

Calvin's New Carbon Neutrality Date

ENGR-333-A
Professor Heun

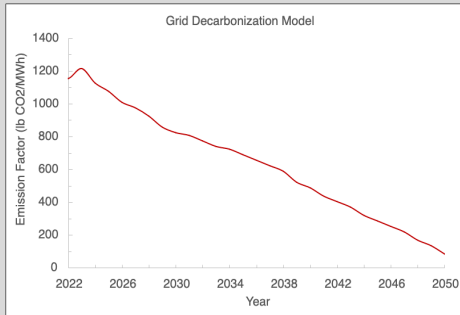


Project Overview

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, how can Calvin University become carbon neutral at a sooner date to help reduce climate change? This was the question which President Boer tasked the mechanical engineering students of the ENGR-333 Class with answering. In response, they investigated renewable energy sources, how to replace natural gas heating, energy efficiency projects, and how to practically implement and fund these projects.

Grid Decarbonization

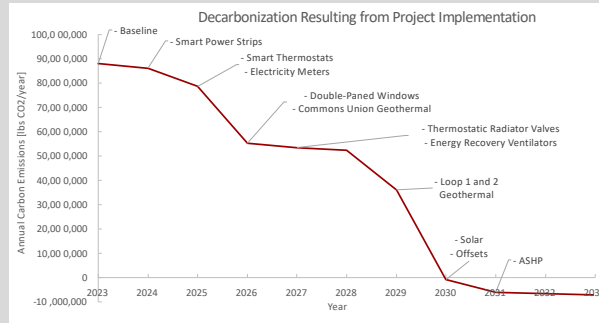
As energy providers begin to implement clean energy projects themselves, the electricity grid itself will decarbonize. Consumers Energy has stated a date of 2040 to be carbon neutral, however this is including the purchase of offsets. For Calvin to be carbon neutral sooner, we must implement projects that reduce emissions from natural gas, grid electricity, and more – prior to the electricity grid being fully decarbonized. The figure below shows a conservative estimate of grid decarbonization, which was used to quantify Calvin's emissions from purchased electricity through Consumers Energy and used for analysis.



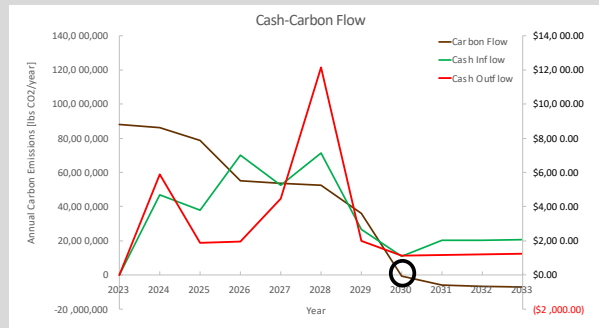
Project Findings

- Modeled scenarios:
- 1) Carbon Offsets
 - 2) Clean energy projects
 - 3) Combination of both

The final model consisted of scenario 3. Levelized investments, payback periods, and overall impacts on CO₂ reductions were all considered. Based on final results, it is recommended that Calvin moves its target carbon neutrality date to **2030!**



As seen above, annual carbon emissions reach zero by the year 2030. Implementation of efficiency improvements and clean energy projects lead to decreases in carbon emissions as funding is available. The largest contributors to carbon reductions include the addition of geothermal heating loops on campus along with rooftop solar panels. Carbon offsets are then used to make Calvin fully carbon neutral.

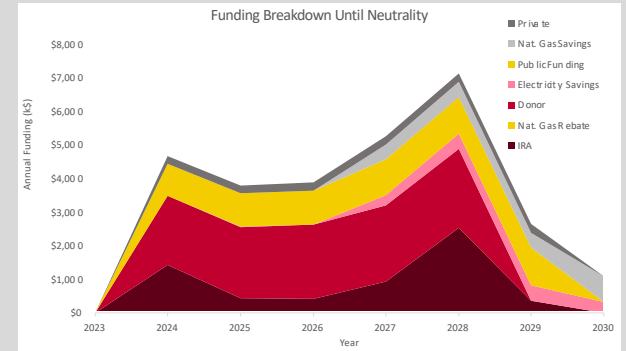


The graph above shows predicted cash flows and reductions in carbon emissions as projects are implemented. It is assumed that extra money saved in net positive cash flow years is used to balance the net negative cash flow years. This ensures that Calvin will never be in a position of debt as they strive towards carbon neutrality.



Pictured: (back left to right) Kyle Borrer, Stephen Langerak, David Visser, Brayden Raches, Michael Lanning, Sam Mennega, Luke Penning, (front left to right) Caleb Gaffner, Caleb Clark, Seth DeVries, Panashe Makuvaro, Kyle VanDusen, Jared Skaggs, Owen Kalsbeek, Hayden White.

Funding Sources



The greatest funding contributions are anticipated to come from donor funding, public funding, and a 30% IRA rebate for the total costs of all major projects implemented to achieve carbon neutrality. Additional sources of funding include grant money from private foundations, natural gas rebates, and savings over time from reduced natural gas usage and reduced electricity purchased.

Conclusions

Calvin University should change their target carbon neutrality date to **2030**. The removal of natural gas via geothermal heating methods, efficiency projects such as smart power strips, smart thermostats and thermostatic radiator valves, along with the implementation of solar and purchase of carbon offsets will lead Calvin towards carbon neutrality. Based on funding estimates, Calvin will never be in a position of debt, however donor funding is needed to kick projects off. Additionally, Calvin needs to spend money to receive money through public funding options and IRA incentives.