

An Earlier Carbon Neutrality Date for Calvin University

ENGR-333 Section B
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 December 7, 2023



Introduction

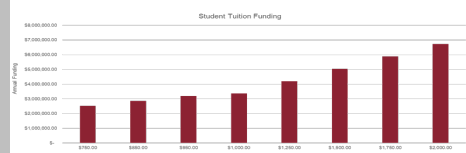
Calvin University is currently committed to being carbon neutral by 2057. However, by 2057 the average global temperature will have risen by well over 1.5° C, a temperature change experts say will cause irreparable damage to the global climate. Thus, it is desired for Calvin University to reach carbon neutrality well before 2057. To achieve this, Calvin must address emissions linked to campus heating and electricity consumption. Energy efficiency initiatives offer a viable approach to curbing campus energy consumption. In this analysis, three distinct models were developed, each proposing different methods for carbon reduction, taking into account factors such as expenses and the target date for carbon neutrality. One of these models has been selected as the ENGR-333B official recommendation for Calvin University's accelerated carbon neutrality goal.

Finances

To raise the capital needed to cover the costs of the proposed models, Calvin University's fundraising strategy would comprise of federal and state grants along with private funding from donors. The federal funding would come through the Inflation Reduction Act. Several state level grants that Calvin could apply was found with the help from District Director Kooyman.

How Can You Help?

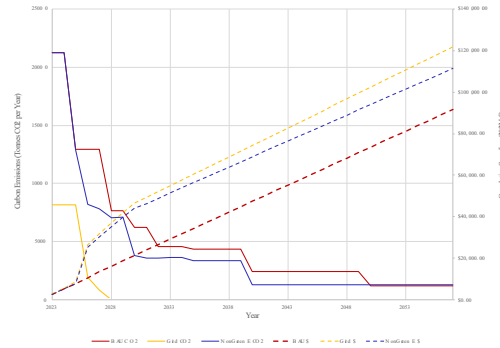
Calvin students can contribute to financing the necessary changes through an extra sustainability fee incorporated into tuition. This approach enables Calvin to generate the required funds for implementing the necessary modifications. While it may be challenging to request students to bear an additional tuition burden, it opens up an avenue for donors to support covering the extra cost. The accompanying chart illustrates the potential funding that can be acquired by adjusting the tuition by a specific amount.



Comprehensive Models

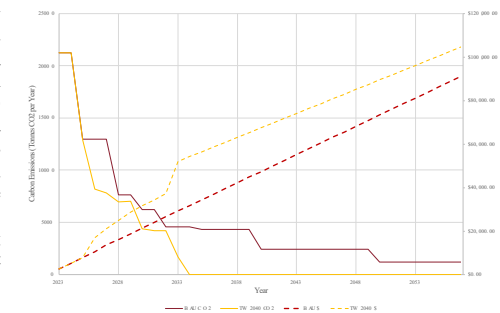
Grid Decarbonization – 2029

In this model, Calvin reaches carbon neutrality by 2029. Calvin University buys renewable electricity from consumers energy at a 12% price increase starting immediately. This will eliminate all emissions linked with electricity. Carbon-free electricity will need to be purchased up until 2040, when Consumer's Energy claims to become carbon neutral. The natural gas boilers are replaced with electric ground-source and air-source heat pumps, mitigating the emission of burning natural gas. This would begin in 2026 and would be completed by 2029. Energy efficiency projects are implemented throughout the campus to reduce energy consumption. Carbon neutrality is reached in 2029, when heating is electrified, and carbon-free electricity is purchased until 2040.



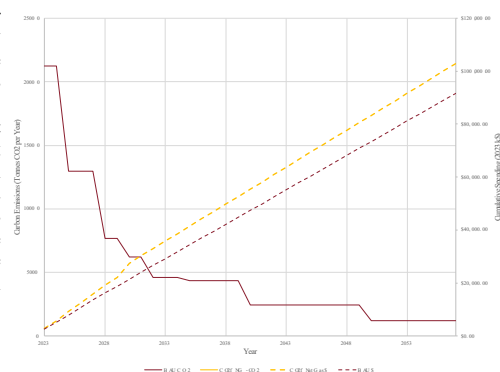
Texas Wind – 2034

In this model, Calvin reaches carbon neutrality by 2034. Green energy is produced by building a wind farm in Texas and sold to the Texas grid acting as a carbon offset. Electricity would still be bought from Consumers Energy as is. Texas was chosen for cheap land, lax energy production regulations, and a regular occurrence of wind. Calvin's natural gas boilers would be replaced with electric ground and air source heat pumps. Efficiency projects are implemented throughout campus to save energy. Carbon neutrality is reached in 2034, when heating is electrified, and the electric emissions are offset with the wind farm.



Carbon Offsets – Tomorrow

Instead of replacing the natural gas boilers or creating renewable energy farm, Calvin would buy carbon offset natural gas from DTE, and purchase carbon free electricity from Consumer's Energy. This would eliminate all carbon emissions immediately. Efficiency projects will be implemented throughout campus to lower energy consumption thus lowering the carbon offsets needed. This model is the best in the short term; however, carbon offsets are predicted to rise rapidly (3000% increase by 2043) which puts this model's feasibility in jeopardy for the future. Using this approach, Calvin can become carbon neutral as soon as the offsets for both electricity and natural gas are purchased.



Conclusion

Best Option: Grid Decarbonization – 2029

It was determined that the best option is the Grid Decarbonization model which gets Calvin University carbon neutral by 2029. Commencing in 2025, ground and air source heat pumps will be eligible for a 30% tax credit on their highest-cost acquisitions. This initiative aims to render Calvin's heating load entirely carbon neutral once the process of decarbonizing electricity is completed. Accomplishing this involves the purchase of carbon-free electricity from Consumers Energy, albeit at a higher cost, with immediate implementation to swiftly mitigate emissions. Carbon-free electricity must be purchased until 2040, when Consumer's Energy claims to become carbon neutral. Efficiency projects such as double-paned windows, upgraded control systems, and efficient radiators will be implemented throughout campus.

The Texas Wind model was not chosen due to the inconvenience and uncertainty of owning and operating a wind farm in Texas. There are also extremely high upfront costs that will never be fully recouped as the selling price of electricity is less than the market value for small producers.

The Carbon Offsets model was not chosen as natural gas offsets are projected to increase immensely over time (some projections say up to 3000% by 2043). Long term, it would be more cost effective to install electric heat pumps.

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