

WACUBO 



Rising to the Challenge

2023 WACUBO ANNUAL CONFERENCE



Carbon Reduction for the Business Officer

What a financial manager needs to know to evaluate and fund decarbonization projects

- Efficiency
- Electrification
- Renewables



Agenda



Introduction

Presentation Objectives

Summary of Key Terms

UC and State Policies

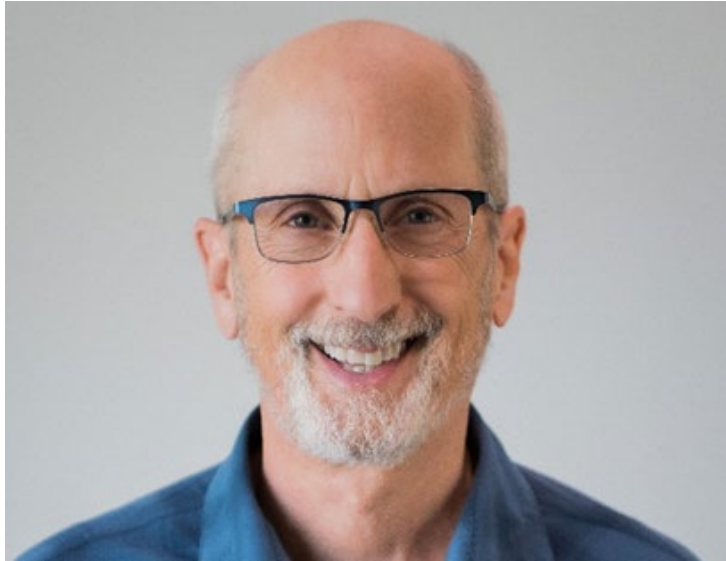
What makes a good decarbonization project?

Case Studies

Funding Opportunities

Questions

Introduction



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University of California San Francisco (UCSF)

- Dedicated entirely to health science and life science
- Academic medical center: medicine, nursing, pharmacy, dentistry, physical therapy, graduate education
- No undergraduates
- 75+ buildings, 11 million square feet
- 3200 students, 22000 non-academic and 5000 academic employees, 400+ campus facilities employees
- # 2 employer in San Francisco, generates 43000 jobs, estimated \$8.9 billion in economic impact



Presentation Objectives

- Objective 1: Understand the costs and benefits of carbon reduction projects
- Objective 2: Questions to ask to facilities/utilities staff about carbon reduction opportunities
- Objective 3: Identify potential funding mechanisms for carbon reduction projects

UC Climate Policies - Key Terms

- **Greenhouse Gas (GHG) Emissions** - gases that trap heat in the atmosphere - Carbon dioxide (CO₂), Methane (CH₄), Nitrous oxide (N₂O), Fluorinated gases
 - **Scope 1 Emissions** - produced on campus (e.g., on-campus power production)
 - **Scope 2 Emissions** - associated with purchased utilities required for campus operation (e.g., purchased electricity)
 - **Scope 3 Emissions** - not owned or controlled on campus, but central to campus operations/ activities (e.g., commuting, air travel)
- **Climate Neutrality** - net zero climate impacts from greenhouse gas (GHG) emissions achieved by minimizing GHG emissions as much as possible and using carbon offsets or other measures to mitigate the remaining GHG emissions

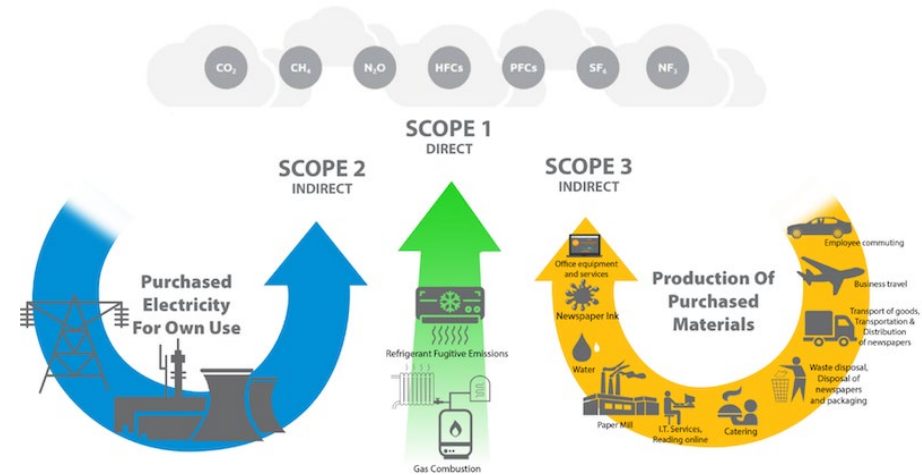


Figure 1: GHG Protocol, Scopes 1, 2, and 3 emissions. Adapted by Compare Your Footprint.

UC Climate Policies

- UC's Climate Policies
 - All campuses, including their health systems, will maintain greenhouse gas emissions at, or below, 1990 levels.
 - All campuses, including their health systems, will achieve climate neutrality from scope 1 and 2 sources by 2025.
 - All campuses, including their health systems, will achieve climate neutrality from specific scope 3 sources (as defined by Second Nature's Climate Commitment) by 2050 or sooner.



UC Energy Policies – *Key Terms*

- **Energy Use Intensity (EUI)** – total annual energy usage divided by total square footage (kBtu/ft²)
- **Clean Electricity** - electrical power generated by renewable energy (e.g., solar, wind, geothermal) or non fossil fuel sources (e.g., nuclear, large hydro)
- **Biogas** - a renewable natural gas produced from decaying organic matter (e.g., wastewater treatment, food waste, landfill gas)



UC Energy Policies

- UC's Energy Policies
 - Energy efficiency: Reduce each location's energy use intensity by an average of at least 2% annually.
 - Clean electricity: Obtain 100% clean electricity at each campus and health location by 2025. By 2018, the University's Clean Power Program will provide 100% clean electricity to participating locations.
 - On-campus combustion: Increase biogas combustion to at least 40% of on-site natural gas combustion at each campus and health location by 2025.



CA State Policies

- California Global Warming Solutions Act of 2006 (AB 32)
 - Requires California to reduce its GHG emissions to 1990 levels by 2020
 - Cap and Trade Program adopted in 2010
- The California Climate Crisis Act of 2022 (AB 1279)
 - California to achieve statewide carbon neutrality no later than 2045
 - A minimum of 85% of emissions reductions, up to 15% carbon removal
- 100% Clean Electric Grid Bill (SB 1020)
 - Creates clean energy targets of 90% by 2035 and 95% by 2040, advancing the state's trajectory to 100% clean energy by 2045.

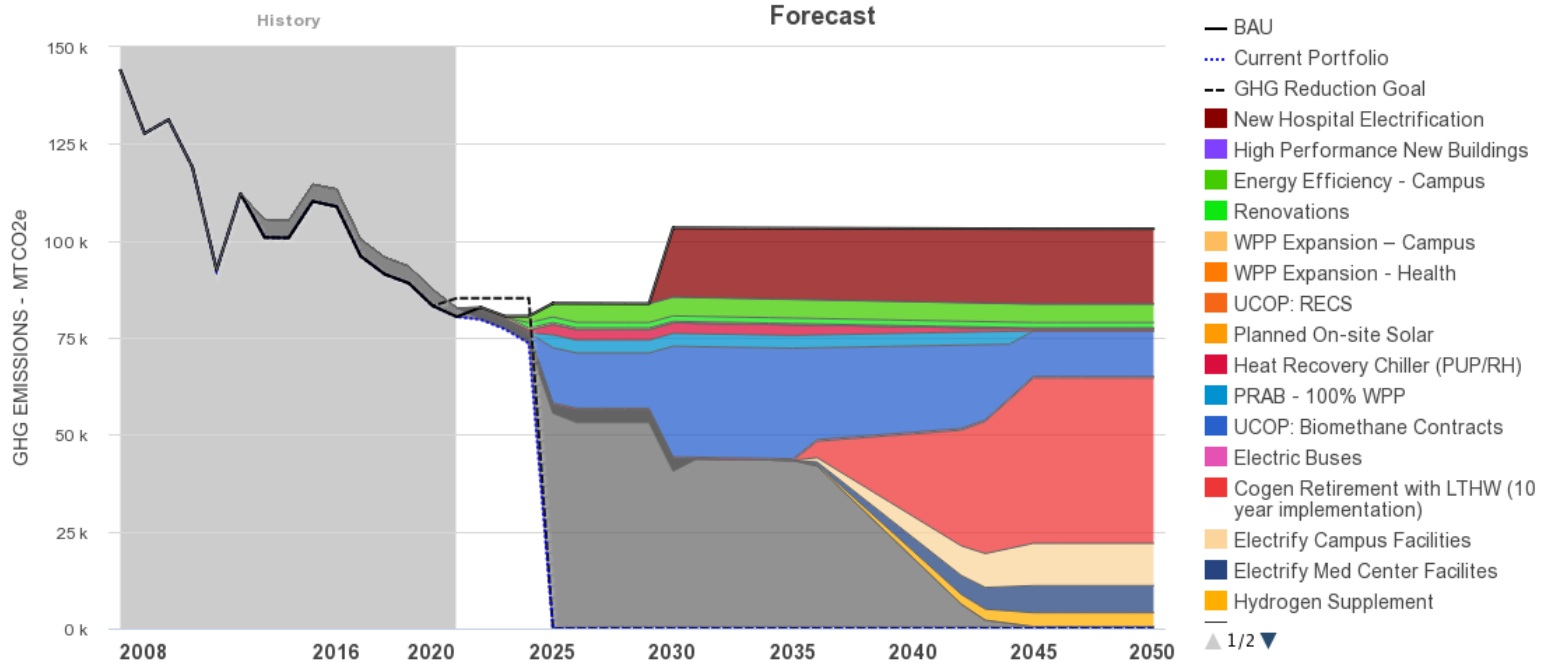


Climate Planning - *Key Terms*

- **Electrification** - replacing technologies and systems that run on fossil fuels (e.g., coal, oil, natural gas) with alternatives that run on clean electricity
- **Decarbonization** - reduction or elimination of carbon dioxide emissions
- **Carbon Offset** - a reduction or removal of GHG emissions that is used to compensate for emissions that occur elsewhere, quantified and traded as part of a commercial program – represents an emission reduction of one metric tonne (mt) of CO₂e
- **Renewable Energy Credit (REC)** - market-based instrument that represents the property rights to the environmental, social, and other non-power attributes of renewable electricity generation – represents one megawatt-hour (MWh) of electricity generated and delivered to the electricity grid from a renewable energy resource



UCSF Climate Action Plan



Carbon Offsets

- Controversial and criticized
- UC's Carbon Abatement Technical Committee developed priorities for selecting offsets
 - Cost Effective
 - High Quality - additional, real, permanent and based on science
 - Align with UC's mission – research, education, public service, and health
- Pressure from faculty and students
 - UC Academic Senate Memorial
 - Fossil Free UC Petition
- Proposed UC climate policy changes
 - Limits use of voluntary offsets
 - Redirect funds that would have been spent on offsets to direct emissions reduction projects



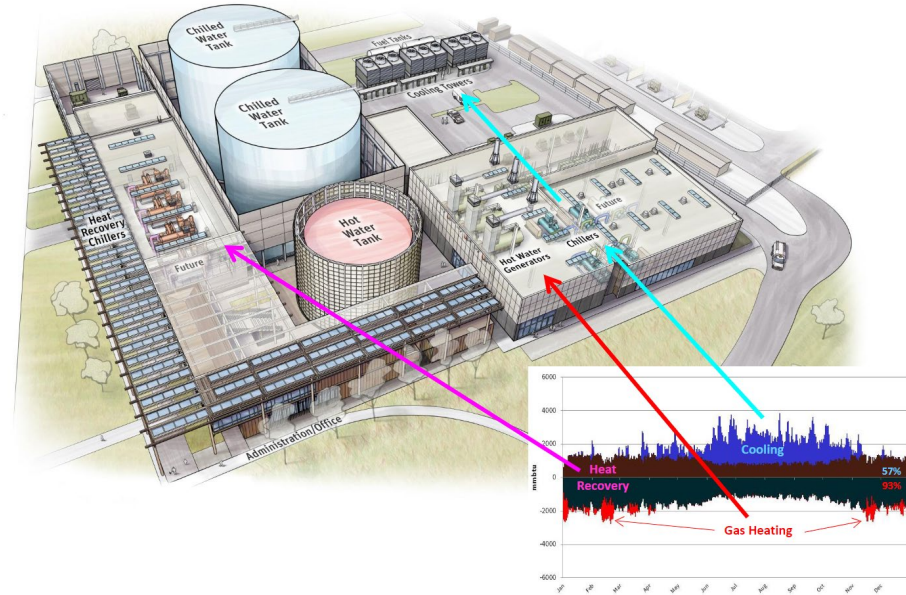
Ways to do decarbonization

- All in – complete decarbonization of campus central utilities
 - Advantage – major carbon reduction
 - Disadvantage – high capital cost - possibly mitigated by replacement costs due to end of life
- Project by Project
 - Potentially good ROI if energy savings are high enough and incentives available
 - Moderate to low ROI can be offset by other factors such as:
 - Show progress on decarbonization goals – competitive/attractive to students and faculty
 - Maintenance/Renewal – e.g. aged/failing lighting will continue to require replacements as they fail
 - Boilers require additional safety measures and personnel vs heat pumps



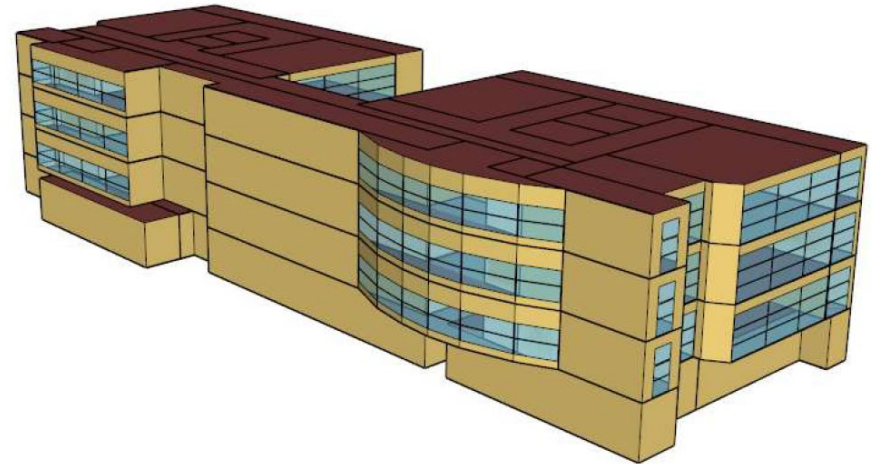
Stanford Energy System Innovation

- Replaced aging cogeneration steam/electric system with heat recovery chiller/thermal storage
- Primary Benefits
 - Reduce campus greenhouse gas emissions by 68% (and growing)
 - Reduce cooling tower water
 - Capital costs much higher over replacement in kind, but NPV is positive.



UCSF Mount Zion Cancer Research Project

- 109,600 gross square feet. Labs and Offices
- Participating in Pacific Gas & Electric's Smart Labs Incentive Program
- The project will convert the Constant Air Volume (CAV) ventilation system to Variable Air Volume (VAV)
- Estimated to save over 50% of the existing buildings energy use with significant GHG emissions savings
- Funded through partnership from the Strategic Energy Partnership, Renewal Program and Utility Incentives
- Cost of Project - \$12 million
- Facility Infrastructure Needs Funds - \$6 million
- Energy Savings
 - 1 million kWh & 120 thousand therms
 - \$300,000 annual utilities cost savings
- Utility Incentives - \$166,000
- Inflation Reduction Act incentives – \$100,000



Byers Hall Hot Water Heater Replacement – Options for Electrification of a gas fired domestic hot water commercial heater.

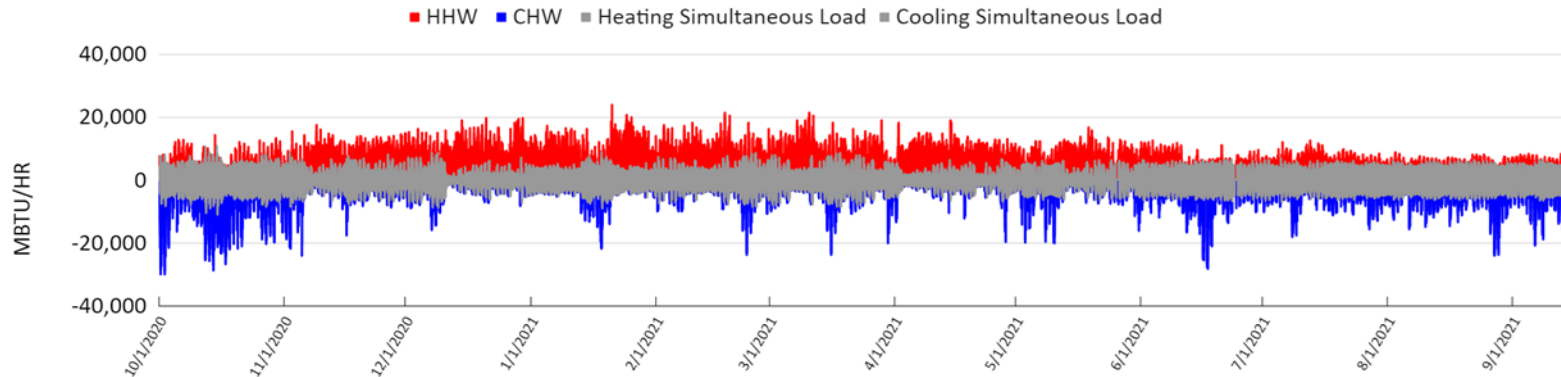
	Cost (\$)	Energy MMBTU/yr	Energy \$/yr	Payback yrs ¹	CO2 Tons/yr
Baseline		1401	16,500	NA	74
Electric Resistance	220,000	1191	60,000	NA	0
Air Sourced Heat Pump	1,000,000	677	34,600	31	0
Water Sourced Heat Pump	600,000	518	26,000	11	0



Choosing the best option – Look at payback yrs and other factors – cold weather operation, maintenance.

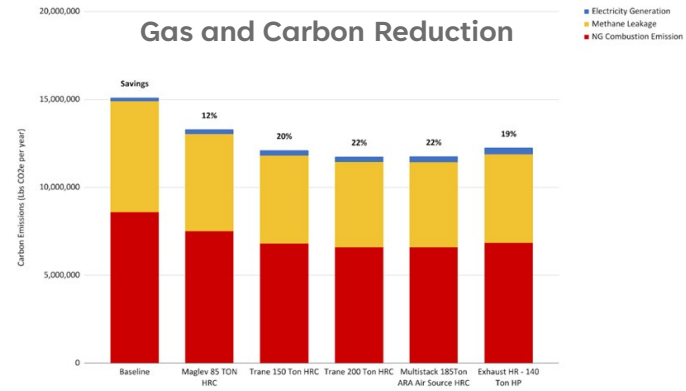
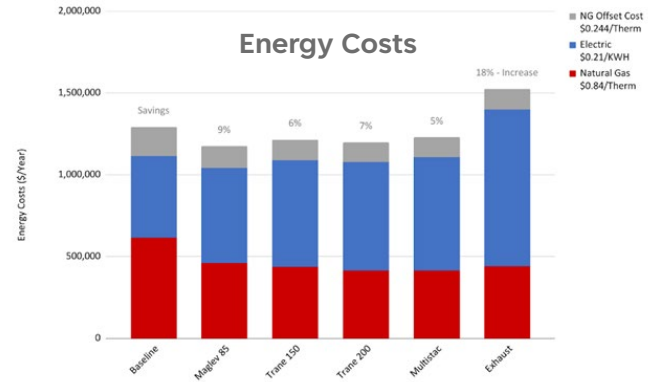
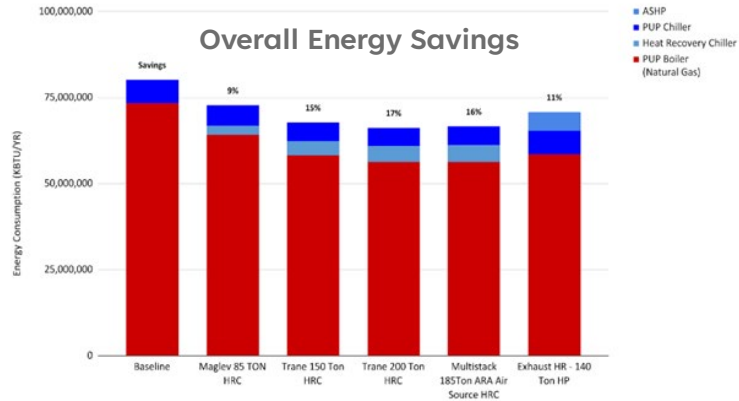
Rock Hall Heat Recovery Chiller Project

- Central utility plant provides high temperature hot water and chilled water to 5 large lab buildings on UCSF East Campus (Mission Bay).
- Installing a heat recovery chiller at one building can provide heat to this building during most months of the year and simultaneously generate a base load of chilled water year-round to all 5 buildings.



Energy and Carbon reductions for Rock Hall Heat Recovery Chiller

- Utility consumption reduced 15-17%
- Carbon reduced by 20-22% at PUP
- Utility costs reduced up to 7% incl carbon offsets savings
- Water savings of 1.5 MM gal/year



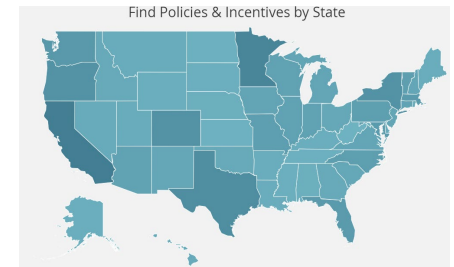
What makes a good decarbonization project?

- Well researched and planned, follows all practical energy efficiency measures, ties in with campus infrastructure now or planned
- Reduces gas and/or electric use significantly and permanently as compared to the current campus consumption
- Increases overall energy efficiency as measured by Energy Usage Index (kbtu/sqft/yr)
- Resilient – can perform in periods of interruptions, weather extremes
- Smart- comfort and lighting maintained or improved, responds to occupants, communicates with the grid



Funding Opportunities

- CA Utility Incentive Programs
 - Normalized Metered Energy Consumption (NMEC) - Whole building comprehensive energy efficiency retrofits and incentives
 - Smart Labs – Energy efficiency program that provides free technical services and financial incentives
 - Self-Generation Incentive Program (SGIP) - provides incentives to support existing, new, and emerging distributed energy resources
 - Clean Energy Optimization Pilot (CEOP) – Performance based greenhouse gas reduction program
 - California Energy Design Assistance (CEDA) Program – Energy efficiency for new construction and major renovations
 - Calculated/Deemed Rebates
- Database of State Incentives for Renewables & Efficiency
 - <https://www.dsireusa.org/>



Funding Opportunities

- On-Bill Financing (OBF) - No or low interest financing provided by public, utility or ratepayer funds is repaid through monthly utility bills
- On-Bill Repayment (OBR) – Low interest financing provided by third-party investors that is repaid through monthly utility bills
- Power Purchase Agreement (PPA) - Financial agreement where a third-party developer, installs, owns and maintains an energy system. The customer then purchases the system's electric output for a predetermined amount and period.
- Energy Service Company (ESCO) – Develop, design, build, and arrange financing for projects that save energy and reduce costs. ESCOs use the performance-based contracting methodology, where the company's compensation is directly linked to the actual energy cost savings

Sample OBF Loan Calculation

	OBF	OBF with incentive
Project Cost	\$10,000	\$10,000
Energy Efficiency incentives	\$0	-\$2,500
Loan Amount	\$10,000	\$7,500
Estimated energy savings from retrofit	\$300	\$300
Monthly loan installment billed on utility bill	\$300	\$300
Loan Term (simple payback period)	33 months	25 months

Funding Opportunities

- Inflation Reduction Act of 2022 (the IRA)
 - Provides a “Direct Pay” option for tax-exempt organizations – up to 70% of project cost
 - \$370 billion in funds for eligible projects
 - Energy efficiency, renewable and clean energy investments, fleet decarbonization, heat recovery, infrastructure improvements and other sustainability-related investments
 - Base funding with increased funding opportunities
 - Examples: projects meet prevailing wage, apprenticeship requirements, US made products, facilities located in low-income communities
- Borrowing Mechanisms
 - Bond Funding – External bond funding for energy efficiency project repaid through the Campus Purchased Utilities Budget
 - Sinking Fund – Deficit spending agreement that is repaid through the Campus Purchased Utilities Budget
- Budget Requests
 - Purchased Utilities Budget, Capital Budget, Deferred Maintenance
 - Legislative Earmark, State Budget Request



Quiz Questions

- Greenhouse gas emissions associated with your organizations commuting and air travel are an example of:**
 - Scope 1 emissions
 - Scope 2 emissions
 - Scope 3 emissions
 - Scope 1 and 3 emissions
- A financial agreement where a third-party developer, installs, owns and maintains an energy system. The customer then purchases the system's electric output for a predetermined amount and period is known as:**
 - On-Bill Financing (OBF)
 - Power Purchase Agreement (PPA)
 - On-Bill Repayment (OBR)
 - Energy Services Company (ESCO) Agreement
- What policy does not help drive on-site decarbonization?**
 - Reduce Scope 1 & 2 emissions by at least 90% no later than 2045
 - Reduce energy use intensity (EUI) by an average of at least 2% annually
 - Purchase cost effective and high-quality offsets that align with your organization's mission
 - Require the construction of new buildings to be fossil free
- Which of these reasons is not a justification for a decarbonization project**
 - Reduction of Fossil fuel use on campus is a priority
 - The project is more expensive than a replacement in kind but has lower O&M costs and energy
 - The project increases gas use without a commensurate reduction in electric consumption
 - The project is including resiliency and response to grid pricing/carbon emissions
- What is the best question to ask before reviewing the financing of a project from the engineering staff?**
 - Have you considered all viable options for energy reduction, integration with existing infrastructure?
 - Did you get three bids?
 - Is the project aligned with a campus master plan of decarbonization?
 - Are you installing the highest efficiency equipment available?





Questions?





Appendices

Summary of Key Terms

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- **Carbon dioxide equivalent (CO₂e)** - number of metric tons of CO₂ emissions with the same global warming potential as one metric ton of another greenhouse gas
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Quiz Questions – *Answers*

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UC Climate Policy – *Proposed Changes*

- Why the change?
 - Urgent Climate Crisis
 - Alignment with State & Local policies
 - UC Academic Senate – memorial passes with 83% of the vote (2022), ***“The University of California Academic Senate petitions the Regents for investments in UC’s infrastructure that will reduce on-campus fossil fuel combustion by at least 60% of current levels by 2030 and by 95% of current levels by 2035.”***
 - Fossil Free UC – petition collects 3,500 signatures (2020), ... ***We request that UC develops a detailed [shovel-ready] PLAN for true decarbonization of its energy regime for all campuses, with appropriate backups for outages....***
- Brief overview of changes
 - 90% of direct emissions reduction by 2045 with short term targets by 2030 and 2035
 - Expected to be codified Spring 2024

