Office of Sustainability
UNIVERSITY of FLORIDA

CLIMATE CONSIDERATIONS FOR NEW UF CENTRAL ENERGY PLANT (CEP)

// 2021

This document addresses the climate considerations for the new UF Central Energy Plant only as a subset of UF's larger sustainability commitments, goals, and processes. For more information about comprehensive ongoing efforts in climate action and sustainability, visit the UF Office of Sustainability website.

WHAT'S HAPPENING, AND WHY NOW?

For the past 30 years, UF has had a contract to purchase steam from a 1992 co-generation plant owned and operated by Duke Energy Florida. With that contract coming to an end and the plant being decommissioned in 2027, UF needs to have an independent source to meet campus thermal energy (i.e. steam) needs.

Separate from the steam contract, UF also purchases electricity from Duke Energy Florida as part of a service territory agreement regulated at the state level by the Florida Public Service Commission.

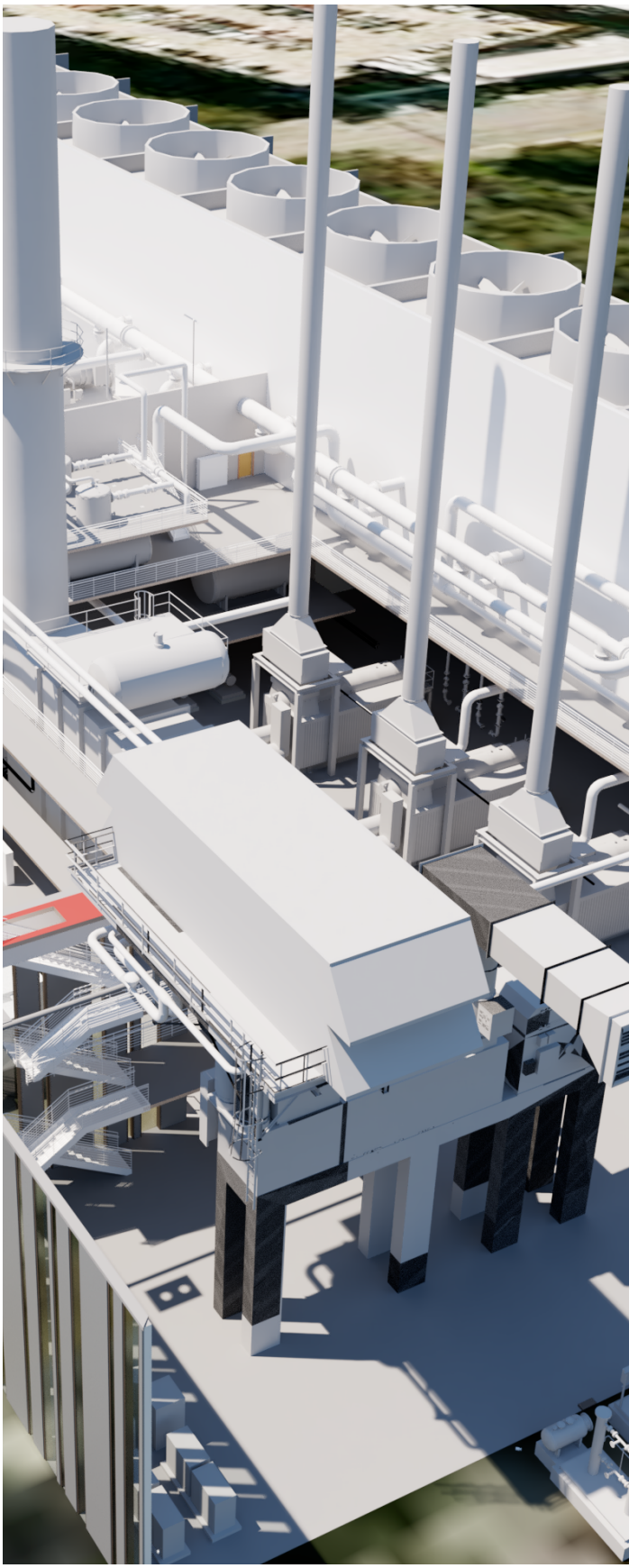
The new UF Central Energy Plant (CEP) will allow UF to right-size steam production for present and future campus needs while also gaining the benefit of on-campus electricity generation. The new CEP will not only allow UF to use a more efficient plant to generate steam, but also generate electricity, reducing purchases of less environmentally friendly, and more expensive power from the state-regulated utility territory. When coupled with the reliability benefits, the CEP will provide the energy to allow the University to continue serving as a worldwide leader in academics and research.

ROLE OF STEAM AND CO-GENERATION IN CAMPUS ENERGY

The majority of UF's buildings in the core of campus are heated and cooled using a district energy system, where chilled water and steam are produced in larger, centralized facilities and distributed to buildings through underground pipes. Outdoor air is cooled with chilled water to 45℉ to precipitate the moisture out for humidity control. Steam is then used to heat the air back up to levels that are comfortable for building occupants. This system has benefits to addressing indoor air quality and humidity concerns in the Florida climate while being a more efficient and reliable system compared to providing heating and cooling at the site of each building. The US DOE Office of Energy Efficiency and Renewable Energy provides a summary of how district energy systems can be more efficient.

Co-generating electricity and steam simultaneously is more efficient than producing either independently. In a US EPA comparison of co-generation and conventional utility production, conventional generation of heat and electricity separately has an expected combined efficiency of 51%.

Using co-generation to produce the same amount of heat and electricity increases a total efficiency to 75%



Immediate carbon reduction

The proposed CEP is designed to offer a net reduction in greenhouse gas emissions associated with energy, which make up 76% of UF's Greenhouse Gas Inventory. From the first day of operation, the CEP is estimated to reduce UF's overall carbon emissions by 25% or ~90,000 MTCO2e (based on current design and operating parameters).

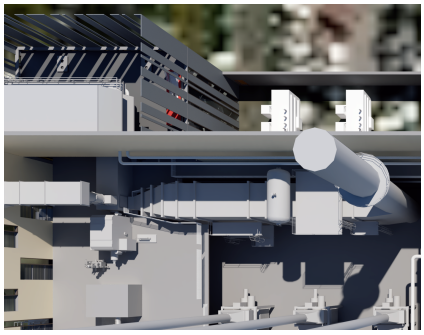
25% **Reduction in UF's overall carbon emissions**

The emission reductions will come from improving efficiency in UF's steam supply and by enabling UF to generate up to ~60% of its electricity needs rather than purchasing from the electricity grid, where coal is currently used for a portion of generation. Because electricity from the CEP sited on UF's campus will travel shorter distances to get where needed, there are additional carbon savings from eliminating inefficiency of electricity being transmitted over long distances (i.e. Transmission & Delivery losses).

This 25% reduction from the CEP will be the largest single-step reduction in UF's carbon footprint in 15 years. On an annual basis, it is the equivalent of shifting 16,000 US homes to zero-emission electricity (e.g. solar photovoltaic), and will otherwise require 110,000 acres of US forest for carbon sequestration. [US EPA Greenhouse Gas Equivalencies Calculator]

LONGER-TERM CARBON IMPLICATIONS

Beyond the initial emission reductions, the CEP offers various opportunities for UF to continue to improve energy efficiency and generation, while meeting campus energy needs. Understanding what options UF has for mitigating long-term carbon implications of the CEP plant is crucial for any future sustainability or carbon neutrality goals. Steps taken in the design phase of the plant, as well as potential pathways for UF to consider in the future, are outlined below.


Fuel-switching Capacity

Beginning in the design phase, UF has made a commitment to develop the CEP with the flexibility to incorporate new technologies as they become available. The CEP is designed to initially operate on natural gas with the flexibility to incorporate other fuel sources as technology continues to advance. The turbines currently specified for the CEP have the potential to fuel-switch to combust renewable natural gas (i.e. biogas) as well as up to 20% pure hydrogen – both resulting in lower emissions compared to traditional fuel sources.

While there are a number of options for renewable electricity production, there are still limited solutions to meet large-scale thermal energy needs (i.e. steam) without fossil fuel combustion. Both renewable natural gas and hydrogen fuels are still expanding to meet market needs nation-wide but may not currently be financially viable options at this point in CEP planning.

Electricity & Steam Infrastructure Upgrades

In conjunction with the new CEP, improvements to the utility distribution infrastructure will support reliability and efficiency on main campus. These efforts support ongoing mitigation of carbon emissions and support future energy transition.

By reducing the number of voltage transformations and reducing the number of redundant circuits used to provide electrical service to campus, UF will be reducing system losses and failure points. Though it is difficult to quantify, these improvements can be expected to reduce greenhouse gas emissions related to the loss of electricity distribution and transmission losses.

UF's steam distribution network has seen delayed upgrades for several years because of other budget priorities. It is estimated that the proposed upgrades in the UF steam distribution system could result in a 30% increase in efficiency.

Solar & other renewables

Because the CEP is being right-sized to meet UF steam needs (compared to maximizing electricity production), it will only have the capacity to generate up to ~60% of UF's electricity needs. UF will be able to mitigate long-term carbon impacts by pursuing solar/renewable energy for the remainder of its electricity needs. UF has the potential to go beyond the 352 kilowatts (kW) of currently installed solar capacity. UF could install up to a total of 4 megawatts (MW) of solar power generation on campus based on current state-wide net-metering regulations. Additionally, UF is looking into ways to increase the amount of renewable electricity available for purchase from off-campus and support larger market transition to more solar/renewable energy.

MITIGATING LONG-TERM CARBON IMPLICATIONS

UF has had a Presidential-level goal to be a carbon neutral campus since 2006, when UF joined as one of the initial 12 signatories to the American College and University Presidents' Climate Commitment (ACUPCC). UF is currently in the process of drafting the UF Climate Action Plan 2.0 (UF CAP 2.0), which will identify pathways for UF to reduce greenhouse gas emissions and consider the goal for UF to be carbon neutral by 2025 – a target established in the UF CAP v1.0 published in 2009.

The efficiency and carbon benefits of the CEP, as well as the limitations, have significant implications for the UF CAP 2.0, which is looking at comprehensive ways for UF to reach a carbon neutrality goal through reduction and efficiency projects.

The current design of the CEP delivers the largest single-step reduction in UF's carbon footprint being evaluated in the UF CAP 2.0. However, should the CEP be fueled solely by natural gas over the expected 30-year lifespan, it will be the largest single contributor to UF's greenhouse gas footprint - an important consideration for reaching UF's carbon neutrality goal. Fuel-switching and other future technologies that would reduce operating emissions are discussed above.

Peer Comparisons in

ADDRESSING UNIVERSITY THERMAL UTILITY NEEDS

As other campuses around the country are addressing their climate goals, a number are just beginning the process of moving to co-generation as a more efficient process compared to early coal and oil plants.

UF's interests in low-carbon solutions align with organizations like the Renewable Thermal Collaborative (RTC) that bring together international academic, business, and government partners to help advance renewable options for heating and cooling requirements. UF is currently evaluating joining the RTC to contribute research talent to, and operationally benefit from the search for renewable thermal solutions that are compatible with global climate limits.

Stanford University is the first US campus to have originally planned a co-generation facility, and then shifted in the design process to meet campus thermal needs through efficiency and thermal harvesting solutions as part of the 2015 Stanford Energy System Innovations system.

Other institutions taking a leading role in addressing climate change are also evaluating ways to ultimately transition away from natural gas in the next 30 years:

- The University of California System shares UF's current 2025 neutrality target. The 2018 Working Group Report: University of California System Strategies for Decarbonization: Replacing Natural Gas explores ways the California University System might transition existing co-generation plants to meet climate targets.
- New York University recently released a 2021 Climate Action Plan Update that includes a Net-Zero Loop Study. The goal of the multi-year working group study is to evaluate options to bring their campus co-generation plant, and the connected buildings to net-zero carbon.

The Working Groups involved with the UF Climate Action Plan 2.0 are incorporating ideas and actions from peer campuses like these for both the consideration of the CEP, and the overall goal of carbon neutrality for UF.