Carbon Neutral Before 2057?

Determining an earlier date for Calvin to reach carbon neutrality

Calvin University — ENGR333 — 5 December 2023
Michael Lanning and Panashe Makuvaro (Section A)
David Harris and Stuart Johnston (Section B)

Nations Approve Landmark Climate A

Global temperatures to rise by more 2030 under business-as-usual scena

Heavy precipitatio

Ashley Tan | Augu

United Nations
Climate Change

Home | COP 28 | Process and meetings | Topics | Calendar

UN Climate Change Conference – United Arab Emirates

UN Climate Chang
United Arab

30 Nov – 12 Dec

Previous

https://unfccc.int/cop

King Charles Urges ‘Transformational Action’ at COP28 Climate Summit

“The hope of the world rests on the decisions you must take,” the British monarch told world leaders at the U.N. climate summit in Dubai.

Share full article

https://www.nytimes.com/2023/12/01/climate/king-charles-cop28-climate-summit.html?searchResultPosition=4

Chimes

Calvin commits to carbon neutrality by 2057

Rae Gernant, Head Copy Editor | December 8, 2017

Le Roy signing the Second Nature Climate Commitment. Photo by Hannah Butler.

https://calvinchimes.org/2017/12/08/calvin-commits-to-carbon-neutrality-by-2057/

2017

2023

2030

Global temperatures to rise by more than 1.5°C by 2030 under business-as-usual scenario: IPCC report

Heavy precipitation events will intensify and become more frequent with each additional degree of warming.

Ashley Tan | August 09, 2021, 04:15 PM

?

2017

2023

2030

2050

2057

Global temperatures to rise by more than 1.5°C by 2030 under business-as-usual scenario: IPCC report

Heavy precipitation events will intensify and become more frequent with each additional degree of warming.

Ashley Tan | August 09, 2021, 04:15 PM

ENGR 333 - Thermal Systems Design

ENGR 333 – Thermal Systems Design

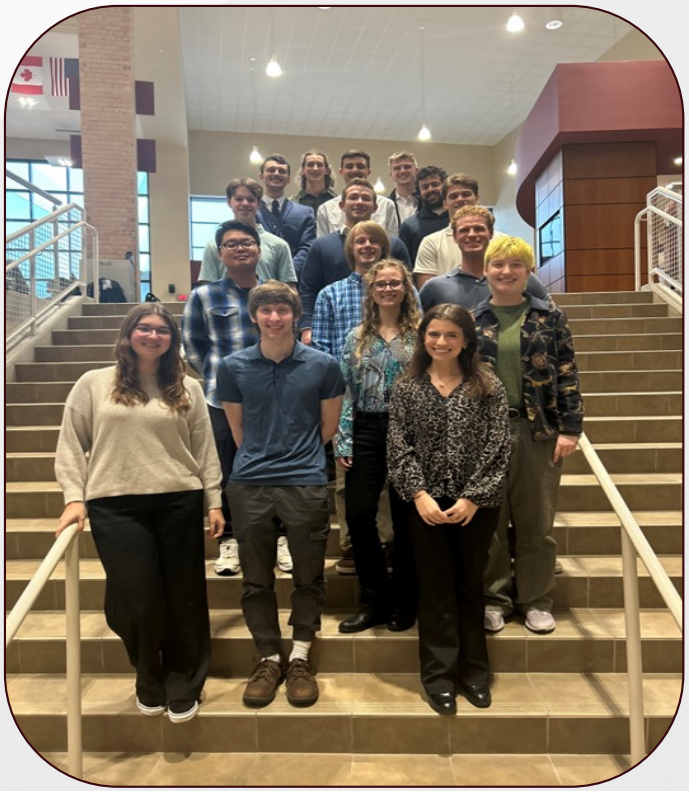
(4)

FA. Advanced heat transfer, thermodynamic, and fluid flow topics important for the design of thermal systems are presented. Sustainability and creation care topics are covered as they pertain to energy generation and fossil fuel resource depletion. Availability (exergy) analysis and methods for the optimization of system components are discussed. Selection and design of fluid flow and heat transfer equipment used in energy conversion systems are emphasized. Economic evaluation is studied. A co-generation system is studied throughout the semester to emphasize basic principles of analysis and design. A design project focused on sustainable energy generation or energy conservation is required. Prerequisite(s): ENGR 328.

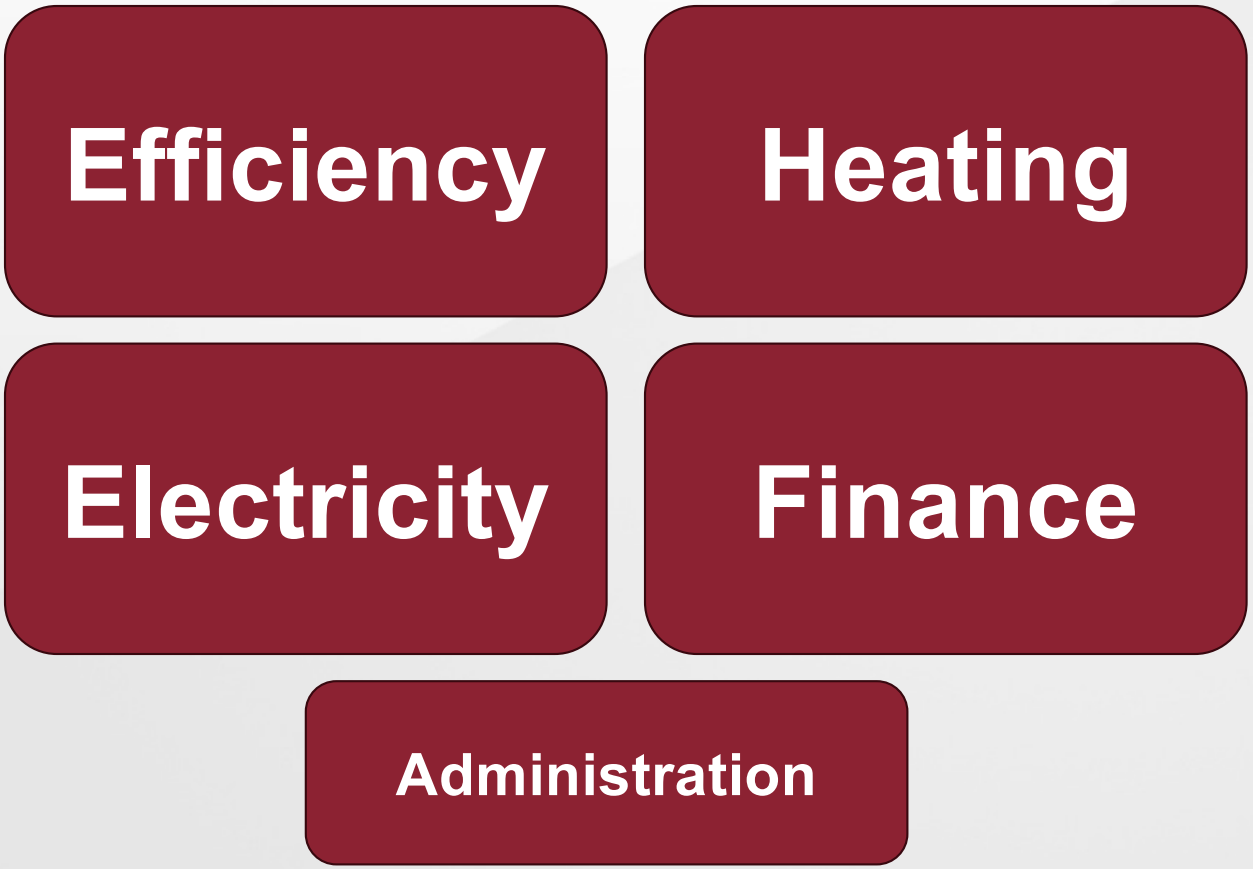
Wind energy design (2006)
Low-Carbon Housing (2021)
Carbon Neutral Heating (2022)

What earlier year should Calvin University choose for its carbon neutrality date?

Section A

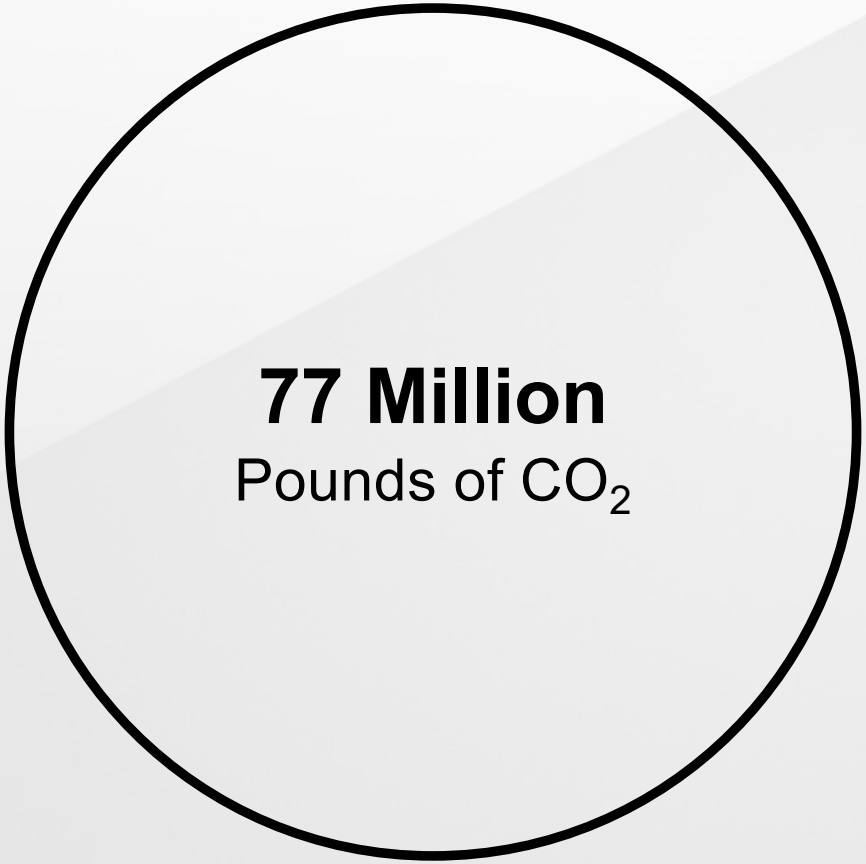


Section B


Efficiency
Heating
Electricity
Finance
Administration

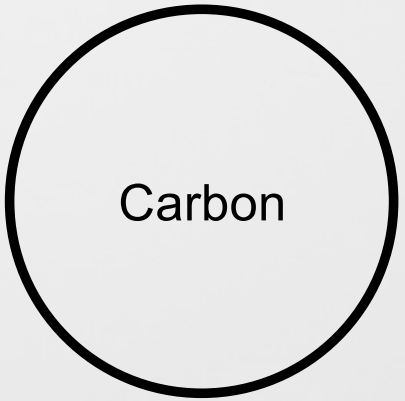
Calvin’s Carbon Emissions

Panashe Makuvaro

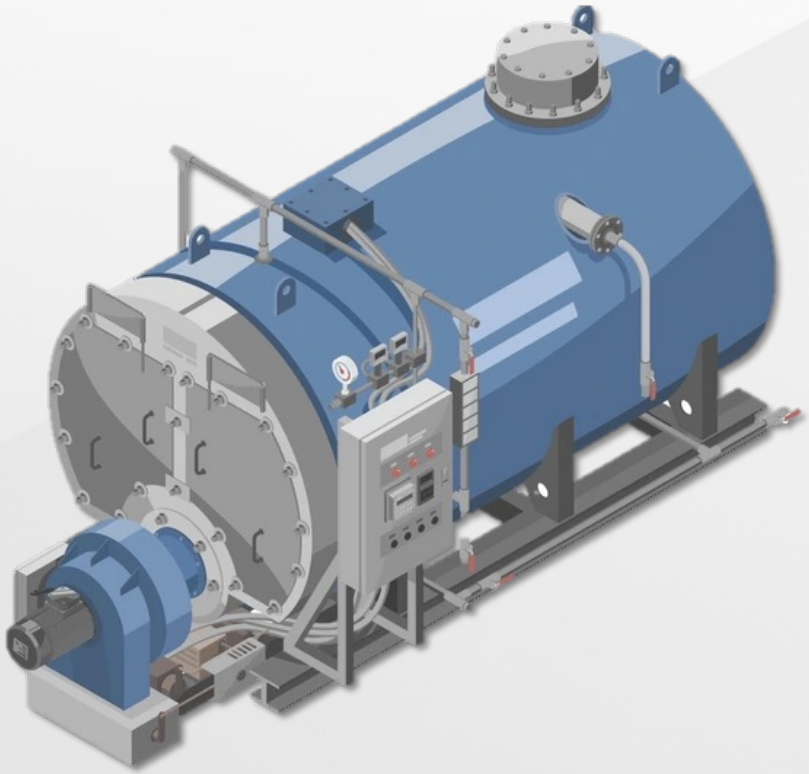

77 Million
Pounds of CO_2

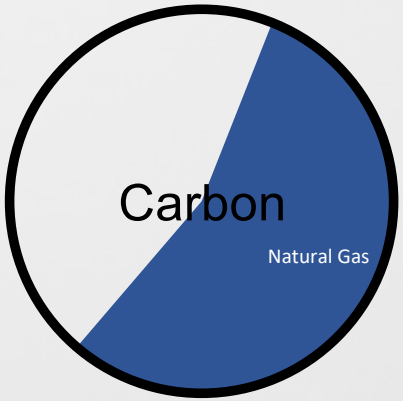
77 Million

Pounds of CO_2

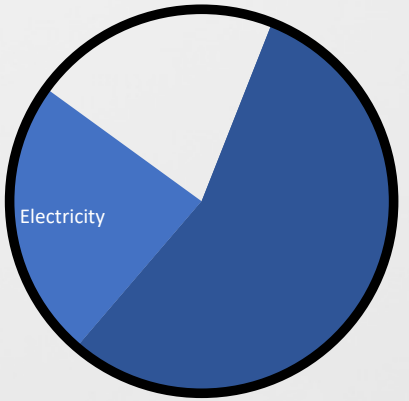


Heating Carbon Emissions

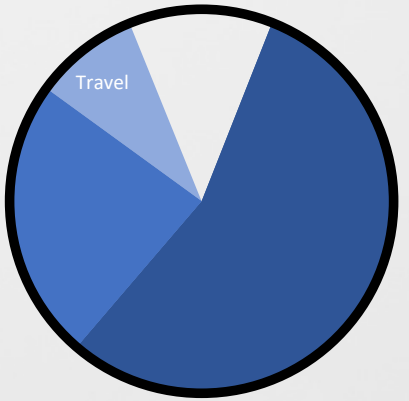




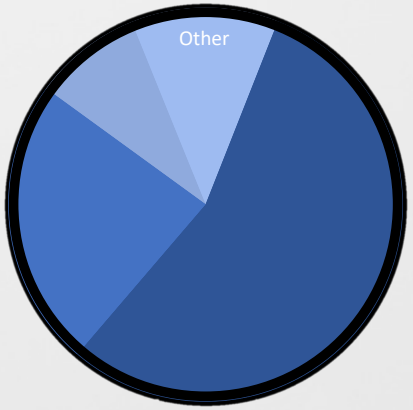
Electricity Carbon Emissions



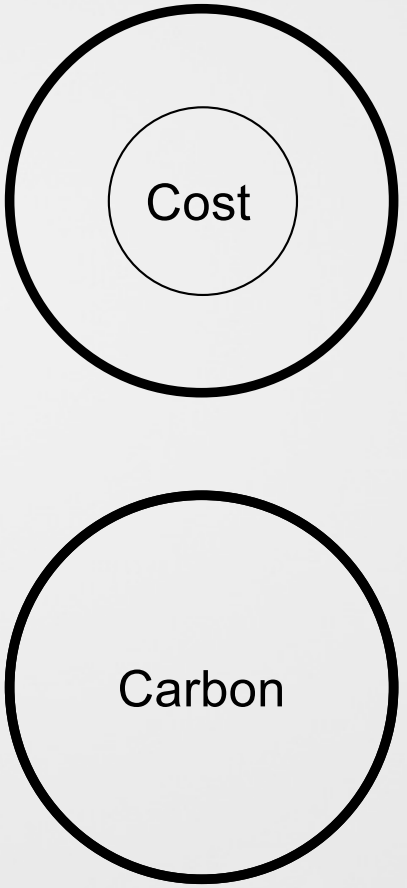
Travel Carbon Emissions



Other Carbon Emissions

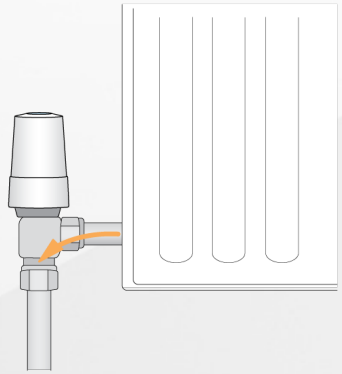


2030

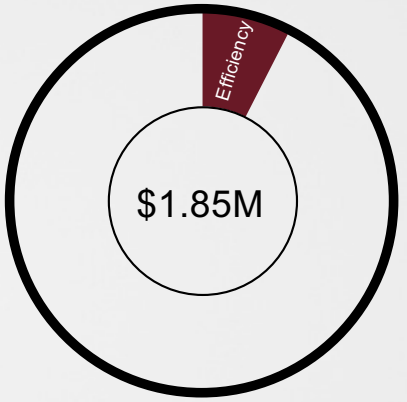


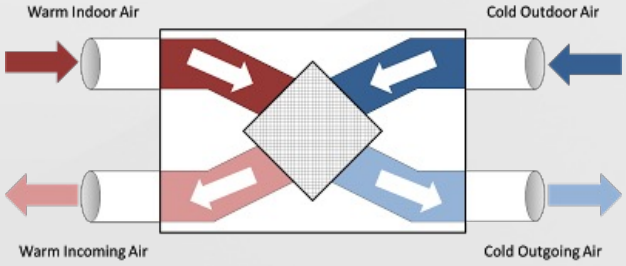
Efficiency Projects

Smart Thermostats



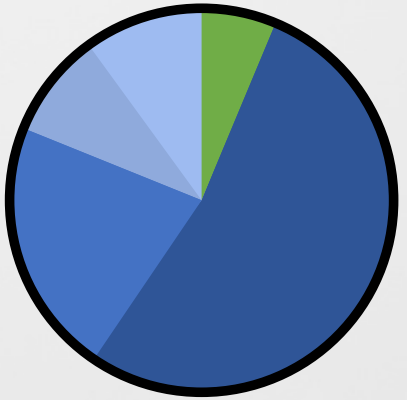
Thermostatic Radiator Valves





Energy Recovery Ventilators

Smart Power Strips



Heating Load

Stuart Johnston

What is Geothermal?

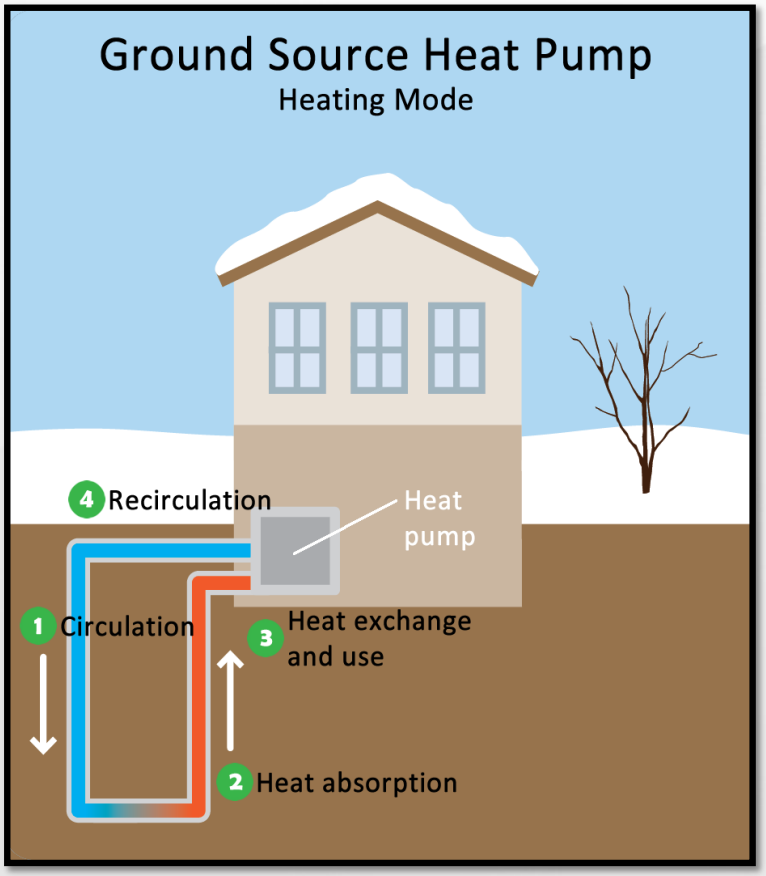
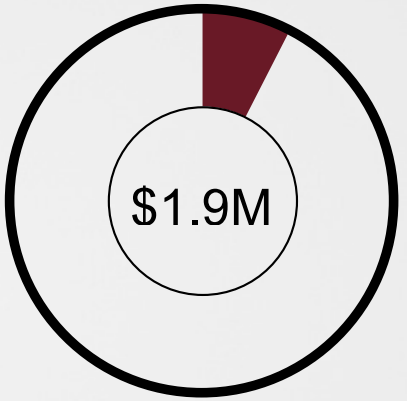
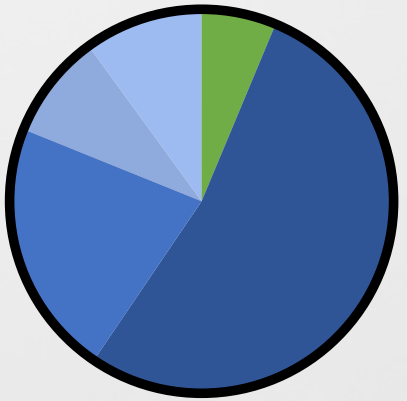
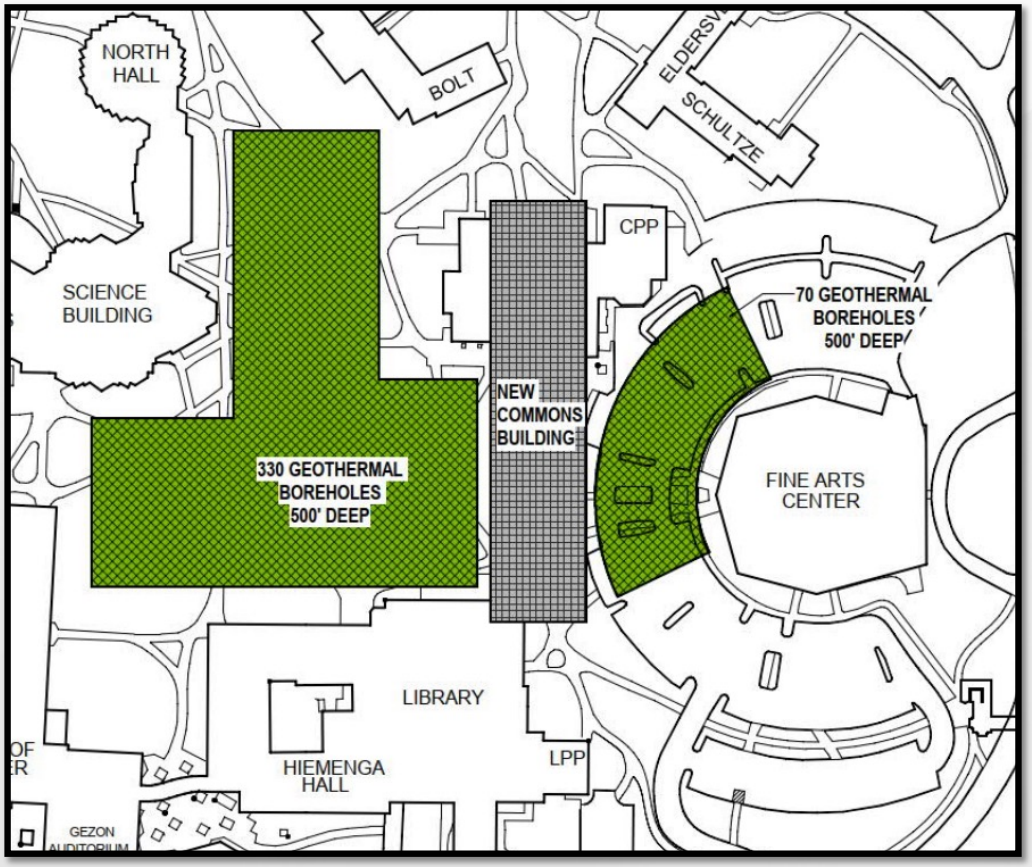


Diagram by: US Environmental Protection Agency

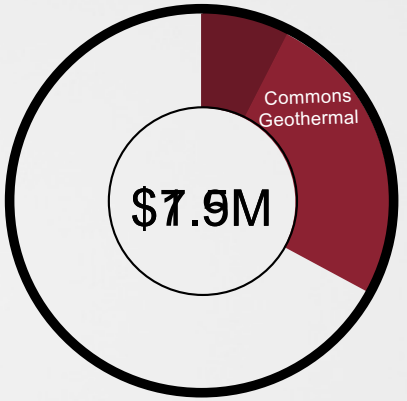


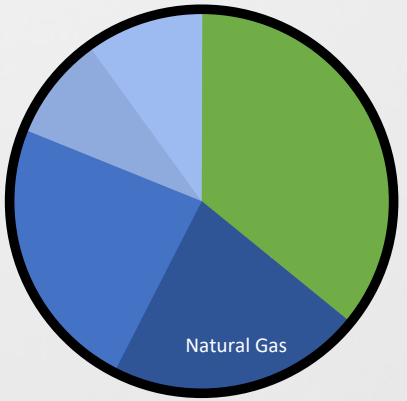


Commons Geothermal - 2024

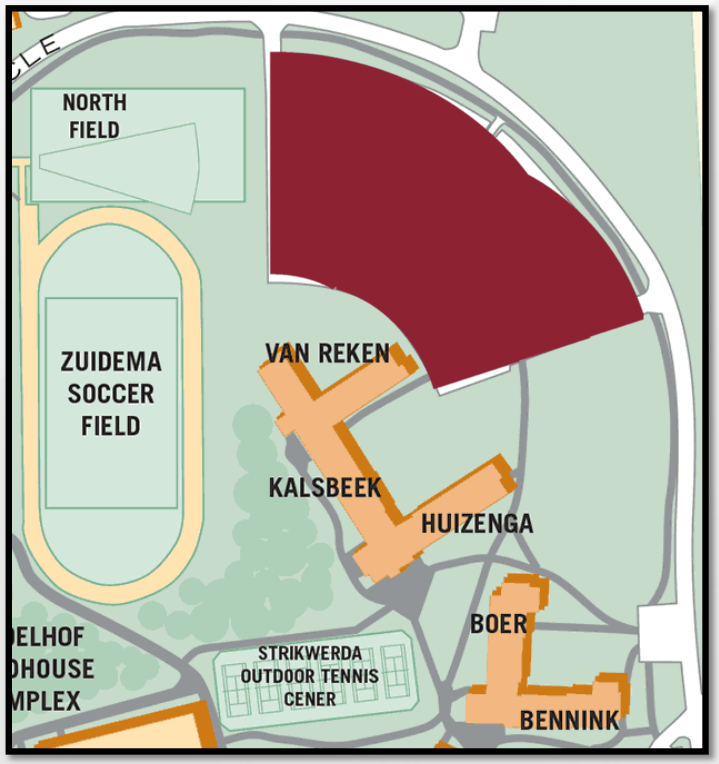


Borehole area

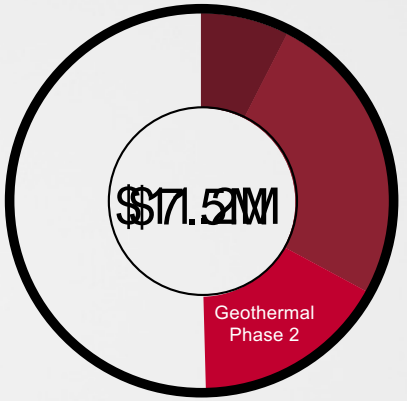


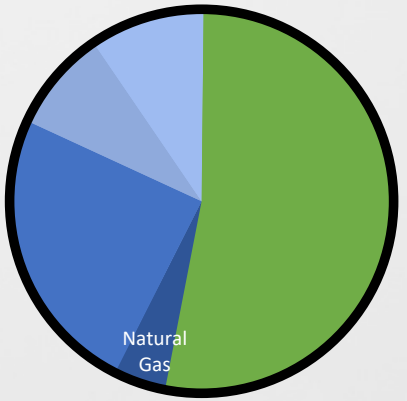


Geothermal Phase 2 – 2026



Borehole area





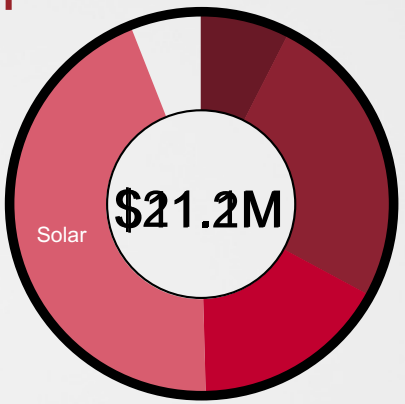
Carbon Free Electricity and Offset

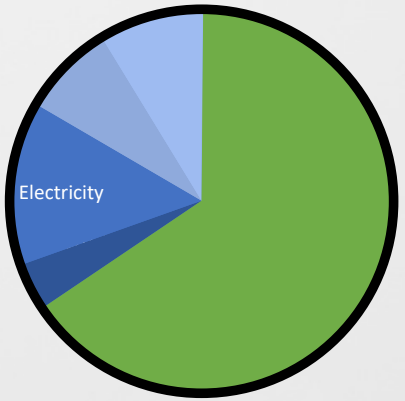
David Harris

Calvin Solar Farm

$9.9 million

38% of electricity

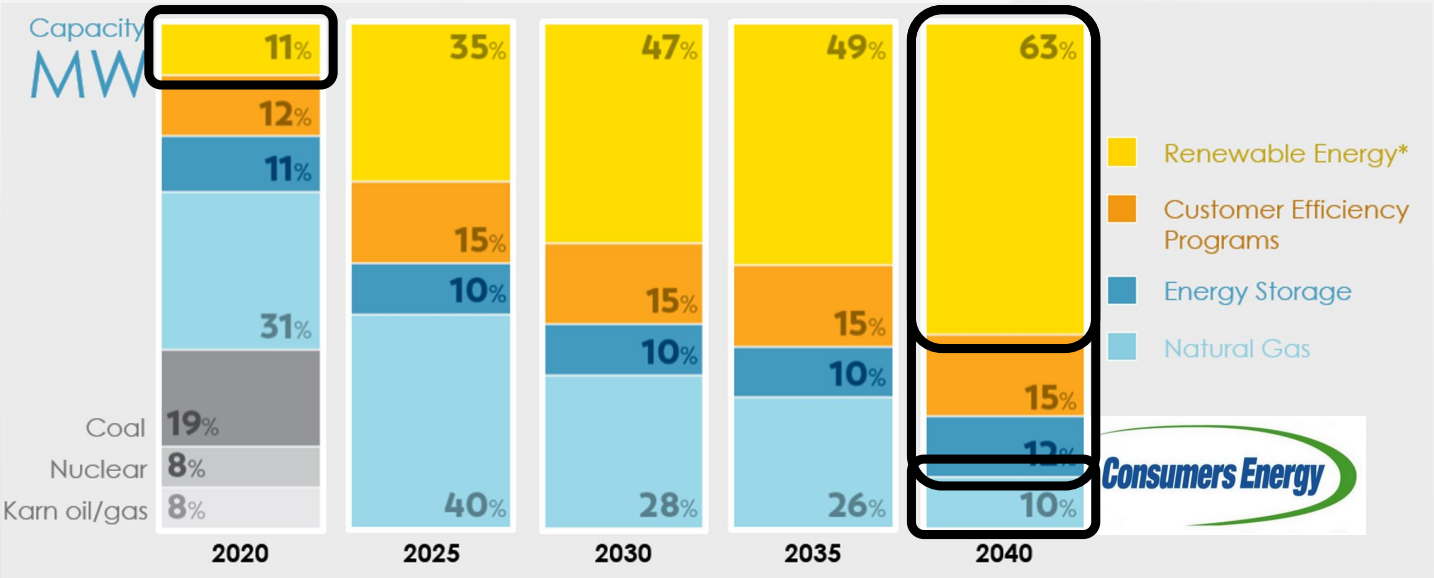


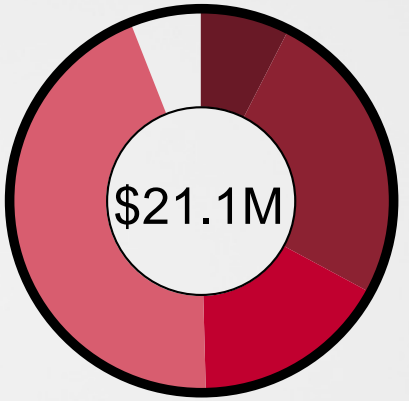


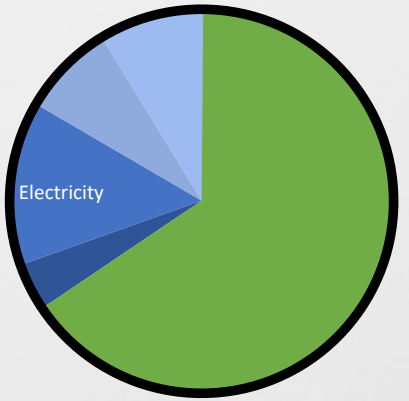
Roof Top Solar

Parking Lot 8 Solar

Electricity Grid Decarbonization



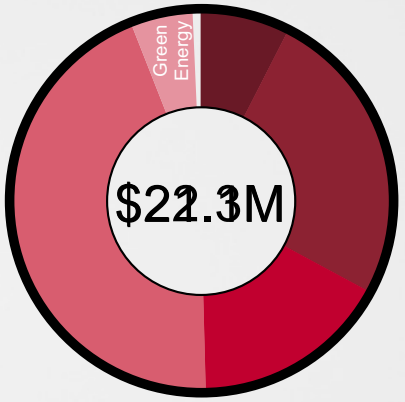


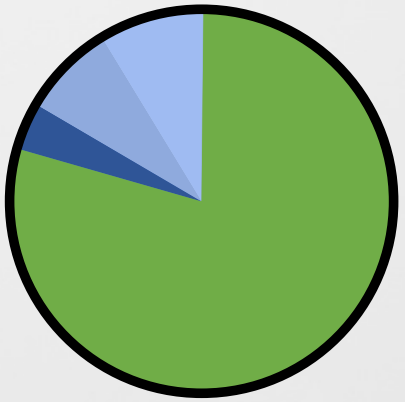


Consumers Energy Green Credit Program

13% electricity rate increase

62% of electricity until 2040

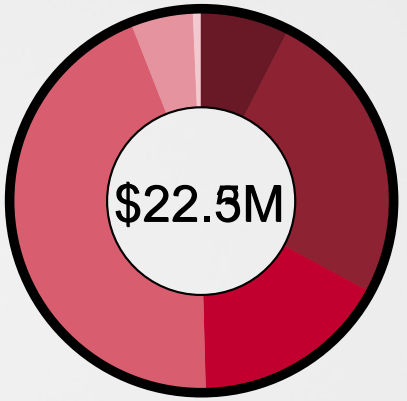


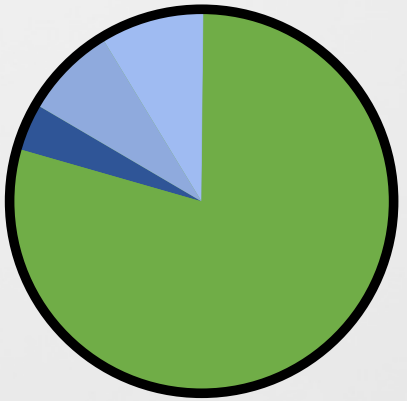


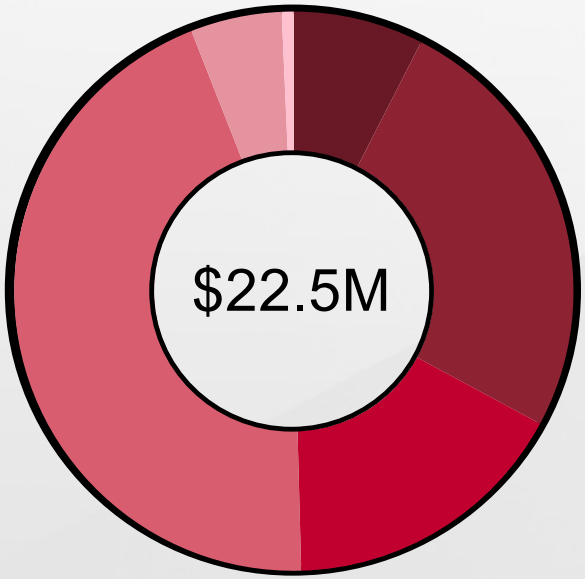
Carbon Offsets

How does offsetting work?

Diagram by: SINAI Technologies







Initial Cost

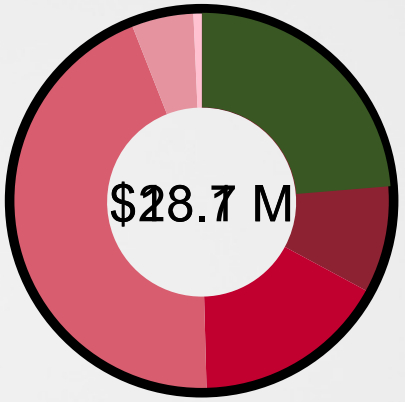
\+ O&M
Depreciation
Inflation

= $23.7M

Funding

Michael Lanning

Energy Cost Savings



48% Efficiency Improvements

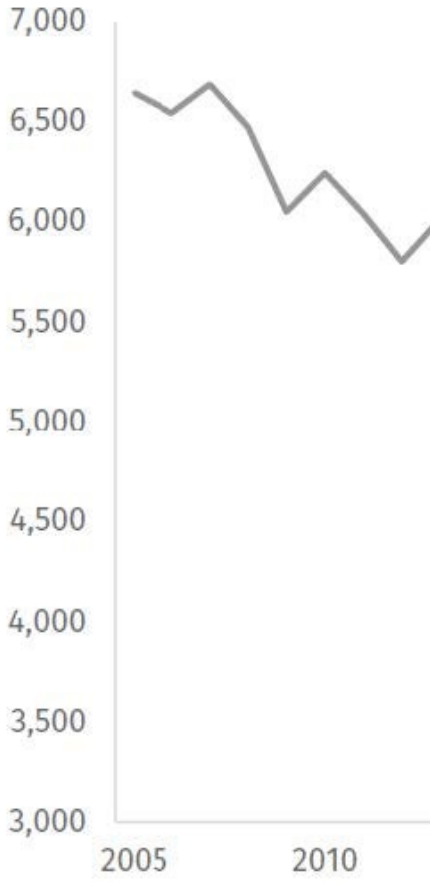
31% Natural Gas Cost Savings

21% Electricity Cost Savings

FIGURE 1

US greenhouse gas emissions

Net million metric tons (mmt) of



Source: Rhodium Group. The range reflects u
with high, central, and low emissions scenar

Clean Energy Funding

In the Inflation Reduction Act

The Inflation Reduction Act (IRA) is the largest climate legislation in U.S. history.

Here's a breakdown of all the clean energy and climate funding in the IRA.

Estimated Spending
(2022–2031) USD

Total Spending (2022–2031) **$392.5B**

Clean Electricity Tax Credits

- **$51.0B** Credit for Electricity Produced from Renewable Sources*
  - The bill provides from **$5 up to $25** per megawatt-hour (MWh) of electricity generated from renewables.
- **$50.9B** Clean Electricity Investment Credit
  - Clean electricity projects that begin construction before 2031 can qualify for a **6% to 30%** investment tax credit.
- **$30.0B** Zero-Emission Nuclear Power Production Credit
  - Nuclear power plants can receive from **$3/MWh up to $15/MWh** if they meet certain wage conditions.
- **$14.0B** Energy Investment Credit*
- **$11.2B** Clean Electricity Production Credit
- **$3.9B** Other

Air Pollution, Hazardous Materials, Transportation and Infrastructure

- **$20.0B** Greenhouse Gas Reduction Fund
- **$4.0B** Climate Pollution Reduction Grants
- **$3.0B** Hazardous materials
- **$3.0B** Grants to Reduce Air Pollution at Ports
- **$11.8B** Other

Individual Clean Energy Incentives

- **$22.0B** Residential Clean Energy Credit
  - Taxpayers can get a **30%** credit on the total cost of residential solar panels, heat pumps, and battery storage systems.
- **$12.5B** Nonbusiness Energy Property Credit*
- **$2.4B** Other

Clean Manufacturing Tax Credits

- **$30.6B** Advanced Manufacturing Production Credit
  - Manufacturers of solar, wind, and battery components, including critical minerals, can qualify for this production tax credit.
- **$6.3B** Advanced Energy Project Credit*

Clean Fuel and Vehicle Tax Credits

- **$13.2B** Clean Hydrogen
- **$5.6B** Biodiesel, Renewable Diesel, and Alternative Fuels*
- **$3.6B** Qualified Commercial Clean Vehicles
- **$7.5B** Clean Vehicle Credit
- **$6.1B** Other

Conservation, Rural Development, Forestry

- **$16.7B** Conservation
- **$9.6B** USDA Assistance for Rural Electric Cooperatives
- **$8.4B** Other

Building Efficiency, Electrification, Transmission, Industrial, DOE Grants and Loans

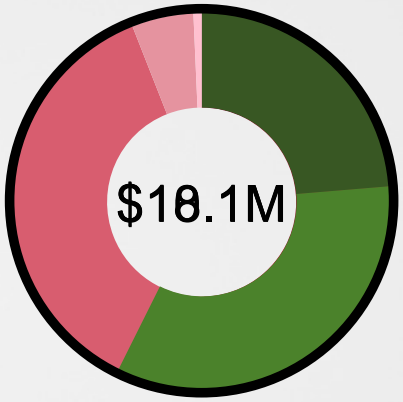
- **$9.8B** DOE Loans and Grants
- **$5.3B** Advanced Industrial Facilities Deployment Program
- **$4.5B** High-Efficiency Electric Home Rebates
- **$7.7B** Other

Other Energy and Climate Spending

- **$18.0B**

Source: Congressional Budget Office

**Indicates extensions or modifications of existing credits*



NPUC

Learn more about how electric utilities and the power sector can lead on the path toward decarbonization.
DecarbonizationReport.com

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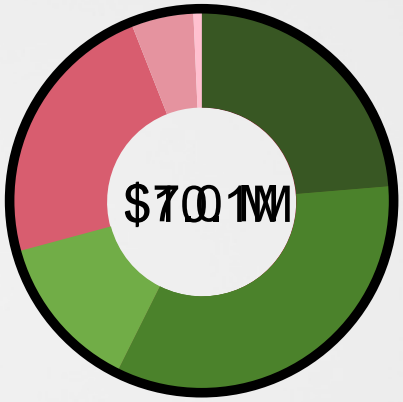
Tax Credits and Grants

Section 45L tax credits
Energy Efficient Home credit
Credit for builders of new energy efficient homes
Energy efficient commercial buildings deduction

Roy A Hunt Foundation
Joyce Foundation
Patagonia
IREM Foundation
Climateworks Foundation
MacArthur Foundation
Mitsubishi Corp. Foundation



Donors

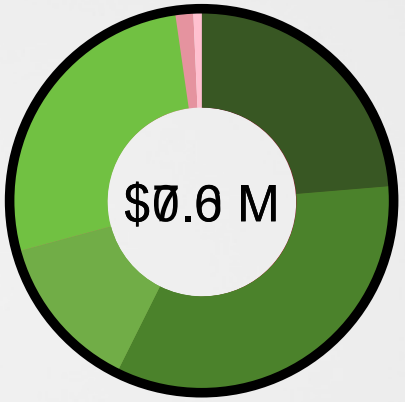
$1.28 million annually

✖

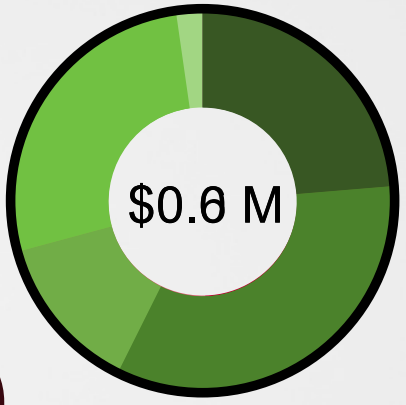
5-year fundraising cycle

=

$6.4 million



Sustainable Scholars



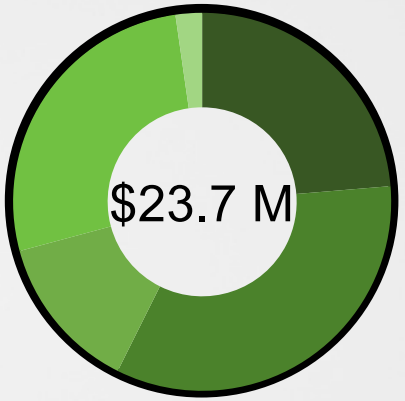
$15

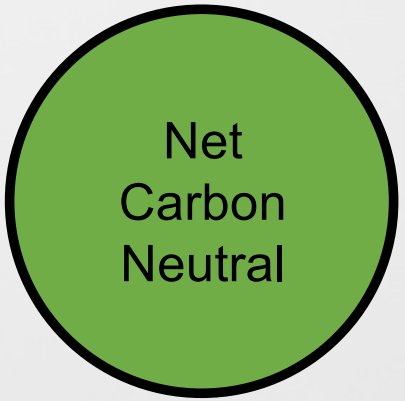
each semester

What earlier year should Calvin University choose for its carbon neutrality date?

$1.2 Million Annually

↳ After Yearly Costs!





2017

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Global temperatures to rise by more than 1.5°C by 2030 under business-as-usual scenario: IPCC report

Heavy precipitation events will intensify and become more frequent with each additional degree of warming.

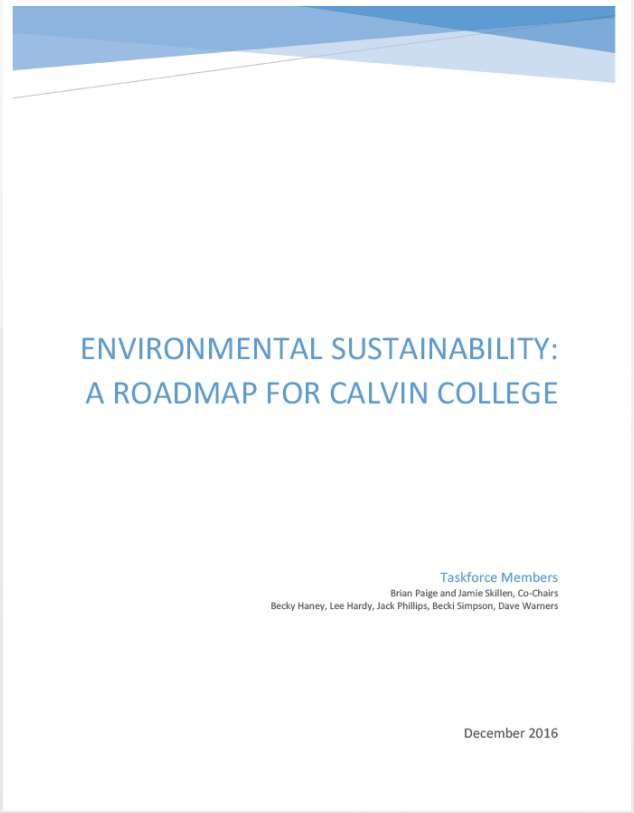
Ashley Tan | August 09, 2021, 04:15 PM

https://mothership.sg/2021/08/ipcc-temperature-increase-1-5-by-2030/

The Next Steps

Panashe Makuvaro

Cabinet Level Director



ENVIRONMENTAL SUSTAINABILITY:
A ROADMAP FOR CALVIN COLLEGE

Taskforce Members
Brian Paige and Jamie Skillen, Co-Chairs
Becky Haney, Lee Hardy, Jack Phillips, Becki Simpson, Dave Warners

December 2016

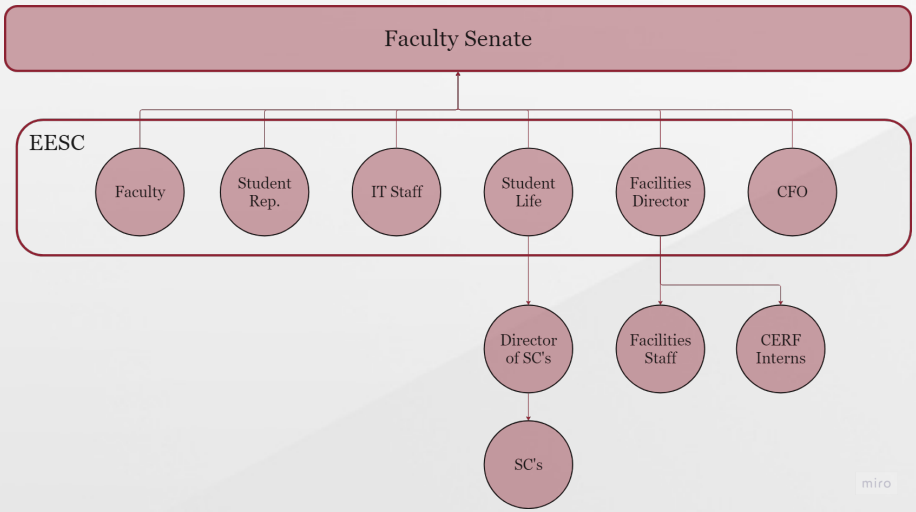
Projected Roles and Responsibilities

Maintain sustainability strategy

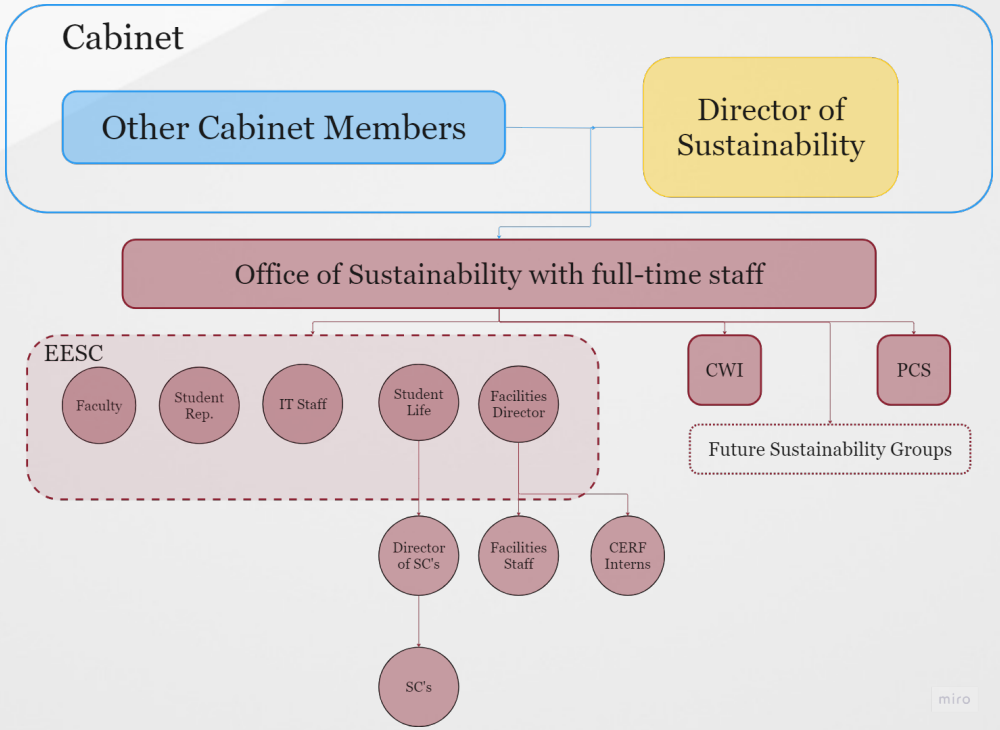
Data collection, organization, and reporting

Spearhead proposed carbon neutrality initiatives

Proposed Structural Change



Existing administrative structure



Proposed administrative structure

Integrated Carbon and Energy Master Plan

Acknowledgements

- **President Wiebe Boer**
- **Dirk Pruis**: CFO
- **Greg Elzinga**: VP of Advancement
- **Brett Hoogewind**: Keystone
- **Trent DeBoer**: GMB Architects
- **Toby Della Santa**: GMB Architects

- **Professor Heun**
- **All current students in sections A and B**
- **Past ENGR 333 students**
- **Jennifer Ambrose**: Director of Facilities
- **Matthew Johnson**: Elara Engineering
- **Sarah Turnage**: Calvin Grant Associate
- **Bill White**: Program Manager for the City of San Diego
- **Aaron Mecks:** Current SCHS Head of School
- **Suzette Peplinski**: Region Traffic Safety & Operations Engineer
- **Jon Lanning:** Financial Consultant
- **Eric Walstra** : Calvin Engineering Professor
- **Larry Molnar**: Calvin Professor/Observatory Director
- **Isaiah Hageman**: GIS Grad Student
- **Philip Johnson**: Calvin Business Professor
- **Jim Peterson**: Former Principal of South Christian schools
- **Winnie Brinks**: Grand Rapids/Kent County State Senator
- **Kate Kooyman**: District Director for Kent County
- **Shannon Steinebach**: Consumer's Energy Associate Product Manager
- **Cheryl Rieff**: Grant Writer/Advisor for the Sierra Club

Questions?