiency new buildings are a significant upfront investment, but also hedge against uncertain energy prices.

Methods and Process

The BAU energy use forecast informs estimates of future carbon emissions that must be mitigated or offset. Mitigation can take the form of on-campus energy use reductions or substitution to lower-carbon energy sources, whereas offsets typically represent off-campus carbon impacts. To inform campus decision-making, we assembled a portfolio of carbon reduction strategies.

Energy Efficiency

Buildings are the largest user of energy on UCLA's campus. Energy efficient HVAC, lighting and other system retrofits reduce energy loads which also reduces energy cost, often offsetting the cost of the retrofit. Projects are already underway at UCLA, however, efficiency upgrades are often invisible to the campus community. UCLA is financing projects with financing provided by the Statewide Energy Partnership (SEP)

New buildings can also be built to higher standards of efficiency. However, because California Building Codes are already stringent, doing so does not guarantee a positive ROI. Complete evaluation of carbon savings and cost of these features is in progress.

Solar PV

Solar Photovoltaic panels generate carbon-free electricity from solar radiation, an abundant Southern California resource. UCLA's small campus footprint relative to energy needs puts physical constraints on the capacity of on-site solar generation. To supplement on-site generation, UCLA is seeking to secure off-site solar generation assets elsewhere in the Southern California region.

Biomethane

Most of the energy consumed at UCLA's campus is derived from the fossil methane (natural gas) powering the campus cogeneration plant. Biomethane is chemically identical to fossil methane, but is derived from the controlled decomposition of organic wastes. Carbon emissions from the combustion of bio-based fuel are balanced out when accounted against carbon that is fixed by biological feedstocks. UC is developing biomethane projects to supply the campuses starting in 2025, is investigating other potential supplemental biomethane sources.

Carbon Offsets

UCLA can pay other entities to reduce atmospheric carbon in exchange for credits which UCLA can use to offset its own emissions. Offsets are validated by third parties to ensure that carbon has been offset. California law allows UCLA to purchase offsets to satisfy up to 8% of its compliance obligations under its cap and trade policy. UCLA can purchase further, voluntary offsets to meet carbon neutrality goals; however, they will not reduce UCLA's regulatory compliance obligations.

In coordination with UCLA management and contracted consultants, we gathered cost and carbon reduction information about these options and how they could be implemented in the context of the UCLA campus. These details were built into project options such as "On-site Solar" or "50% Biomethane" which could each be turned on or off to model different carbon reduction scenarios. All options with cost-saving, positive ROIs were incorporated into all the scenarios, as they are seen as "no-regrets" decisions.

At regular intervals in this process of data-gathering and responding to negotiations among UCLA administrators and between UCLA and outside parties, the scenario planning tool was updated and iterated. Ultimately, about ten different scenarios were developed. This poster demonstrates three scenarios that illustrate two single-option dependent, and one balanced approach to achieving carbon neutrality. These scenarios provide a foundation for further analysis and development of carbon neutrality planning by campus stakeholders.

Results and Conclusions

Carbon reduction strategies present financial, operational, and political trade-offs. Fortunately, UCLA is a stable institution that can afford to finance ambitious projects with long return horizons. The interoperability of offsets and biomethane gives the campus flexibility as management plans for energy infrastructure projects. Politically, confidence in carbon reduction is higher for biomethane than it is for off-campus carbon offsets while high-visibility projects such as solar power and high-efficiency buildings demonstrate UC climate leadership.

These alternative scenarios are designed to help management optimize UCLA's path to decarbonization, but major uncertainties remain. Construction of an energy intensive bed tower is under consideration by the UCLA medical center which may necessitate a new utility plant. Because the cogeneration plant is nearing thermal capacity UCLA has engaged consultants to evaluate both near term and long term energy infrastructure planning. Long-range planning will depend on decisions surrounding the turn-down or eventual sunset of the cogeneration plant.

Working with consultants, UCLA will continue to refine these scenarios to develop cost analyses that can be relied on for high level decision making and to continue to refine the path towards carbon neutrality. Results from the hospital plant study and infrastructure planning study, as well as a study of on site solar potential will be integrated into the scenarios as they become available.

Acknowledgments

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