A 100% Clean Energy Portfolio Can Cost-Effectively and Reliably Replace the Proposed UF Central Energy Plant's Electricity Generation

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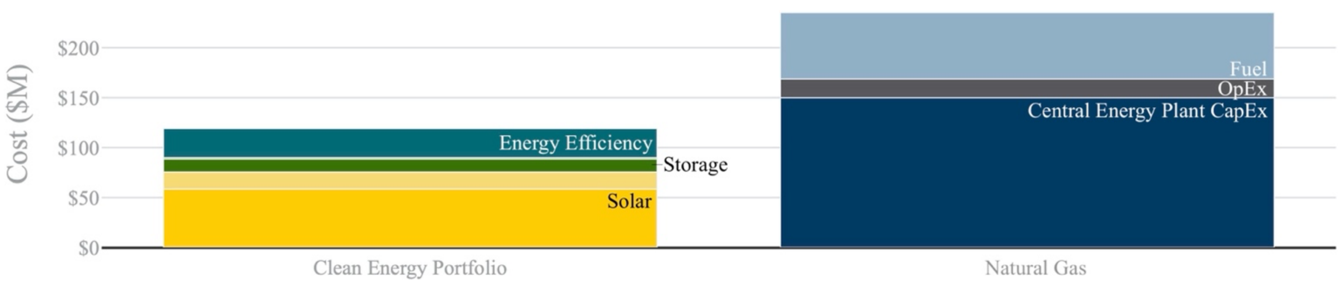
Executive Summary

To support the University of Florida's (UF) growing population and needs, the UF administration has proposed to construct a new natural gas fired combined heat-and-power plant, called the Central Energy Plant[1]. UF issued a Phase I Invitation to Negotiate on September 9, 2021, seeking proposals to construct this plant. UF has received numerous proposals since then but have not yet considered whether it can instead meet its needs with clean solutions.

The Central Energy Plant would serve two functions. The first function is electricity generation. Of course, the electricity generated by the Central Energy Plant could be supplied by any energy generation technology, including a renewables-based one. In this analysis, we use publicly available information and our Clean Energy Portfolios Model (CEPM) to assess the cost effectiveness of using clean technologies to replicate the proposed plants electricity services.

In addition to the electricity production, the new combined-heat-and-power plant would provide steam and chilled water services for hospital equipment sterilization and building heating, dehumidification, and cooling purposes. While steam heating and dehumidification via chilled water has served building heating needs for centuries, many major universities, cities, and states across the US have already begun converting away from these inefficient and outdated legacy methods[2]. Given the typically warm Florida climate, large opportunity for cost-effective energy efficiency improvements, and availability of modern technological alternatives, the University can achieve their desired interior comfort levels and meet their equipment sterilization needs via non-steam methods; due to the limited amount of information available, a more specific portfolio of options were not analyzed in this report.

Key finding: the net present value cost of a 100% clean energy portfolio is $120M, much less than that of the Central Energy Plant cost of $235M.



Methodology

RMI Clean Energy Portfolios Model

Increasingly, combinations of clean energy technologies are more economical than proposed gas plants.[3] In this short report, RMI has used publicly available information on the proposed University of Florida Central Energy Plant as inputs into our Clean Energy Portfolios Model.[4] More information on the CEPM can be found on our website and in our reports[5].

In brief, the CEPM constructs least-cost portfolios of clean energy resources that provide the same grid services as a natural gas power plant typical for the region. The tool ensures that each portfolio provides: at least the same monthly energy output and at least the same power output during the region's top 50 hours of peak electricity demand. CEPM uses a net present value approach to minimize lifetime costs.

Of course, this analysis only examines options for the electricity portion of the Central Energy Plant's production. We would be happy to discuss with the University Board or administration how to include the plant's other services in the analysis.

Assumptions

We made the following assumptions in the analysis:

- The proposed plant will provide 50 MW of electricity as if it operated as a natural gas combined-cycle plant.
- The university doesn't plan to do a "financial close" with a construction partner until 2023, so we assume an in-service year of 2025; this has important implications for the economics of the clean energy portfolio.
- A Central Energy Plant capital expenditures cost of $150M and additional new piping distribution cost of $55M according to UF-623 Central Energy Plant Thermal Utility Infrastructure Presentation[6].
- Grid load profile based off Florida Power & Light's 2019 profile as reported by the EIA Hourly Grid Monitor[7]; we used 2019 FP&L data as a representative substitute because University-specific load profile data was not available, and the pandemic may have shifted 2020 and 2021 energy demand.
- Renewables cost data from NREL ATB 2021[8] and fuel cost data from EIA AEO 2021[9].
- An inflation rate of 2% and discount rate of 5%.
- We do not model the steam or chilled water services produced by the Central Energy Plant but discuss them in our recommendations.

Findings

A combined 105 MW of solar, storage and energy efficiency can reliably replicate the electric power services provided by the proposed 50 MW gas plant

We find that that a clean energy portfolio consisting of tracking solar, battery energy storage, and energy efficiency improvements can serve the same electric services as the proposed UF Central Energy Plant. Figure 1 shows the nameplate (rated) capacity of each generation type in comparison to the proposed plant. In our analysis, we limited the amount of energy efficiency that the model could choose; because efficiency improvements are usually the most cost-effective option, if more efficiency was allowed, the model would pick less solar and storage.

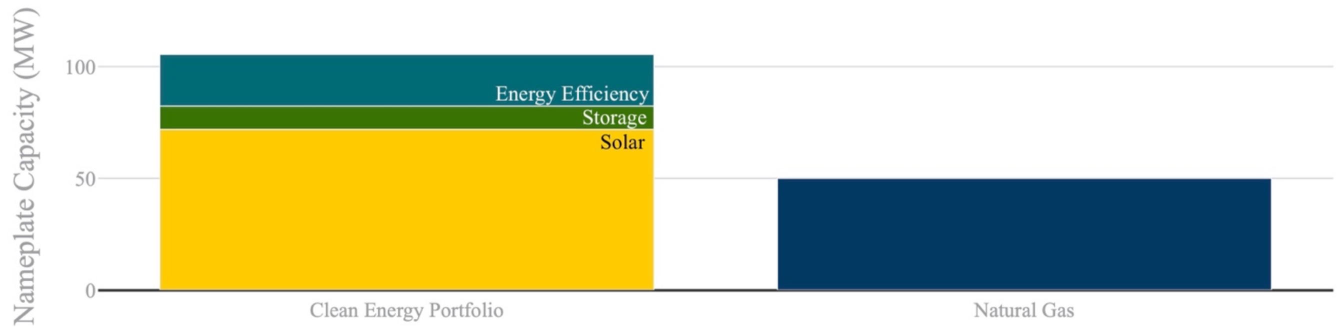


Figure 1. Nameplate (rated) capacity of each generation type (tracking solar, battery storage, and energy efficiency) in the clean energy portfolio compared to the proposed nameplate electric capacity of the Central Energy Plant.

The cost of this proposed clean energy portfolio is $120M

Thanks to the rapidly advancing renewables and storage industries, the cost of renewables has fallen dramatically in recent years. Likely, prices will continue to fall. The largest portion of costs of the clean energy portfolio are for the single-axis tracking solar photovoltaic system (Figure 2).

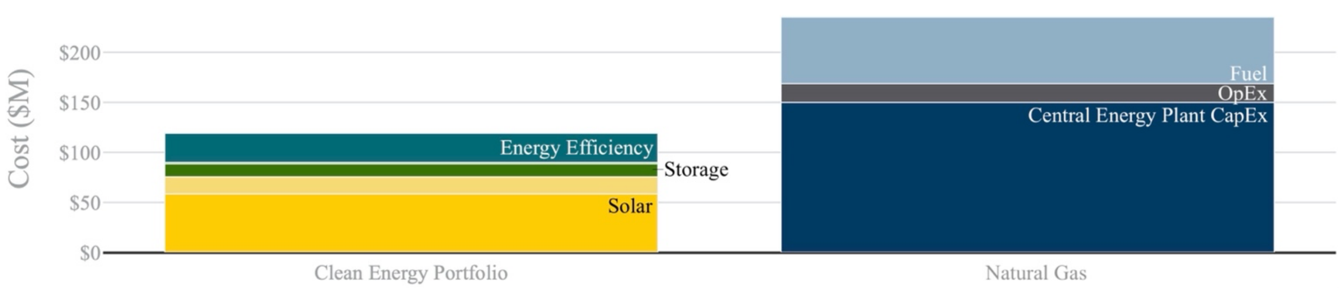


Figure 2. The cost of the proposed clean energy portfolio ($120M) is less than the cost of the capital expenditure (CapEx) of the Central Energy Plant alone ($150M as estimated by the University of Florida). The net present value of additional fuel and operational expenditure (OpEx) costs of a typical natural gas combined cycle plant further add to costs, bringing the total to $235M. Costs are broken down by generation type; for each resource in the clean energy portfolio, solid or darker shades represent CapEx and lighter shades represent OpEx.

The clean energy portfolio can reliably serve the region's top 50 hours grid demand

In Florida today, there are still limited amounts of solar on the grid; therefore, new solar installations are extremely beneficial from both an energy and capacity perspective. Similarly, very few energy efficiency measures have been undertaken despite aging infrastructure, leading to an immense energy efficiency resource. In our analysis, solar remains the primary source of electricity during most of the top 50 hours of the year when the grid is most stressed. In Florida, these hours typically occur during hot summer months. Figure 3 shows how each grid stress hour's capacity needs are met by each clean generation type (single-axis tracked solar, battery energy storage, and energy efficiency); note that in our model excess solar produced above the red requirement line is curtailed, however, it could instead be sold back to the grid, further reducing the net cost of the portfolio.

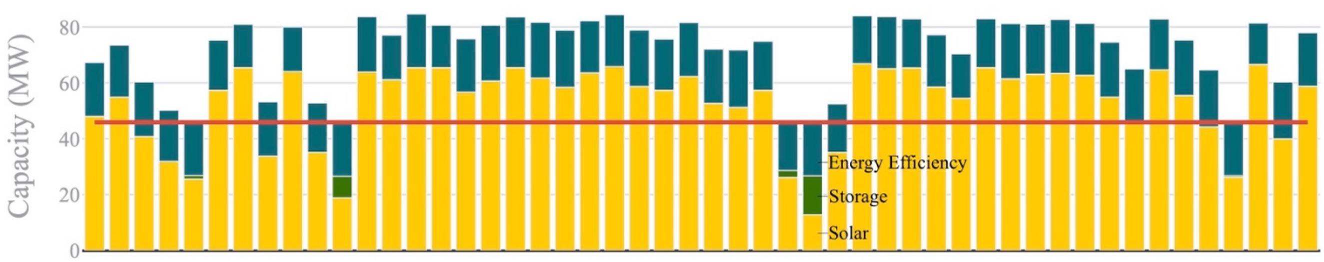


Figure 3: How each of the top 50 grid stress hours is served by clean generation type. Horizontal axis represents 50 [nonconsecutive] hours when regional electricity demand peaks. The red line represents the 50 MW output of the proposed Central Energy Plant, which we assume would run at maximum power output during these hours.

Recommendations

Before moving forward with a new fossil fuel plant, the University should evaluate whether a clean energy option is lower cost. Our analysis shows that the University could use clean energy to provide the same electricity services at 51% of the NPV of the proposed plant cost. This leaves $115M in savings to fund alternatives to the additional services the Central Energy Plant would provide (not including an additional $55M in savings from the now-precluded new steam distribution system). In our analysis, we did not include any explicit financial preference to avoid greenhouse gas emissions. However, in terms of recruitment value, college-aged student populations increasingly demand clean energy and are likely to be attracted to universities that lead by example.

With a 72 MW Solar Buildout, the University could position itself as a leader in solar and battery energy storage research. The large amount of solar required is an opportunity for the University to leverage its research capabilities and enable a flurry of on-campus, hands-on solar photovoltaic and battery energy storage performance and monitoring analytics research.

The University should use a competitive, all-source procurement process to determine the least-cost, least-risk options to meet emerging grid needs. When the net present value of fuel and operational expenditures are included, the clean energy portfolio provides a cost savings of $115M in comparison to the Central Energy Plant. These savings, combined with the additional savings from not having to implement new piping or upgrade existing piping distribution (an additional cost of $55M as estimated by the University), could instead go toward applying innovative and reliable solutions to deliver or curtail the need for any steam or chilled water in the first place. There are a number of energy efficiency retrofits and a suite of alternative building heating and cooling options that could provide the targeted inhabitant comfort levels. Serving heating and cooling needs via non-steam methods would result in greater cost savings in the long term as well as an ability to achieve emissions goals.

References

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