Team Green Impact

The Path to Net-Zero:

Scope 1 and Scope 2 Greenhouse Gas Emission Accounting

For ASUF and The Fulton Center

Presented by
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Lesley Austin (she/ her) is a procurement specialist at Arizona Public Service. She received her undergraduate degree in Supply Chain Management from Arizona State University in 2013 and has worked in supply chain ever since. Lesley is pursuing a Masters in Sustainability Solutions from Arizona State University. Her focus area in the program is building sustainable supply chains through corporate sustainability programs that focus on ESG initiatives. Lesley hopes to work as a sustainability consultant in the future, advising businesses on how they can make their supply chains more sustainable. Lesley has worked in the supply chains of numerous industries, which has given her a wide and varied knowledge of how supply chains function.

LAUREN BOSS

Lauren Boss (she/her) is living in Tempe, Arizona where she is completing her master's degree in Sustainability Solutions at Arizona State University. She recently graduated with her Bachelor of Science in Sustainability from ASUs School of Sustainability and is currently working within Operations Sustainability for a leading roofing manufacturer, GAF. Here, she has established a background with rolling out carbon accounting platforms and working with third party sustainability claim verification processes. Following the completion of her degree, Lauren hopes to aid in encouraging sustainable practices in corporations and intends to use her skills to pursue a more just and sustainable world.

CARISSA FOWLER

Carissa Fowler (she/her) is from Tucson, Arizona where she developed a strong desire to contribute to the successful transition to a sustainable society and planet. Carissa is pursuing a Masters of Sustainability Solutions degree with Arizona State University's School of Sustainability. Her interests reside in emergency management in disaster response and recovery. Through her hazard mitigation research and graduate program knowledge, Carissa hopes to be a positive contribution to a sustainable future by providing equitable disaster relief.

Executive Summary

Project Background

Team Green Impact is partnering with the ASU Foundation (ASUF) to help calculate and work to reduce its Scope 1 and Scope 2 Greenhouse Gas (GHG) emissions. ASUF is a non-profit 501(c)3 organization that strives to be recognized as a model for A New American University Foundation (About Us, n.d.). ASUF works to manage ASU's endowments and aligns the investments with the university's mission. While ASUF is the philanthropic arm of Arizona State University (ASU), it is legally a separate entity. Because of this, the foundation is not included in ASU's sustainability reporting and must set its own sustainability goals. ASUF has set a target of becoming Net-Zero on its Scope 1, Scope 2, and Scope 3 emissions by 2035. To meet this goal, they are seeking help from Team Green Impact to reduce their Scope 1 and Scope 2 emissions, which include emissions from building facilities, purchased electricity, and chilled water. The end goal of this initiative is to remain a model university foundation for stakeholders, donors, and investors by having their own emissions data to put forth when asking their clients to reduce their footprints.

Findings

All findings for Fiscal Year 2022 are hand calculated and reported in Metric Tons of CO2e. Through our calculations, Team Green Impact found ASUF's total Scope 1 Carbon Emissions to be 47.135172 Metric Tons CO2e and their total Scope 2 Carbon Emissions to be 1028.9347697 Metric Tons CO2e. Of the Scope 2 emissions, 62% come from chilled water used to cool the building. Their total emissions for both Scope 1 & 2 were 1076.07 Metric Tons CO2e, which is equivalent to 232.2 gasoline-powered vehicles being driven for one year, or consuming 2,491 barrels of oil.

Recommendations

We set near-term, mid-term, and long-term goals for ASUF to meet their Scope 1 and Scope 2 emissions reduction goals. Team Green Impact's recommended near-term goals for the foundation are to incorporate third-party carbon accounting software, to measure and analyze emissions in the long term in future years and future buildings. We also recommend utilizing employee education and engagement to ensure social sustainability as ASUF assesses and manages its business impacts on its internal stakeholders. Making simple short-term adjustments to lighting and system operations can incentivize larger energy efficiency practices in the future. Mid-term recommendations are for the foundation to upgrade to on-site solar, and utilize WaterSense and ENERGY STAR products to reduce energy and water use, which in turn facilitate water conservation and energy efficiency efforts. Lastly, the long-term goal for ASUF is to develop a greenhouse gas emission reduction strategy that aligns with the EPA standards and the Greenhouse Gas Protocol standards, and responsibly participate in minimal offsetting and renewable energy credits. Moving forward, it is also pivotal to fully calculate ASUF's Scope 3 emissions, to get a better understanding of the Foundation's total GHG emissions.

Introduction

To limit global warming below 2 °C compared to pre-industrial levels, organizations across the globe like governments, non-profits, and corporations have been making drastic commitments to reduce their methane and greenhouse gas (GHG) emissions. Reduction is important to not only preserve the future of the planet and future generations but is also ideal for modern day business. Reducing carbon emissions provides companies with the opportunity to increase demand and build a positive reputation for voluntary GHG emission reductions. Additionally, aligning with GHG emission inventory practices can aid in managing risks and identifying reduction opportunities. On the other hand, companies that fail to reduce emissions are at risk of losing credibility and key stakeholders. Reducing greenhouse gas emissions will sustain our future and is essential for saving money, time, resources, and managing risks.

Measuring and disclosing GHG emissions come with a variety or business and operational opportunities that can improve operation performance. Below are examples of opportunities from the Greenhouse Gas Protocol Corporate Guidance:

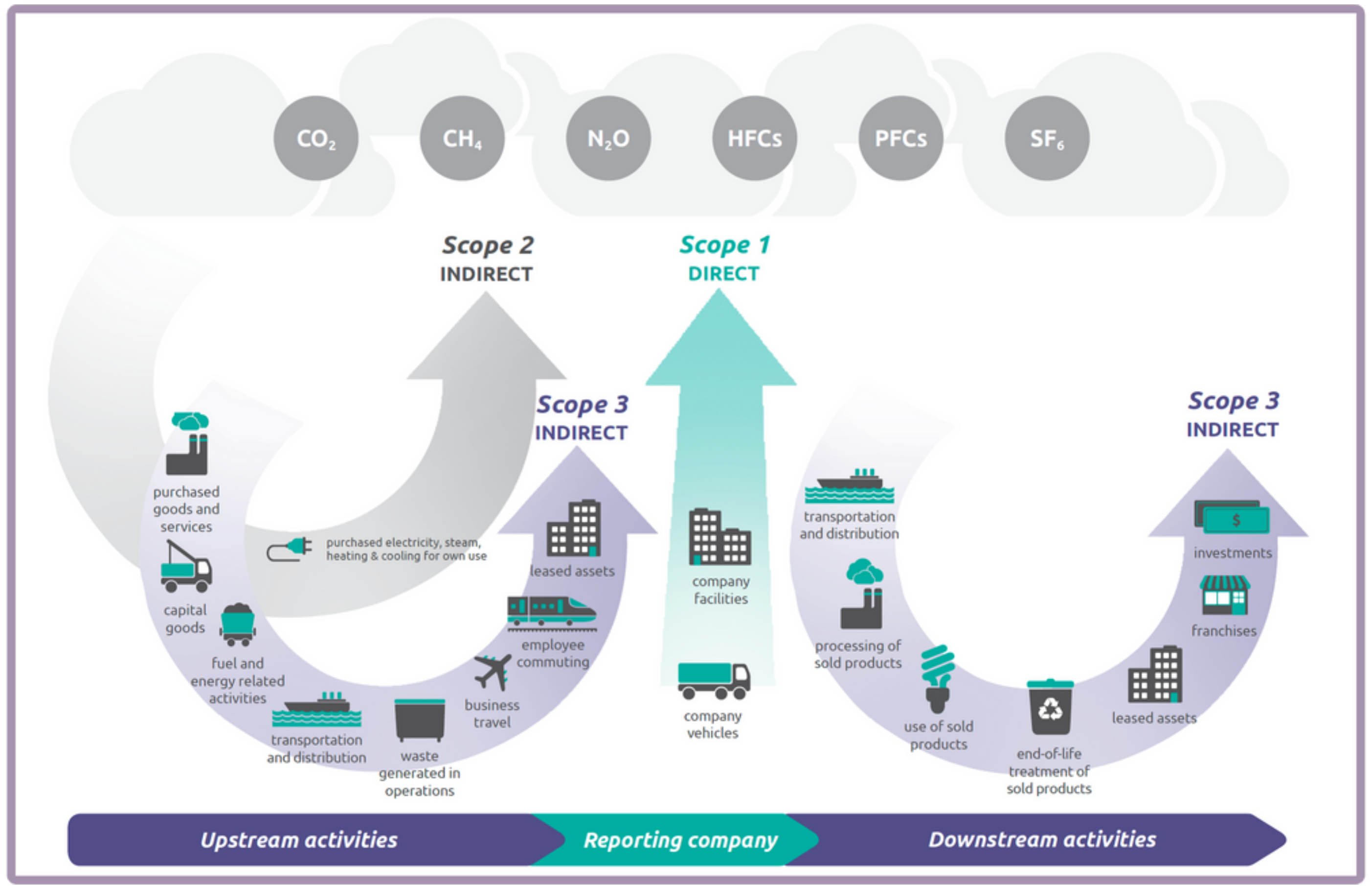
Example	Description
Efficiency and cost savings	A reduction in GHG emissions often corresponds to decreased costs and an increase in companies' operational efficiency.
Drive innovation	A comprehensive approach to GHG management provides new incentives for innovation in energy management and procurement.
Increase sales and customer loyalty	Low-emissions goods and services are increasingly more valuable to consumers, and demand will continue to grow for products made with low-carbon electricity.
Improve stakeholder relations	Improve stakeholder relationships through proactive disclosure and demonstration of environmental stewardship. Examples include demonstrating fiduciary responsibility to shareholders, informing regulators, building trust in the community, improving relationships with customers and suppliers, and increasing employee morale. *However, there may also be risks depending on whether company stakeholders are also invested in fossil fuel or high-GHG emitting resources.*
Company differentiation	External parties—including customers, investors, regulators, shareholders, and others—are increasingly interested in documented emissions reductions. Accounting and reporting scope 2 emissions with greater consistency and transparency about contractual instruments demonstrates a best practice that can differentiate companies in an increasingly environmentally conscious marketplace.

What are Greenhouse Gas Emissions?

Greenhouse gas emissions are greenhouse gasses that trap heat in the atmosphere. Carbon dioxide is the primary GHG and is produced through the burning of fossil fuels like coal, natural gas, and oil. This is the main contributor to the current global temperature rise, hence why it is essential to reduce fossil fuel burning.

There are three different types of greenhouse gas emissions: Scope 1, Scope 2, and Scope 3, seen in **Figure 1**, but for the scope of this project, Team Green Impact will focus solely on Scope 1 and Scope 2 GHG emissions.

- **Scope 1 emissions** are direct emissions from sources that are owned or controlled by the respective organizations, which includes company facilities or company vehicles. (Scope 1 and Scope 2 Inventory Guidance, 2022).
- **Scope 2 emissions** are indirect GHG emissions "associated with the purchase of electricity, stream, heat, or cooling" (Scope 1 and Scope 2 Inventory Guidance, 2022). Though most of these emissions are from a utility provider, they are included in the organization's emissions as they are used at their facility.



Defining Carbon Neutrality & Net-Zero

Carbon neutral and Net-Zero are often used interchangeably; however, there are some slight differences between the terms. **Carbon neutrality** refers to counterbalancing only carbon emissions with offsets without reducing emissions. Being carbon neutral means investing in a significant amount of offsets to meet carbon reduction targets, whereas **Net-Zero** means that all GHG emissions emitted are equal to those being removed from the atmosphere.

To become carbon neutral, companies often use carbon sinks such as forests or oceans to absorb more carbon dioxide from the atmosphere than they emit, which counteracts their emissions. These carbon sinks allow companies to portray a false image of being sustainability focused.

To be Net-Zero, however, requires a lot more effort. Companies often have to go above and beyond what they think is necessary to reduce emissions by critically examining their supply chain activities and how each step of the supply chain contributes to their overall carbon footprint. This analysis often requires looking into their supplier's supply chain to ensure that suppliers are not engaging in activities that overproduce carbon emissions and, in turn, increase the organization's carbon footprint.

GHG Emission Accounting

As organizations are looking to measure and assess their emissions, it is important to follow standards as to report and account for emissions in a universal way. For Team Green Impact's project, we utilized the Greenhouse Gas Protocol along with guidance from the U.S. Environmental Protection Agency.

The **Greenhouse Gas Protocol** has developed GHG accounting standards such as how to measure, manage, and report GHG emissions within the boundaries of an organization. These standards include corporate standards on GHG emission, GHG Protocol for cities, mitigation goal standards, corporate value chain standards, policy and action standards, and product standards. The GHG Protocol was developed by the World Resources Institute and the World Business Council for Sustainable Development. The GHG Protocol was designed to help companies prepare a GHG inventory, provide businesses with information to develop a reduction strategy, and increase transparency in GHG accounting. The overarching goal of the protocol is to ensure transparency, accuracy, completeness, consistency, relevance, and comparability within the GHG emission inventory process.

The **ISO 50001** standard provides organizations with ways that they can improve energy efficiency with an energy management system (EmS) (ISO 50001 Energy Management, n.d.). The ISO 50001 entails a framework for organizations to develop a policy, set targets, analyze, and measure data, and deploy energy management practices (ISO 50001 Energy Management, n.d.).

The **SBTi** standard criteria provides guidance and recommendations for setting Net-Zero emission targets. SBTi gives organizations a path to reduce emissions that is aligned with the Paris Agreement's goals. Over 3,500 companies worldwide are acting with SBTi to curve their current greenhouse emission path. With SBTi, organizations can develop near-term, long-term, and Net-Zero targets, communicate commitments, and align temperature targets with pre-industrial levels.

Team Green Impact

Calculating the Fulton Center's Scope 1 and Scope 2 Greenhouse Gas Emissions

Arizona State University Foundation's goal is to be net zero by 2035 in its Scope 1, Scope 2, and Scope 3 greenhouse gas emissions. To further align the foundation's tactics with ASU, ASUF has explored the idea of reducing their Scope 1 and Scope 2 emissions in their current building, the Fulton Center. ASUF is eager to consider ways in which it can reduce its environmental impact on the planet; thus, aligning the sustainable investment approach with ASUF's operational approach.

There is an urgency for change as ASUF wants to run business in a carbon neutral way, with the hopes of being a positive role model for other companies interested in endowments for ASU.

Source: ASU Fulton Center (n.d.)

Scope 1 Greenhouse Gas Emissions

Emission Factors and Global Warming Potential

For both Scope 1 and Scope 2 GHG emissions, an emission factor and Global Warming Potential (GWP) conversions will need to be made to understand the total CO2 equivalent of a building's emissions.

Emission factors describe the amount of a pollutant that is emitted per one unit of activity. The emission factors normalize the emissions in order to later combine them and get the CO2 equivalent (CO2e). These factors "are simply averages of all available data of acceptable quality, and are generally assumed to be representative of long-term averages for all facilities in the source category" and can be found in EPA carbon emission resources (Basic Information of Air Emissions Factors and Quantification, n.d.)

The Global Warming Potential describes the heat absorbed by any one greenhouse gas in the atmosphere, in relation to how much CO2 it would take to absorb the same amount. Each gas exerts energy and stays in the atmosphere differently than others, hence the GWP was developed to help compare gasses and their effects. These potentials can be found in EPA greenhouse gas emission resources.

Scope 1 Greenhouse Gas Emissions are direct emissions from sources owned or controlled by the respective organizations, including company facilities or company vehicles. Scope 1 emissions can be broken down into four categories: **stationary combustion, fugitive emissions, mobile combustion,** and **process emissions**.

Types of Scope 1 GHG Emissions:

- **Stationary Combustion**: include emissions from fuel combustion that is burned in the facility (e.g., boilers)
- **Fugitive Emissions**: emissions from equipment that leaks (e.g., refrigeration units and air conditioning)
- **Mobile Combustion**: emissions from fuel purchased for leased vehicles or mobile equipment (e.g., company vehicles)
- **Process Emissions**: GHG emissions from processes that involve chemical or physical transformations other than fuel (e.g., production of cement)

Each category has its own calculation and specific inputs for accurate calculation. For example, there are several stationary combustion sources, each with a different fuel type; therefore, calculating stationary combustion differs from calculating fugitive emissions, which have entirely separate sources. Fugitive emissions are generated from air conditions, refrigeration, and industrial gases. In contrast, stationary combustion results from boilers, combustion turbines, process heaters, and incinerators. Equipment that produces stationary combustion tends to run on natural gas, propane, coal, kerosene, or fuel oil.

Furthermore, mobile combustion focuses on emissions generated by vehicles and mobile machinery. And process emissions are GHG emissions from processes that involve chemical or physical transformations other than fuel (e.g., production of cement). For the Fulton Center, we will focus on Scope 1 greenhouse gas emissions from stationary combustion and fugitive emissions since the foundation does not have company vehicles or processes involving chemical or physical transformations.

Calculating Scope 1 Greenhouse Gas Emissions

In order to calculate stationary combustion and fugitive emissions, the source of the emissions must be identified, data collected, emissions quantified, and quality control ensured. Once the company has identified sources of emissions, it can either manually calculate its emissions using standard GHG emission calculation equations, which can be found online or utilize a carbon accounting platform. To calculate stationary combustion emissions, three fuel analysis equations can be used:

Equation 1: ***Emissions = Fuel × EF1***

- "Used when the heat content of the fuel is unknown or when fuel consumption is known only in mass or volume units" (Moretti et al., 2022).

Equation 2: ***Emissions = Fuel × HHV × EF2***

- Preferred calculation method which is utilized when the fuel usage is provided in energy units.

Equation 3: ***Emissions = Fuel x CC x 44/12***

- Recommended method when the actual carbon content of the fuel is known. This method should be used in conjunction with methods 1 & 2.

Fugitive emissions have three different calculations based on refrigeration or air conditioning equipment installation, operation, or disposal. Only the calculation for fugitive emissions operation applies to the Fulton Center. That equation is *emissions from* ***operation = C × (x ÷ 100) × T.***

Stationary Combustion Equations

Equation 1:

Emissions = Fuel x EF_1

Where:

Emissions = Mass of CO_2, CH_4, or N_2O emitted

Fuel = Mass or volume of fuel combusted

EF_1 = CO_2, CH_4, or N_2O emission factor per mass or volume unit

Equation 2:

Emissions = Fuel x HHV x EF_2

Where:

Emissions = Mass of CO_2, CH_4, or N_2O emitted

Fuel = Mass or volume of fuel combusted

HHV = Fuel heat content (higher heating value),in units of energy per mass or volume of fuel

EF_2 = CO_2, CH_4, or N_2O emission factor per energy unit

Equation 3:

Emissions = Fuel x CC x 44/12

Where:

Emissions = Mass of CO_2 emitted

Fuel = Mass or volume of fuel combusted

CC = Fuel carbon content, in units of mass of carbon per mass or volume of fuel

44/12 = ratio of molecular weights of CO_2 and carbon

Fugitive Emissions Equation

Equation 2: Estimating Emissions from Operation

Emissions from Operation = C × (x/100) x T

where:

C = refrigerant capacity of the piece of equipment

x = annual leak rate in percent of capacity

T = time in years used during the reporting period (e.g., 0.5 if used only during half of the reporting period and then disposed)

Step-by-Step

Step 1
Select the appropriate equation

Step 2
Collect Data

Step 3
Determine equation inputs

Step 4
Calculate emissions

Source: epa.gov

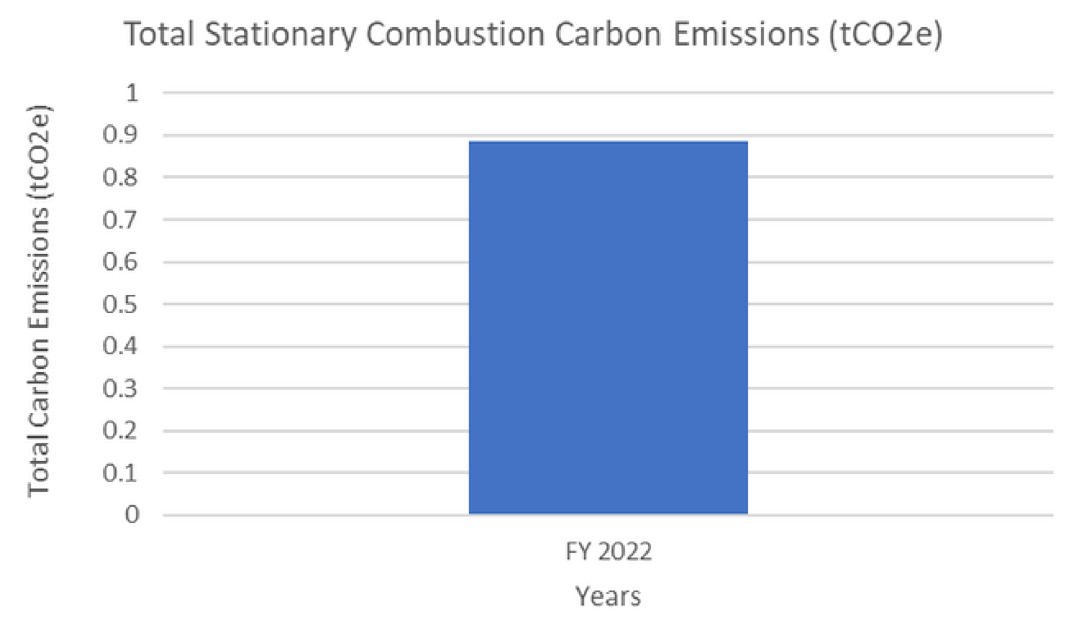
Calculating the Fulton Center's Stationary Combustion GHG Emissions

Determining Equation Parameters

Team Green Impact, was given the stationary combustion data for the Fulton Center's diesel generator. This generator was run once in fiscal year 2022 for 5.8 hours using 14.9 gallons of diesel per hour at a 50% load. Using the EPA's equation Fuel x HHV xEF2, the EPA's default inputs for emissions factor (EF), and heat content (HHV), we calculated tons of CO_2 emitted by the Fulton Center from stationary combustion.

Methodology

Calculating the metric tons of CO_2 emitted required figuring out diesel's emissions factor and heat content (HHV). Diesel is categorized by the EPA as distillate fuel oil no 2, with an emissions factor of 73.96 kg CO_2 per mmBtu and an HHV of 0.138 mmBtu per gallon. For an accurate calculation, it is also necessary to know the metric tons per kilogram of CH_4 and N_2O emitted from the generator. After the metric tons per kilogram have been found, CH_4 and N_2O must be converted to CO_2 equivalent emissions using the EPA's default global warming potential (GWP) factor. Once CH_4 and N_2O have been converted, all three numbers are added to find the total metric tons of CO_2 emitted: **.89 metric tons of CO2e**



Stationary Combustion CO2e Calculation

1. Emission Factor Conversion:

- **CO_2: 73.96 kg CO_2/mmBtu**
  - 86.42gal * 0.138 mmBtu/ gal * 73.96 kg CO_2/ mmBtu = 882.3482 kg
- **CH_4: 0.41 g CH_4/gal**
  - 86.42 gal * 0.41 g CH_4/gal = 35.4322 g CH_4
  - 35.4322/1000 = 0.0354322kg (*convert grams to kg)
- **N_2O: 0.08 g N_2O/gal**
  - 86.42gal * .08 g N_2O/gal= 6.9136 g N_2O
  - 6.9136/1000 = 0.0069136kg(*convert grams to kg)

2. Emissions are converted to CO_2 equivalent emissions using GWP factor:

- **CO_2: 1**
  - 882.3482 kg * 1 GWP = **882.3482 kg CO2e**
- **CH_4: 28**
  - 0.0354322kg * 28 GWP =**0.9921016 kg CO2e**
- **N_2O: 265**
  - 0.0069136 * 265 GWP=**1.832104 kg CO2e**

3. Metric Ton Conversion (1 kg = 0.001 metric ton)

882.3482 + 0.9921016 +1.832104= 885.1724056 kg CO2e

885.1724056 * 0.001 (metric ton conversion) =

0.8851724056 metric tons CO2e from stationary combustion

Calculating the Fulton Center's Fugitive GHG Emissions

Determining Equation Parameters

The Fulton Center's fugitive emissions are made of two refrigerants, R22 and R410A. Seasonal Energy Efficiency Ratio (SEER) ratings are a way to measure the seasonal energy efficiency of HVAC units. The R22 refrigerant has a SEER rating of 10, and the R410A refrigerant has a 12 SEER rating.

We could not use the EPA formula, C × (x/100) x T, to calculate the Fulton's Center's emissions from operating because that formula required knowledge of the leak rate of the refrigerant equipment, and ASU does not measure its HVAC leak rates. Instead, we were given the total metric tons of CO2 emitted from refrigerants for ASU as a whole, which was 7,621 tCO2e, and we were given the total university square footage, 26,740,566. We used these numbers and the square footage of the Fulton Center, 162,293, to calculate refrigerant emissions.

Methodology

In order to find fugitive emissions for the Fulton Center, we divided the total metric tons of CO2 from refrigerants emitted by the university by the university's total square footage, then multiplied that number by the square footage of the Fulton Center.

Fugitive Carbon Emissions Calculation

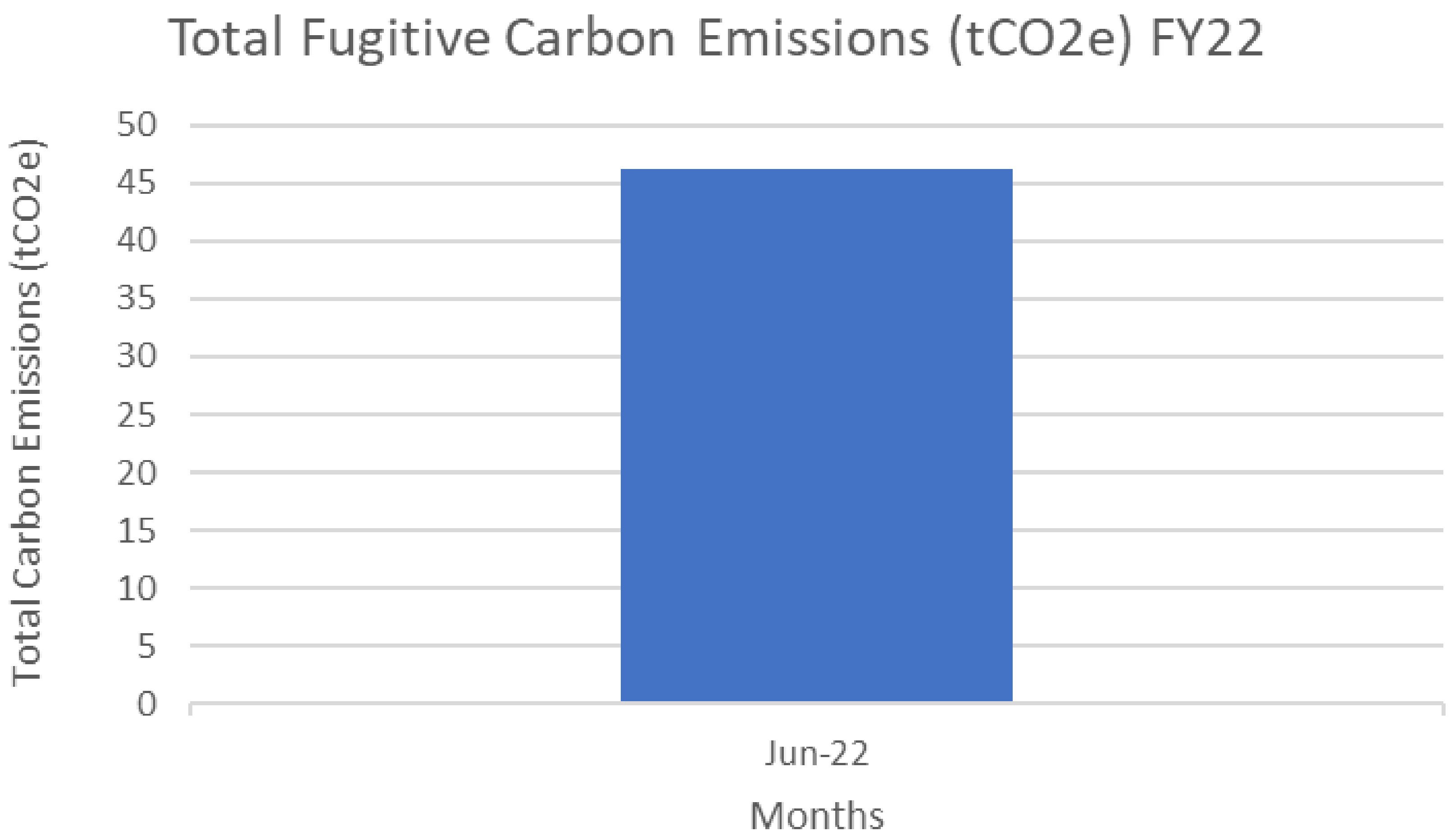
Total tCO2e refrigerant= **7,621 tCO2e**

Total ASU square footage= **26,740,566 sqft**

Fulton square footage= **162,293 sqft**

7,621 tCO2e/26,740,566 sqft*(162,293sqft) =

46.25 metric tons tCO2e from fugitive emissions



Scope 2 Greenhouse Gas Emissions

Scope 2 emissions are indirect GHG emissions that result from the generation of purchase electricity such as **gas, steam, heating, cooling,** and **electricity**.

- Scope 2 greenhouse gas emissions globally represent the largest sources of GHG emissions, with heat and electricity accounting for at least a third of global GHG emissions (GHG Protocol Scope 2 Guidance, 2020).
- Purchased electricity has its own Scope because electricity is easier to offset than other indirect emission sources.

Types of Scope 2 GHG Emissions:

- **Electricity**: Used to operate machines, heating and cooling systems, lighting, and building operations.
- **Steam**: Used for mechanical work.
- **Heat**: Produced from electricity or through solar thermal heat or combustion processes.
- **Cooling**: Produced from electricity or through cooled air or chilled water.

To calculate indirect greenhouse gas emissions like purchased electricity, heat, and steam, organization's must identify emission sources, develop inventory and operational boundaries, collect data, and quantify emissions. Once the company has identified sources of emissions, calculations can be manually calculated using EPA resources and the GHG Protocol Guidance, or through a third-party carbon accounting platform.

There are two ways organizations can measure their Scope 2 emissions: a location-based approach and a market-based approach.

- **Location-based methods** approximates the GHG emissions that are emitted into the atmosphere from energy that is delivered to the organization. This type of accounting is required for all companies that look to report their Scope 2 GHG emissions, relying on data from where the energy is consumed at the grid (Persefoni, n.d.). The location-based method looks at energy generation for a region and "is based on statistical emissions information and electricity output aggregated and averaged within a defined geographic boundary and during a defined time period" (GHG Protocol Scope 2 Guidance, 2020). Measuring Scope 2 emissions with a location-based method discloses to the organization the physical impacts of its operations without market influences.

- **Market-based methods** measure purchased energy based on how an organization buys its energy. This method measured purchased energy based on how the organization buys energy and associated attributes. Decisions for these purchases can be supported by contractual instruments. Instruments can include: Power Purchase Agreement (PPA) which is an investment in renewable energy projects, Supplier Specific Contract which focuses on purchasing products with lower emissions, and Energy Attribute Certificates (EACs) such as Renewable Energy Credits (RECs).

Calculating Scope 2 Purchased Electricity Emissions

As recommended by the EPA, steps to calculate emissions from purchased electricity include:

Step 1

Determine the amount of electricity produced

- Can be found in utility bills, typically in kilowatt-hours (kWh) or megawatt-hours (MWh) units.
- A common unit for cooling is ton-hour (equalling 12,000 Btu)

Step 2

Determine emission factors

- Emission factors reflect the energy resource used "and the efficiency of converting input energy into useful energy output" (GHG Inventory Guidance, n.d.).
- For a location-based method (the method Team Green Impact used), there are three options for emission factors:
    - **Direct Line Emission Factor**: electricity purchased through a direct line connection as opposed to an electricity distribution grid.
    - **Regional Emission Factor** (used by Team Green Impact): emission factor based on geographic location of the grid facility. For the U.S. "the recommended regional factors are the total output subregion grid factors published by the EPA's Emission & Generation Resource Integrated Database (eGRID)" (GHG Inventory Guidance, n.d.). To figure out the regional emission factor, utilize the EPA's GHG Emission Factors Hub or the Climate Registry.
    - **National Emission Factor**: national average emission factor published by the International Energy Agency.

Step 3

Calculate emissions using Equation 1

Equation 1:

Emissions = Electricity x EF

Where:

Emissions = Mass of CO_2, CH_4, or N_2O emitted

Electricity = Quantity of electricity purchased

EF = CO_2, CH_4, or N_2O emission factor

*This same approach/equation adheres to purchased heat, steam, and cooling.

Source: epa.gov

Calculating the Fulton Center's Purchased Electricity GHG Emissions

Determining Equation Parameters

Team Green Impact was provided a years worth of electricity use data in kWh (July 2021 - June 2022). The electricity for the Fulton Center is provided by APS, Arizona Public Service company that is located near the ASU campus, and purchased heating is included in the total purchased electricity.

Methodology

We used a location-based accounting method with a regional eGRID emission factor (819.7 CO_2 kg/MWh, 0.023586803 CH_4 kg/MWh, 0.0031751466 N_2O kg/MWh) specific to the Arizona Southwest region (AZNM) 2023 emission factors provided by the EPA. We were able to calculate the Fulton Center's purchased electricity GHG emissions based on their yearly electricity use in kWh and the Greenhouse Gas Protocol equation.

Step 1 was to obtain the 1,047,312 kwh electricity use from the Fulton Center's utility bill.

Step 2 we converted grams to kg using the conversion kg conversion 0.001.

Step 3 was to convert to CO_2e by multiplying by the kg from the emission factor calculation by the Global Warming Potential (GWP) (GWP of CO_2 = 1, GWP of CH_4 = 28, GWP of N_2O = 265).

Step 4 added all the kg CO_2e results from the GWP conversions and multiplied the metric tons conversion (1 kg = 0.001 metric ton) to get the metric tons CO_2 equivalent which equals the total carbon emissions from Purchased Electricity of **390.97 metric tons CO_2e**

Purchased Electricity CO_2e Calculation

1. Emission Factor Conversion using eGRID for AZMN:

- **CO_2: 371.80967 kg/MWh**
  - **371.80967** kg/MWh * 1,047,312 kWh = 389,400,729.107 grams * 0.001 (kg conversion) = **389,400.73 kg**
- **CH_4: 0.023586803 kg/MWh**
  - 0.023586803 kg/MWh * 1,047,312 kWh = 24,702.74 grams * 0.001 (kg conversion) = **24.70 kg**
- **N_2O: 0.0031751466 kg/MWh**
  - 0.0031751466 kg/MWh * 1,047,312 kWh = 3,325.37 grams * 0.001 (kg conversion) = **3.33 kg**

2. Emissions are converted to CO_2 equivalent emissions using GWP factor:

- **CO_2: 1**
  - 389,400.73 kg x 1 GWP = 389,400.73 kg CO_2e
- **CH_4: 28**
  - 24.70 kg x 28 GWP = 691.68 kg CO_2e
- **N_2O: 265**
  - 3.33 kg x 265 GWP = 881.22 kg CO_2e

3. Metric Ton Conversion (1 kg = 0.001 metric ton)

(389,400.73 + 691.68 + 881.22) kg CO_2e * 0.001 (metric ton conversion) =

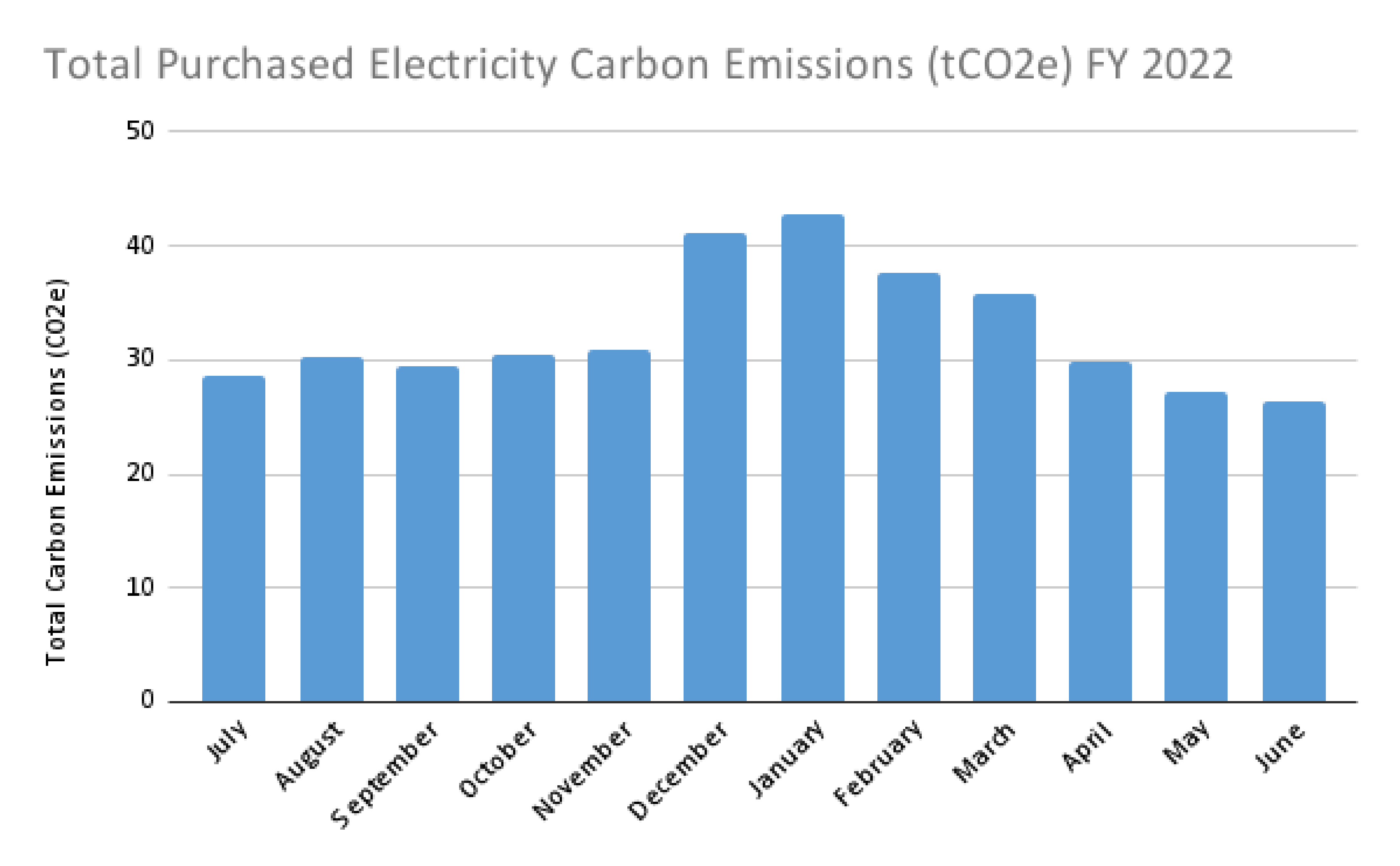
390.97 metric tons CO_2e from purchased electricity

Summary of Fulton Center Scope 2 Purchased Electricity

Use (FY 2022)	July	Aug.	Sept.	Oct.	Nov.	Dec	Jan.	Feb.	Mar.	April	May	June	Total
electric/ kWh	76,652	81,323	79,137	81,682	82,946	110,118	114,849	100,848	95,925	80,264	72,853	70,714	1,047,312
tCO2e	28.6149398	30.36	29.54	30.50	31.00	41.11	42.90	37.65	35.81	30.00	27.20	26.40	390.97

FY22 Total Emissions

FY22 monthly break down of carbon emissions from purchased electricity



Calculating Scope 2 Chilled Water Emissions

Determining Equation Parameters

We met with the ASU Sustainable Practices team to help determine the parameters for this calculation to find out how ASU, as a whole, calculates chilled water emissions. Through our meeting, we found that we needed emissions factors for CO_2, CH_4, and N_2O, the common greenhouse gasses that are used to determine CO_2e, which we got from the Sustainability Indicator Management & Analysis Platform (SIMAP). Efficiency for electric chillers is standard, so ASU uses fixed emissions factors from the SIMAP tool.

Following this, we also needed to determine the Global Warming Potential (GWP) for each of the pollutants. We utilized the most recent EPA GWP numbers for each of the GHGs.

Methodology

To calculate the chilled water emissions;

Step 1 was converting the Fulton Center chilled water usage data that was given to us in Ton Hours into MMBTU. This was necessary because ton hours is a unit of energy rather than an energy quantity (like MMBTU) that was necessary for this equation. These processes were completed for every month in FY22, but for the purposes of being concise, we have only broken down the calculations for the total emissions from FY22.

Step 2 involved taking the total MMBTU, and multiplying it by each emissions factor, 3 times (for CO_2, CH_4, and N_2O).

Step 3 took the answers from the emissions factors and converted them into CO_2 equivalent emissions using the GWP factors for each pollutant.

Step 4 added all three answers together and multiplied it by 0.001 to convert the units into Metric Tons of CO_2e. Following this, we found that the total chilled water emissions for the Fulton Center in FY22 are **637.96 Metric Tons CO_2e**.

Chilled Water CO_2e Calculation

1. Converting Chilled Water in Ton Hours to MMBTU:

1 Refrigeration Ton Hour = 0.012 MMBTU

728,770 ton hours * 0.012 MMBTU = 8745.26 MMBTU

2. Emission Factor Conversion

- **CO_2: 72.622704 kg**
  - 8745.26 MMBTU * 72.622704 kg CO_2 = 635,104.43 kg CO_2/MMBTU
- **CH_4: 0.0081078 kg**
  - 8745.26 MMBTU * 0.0081078 kg CH_4 = 70.90 kg CH_4/MMBTU
- **N_2O: 0.000376 kg**
  - 8745.26 MMBTU * 0.000376 kg N_2O = 3.29 kg N_2O/MMBTU

3. Emissions are converted to CO_2 equivalent emissions using GWP factor:

- **CO_2: 1**
  - 635,104.43 kg CO_2/MMBTU * 1 GWP = 635,104.43 kg CO_2e
- **CH_4: 28**
  - 70.90 kg CH_4/MMBTU * 28 GWP = 1,985.33 kg CO_2e
- **N_2O: 265**
  - 3.29 kg N_2O/MMBTU * 265 GWP = 871.38 kg CO_2e

4. Metric Ton Conversion (1 kg = 0.001 metric ton)

(635,104.43 + 1,985.33 + 871.38) kg CO_2e * 0.001 (metric ton conversion) =

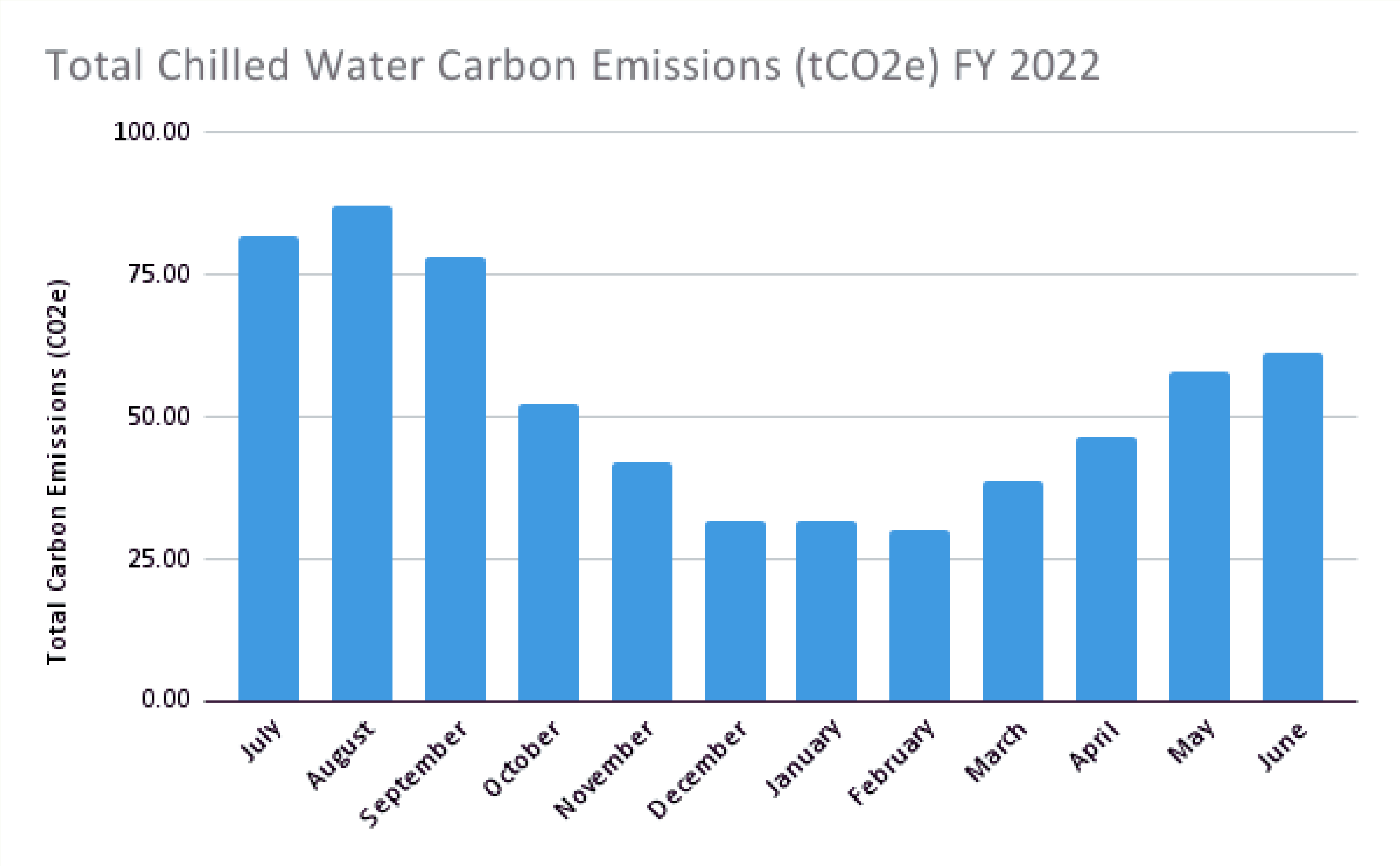
637.96 Metric Tons CO_2e from Chilled Water

Summary of Fulton Center Scope 2 Chilled Water Emissions

Use (FY 2022)	July	Aug.	Sept.	Oct.	Nov.	Dec	Jan.	Feb.	March	April	May	June	Total
chilled water -- tons/hrs	93,501	99,524	89,138	59,679	47,473	35,722	35,923	34,149	44,196	53,311	66,277	69,878	728,770
tCO2e	81.85	87.12	78.03	52.24	42.07	31.65	31.83	30.26	38.69	46.67	58.02	61.17	637.96

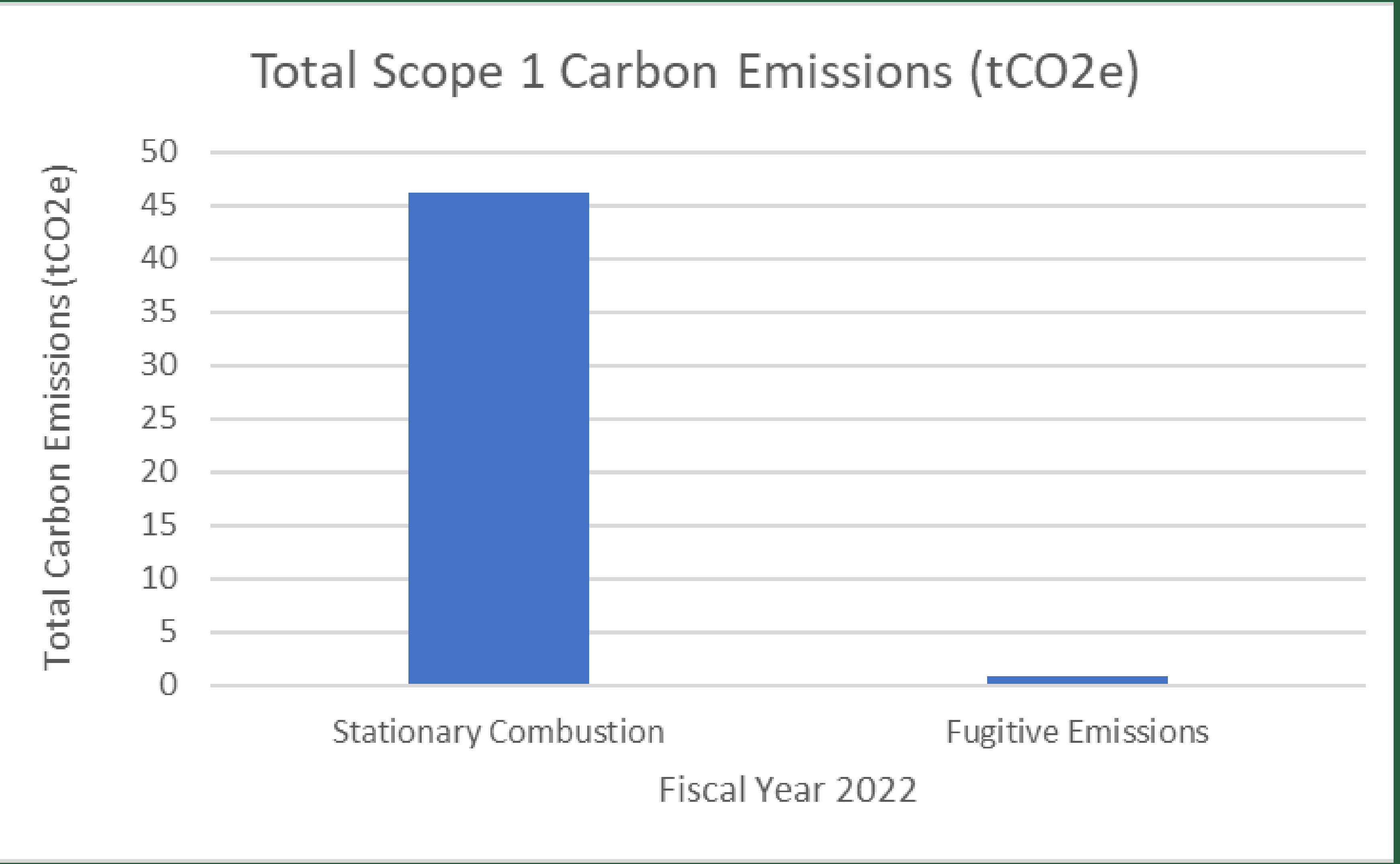
FY22 Total Emissions

FY22 monthly break down of carbon emissions from chilled water usage



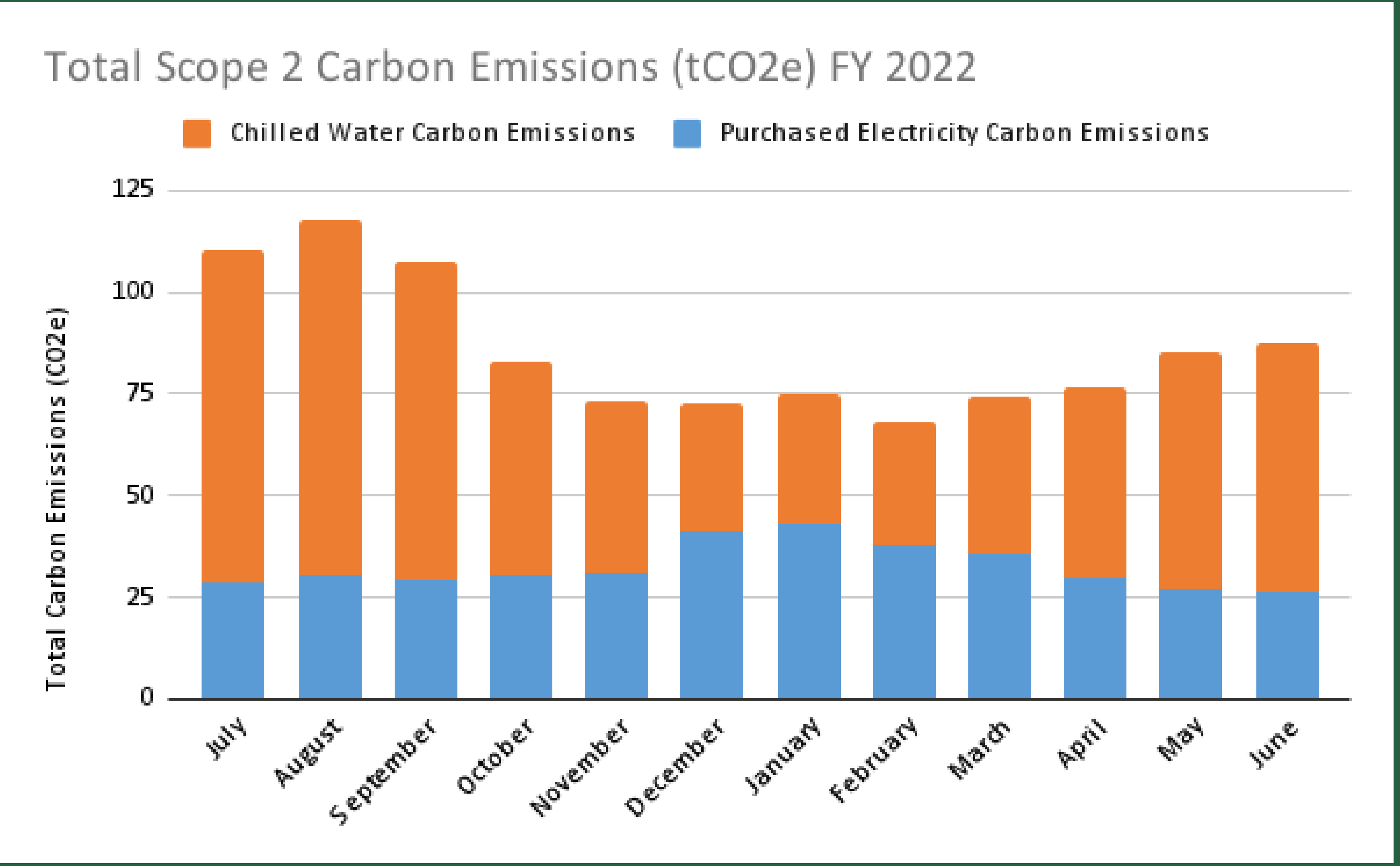
Total Greenhouse Gas Emissions for the Fulton Center

Scope 1



Total Scope 1 Carbon Emissions for the Fulton Center FY 2022: **47.135172 Metric Tons CO2e**

Scope 2



Total Scope 2 Carbon Emissions for the Fulton Center FY 2022: **1028.9347697 Metric Tons CO2e**

Total Scope 1 and Scope 2 Carbon Emissions for the Fulton Center FY 2022: **1076.0699417 Metric Tons CO2e**

Understanding the Fulton Center's Carbon Emissions

Measuring carbon emissions is just the first step in reducing your carbon footprint. To understand your impact, it is useful to assess measured emissions in a way that is more generally understood by the general public such as comparing them to gas powered vehicles or barrels of coal consumed like the examples below. Below is also an assessment of how the Fulton Center is carbon neutral in Scope 1 and Scope 2 emissions -- this Net-Zero status does NOT apply to the Foundation's Scope 3 GHG emissions. Those will have to be measured and assessed separately.

Scope 1 emissions are direct greenhouse gas emissions from sources controlled or owned by an organization. The Fulton Center has two refrigerants, R22 and R410A, and one diesel generator.

Using equations and emission factors from the Greenhouse Gas Protocol and the Environmental Protection Agency, The Fulton Center's Scope 1 carbon emissions for FY22 is **47.14 Metric Tons CO2e, 0.046%** of the Fulton Center's total carbon emissions**.** This is equivalent to 10.2 gasoline-powered passenger vehicles driven for one year and 109 barrels of oil consumed.

Current Net-Zero Information:

According to ASU, as the foundation is housed in a building that is part of ASU's campus, the Fulton Center's Scope 1 emissions are offset through carbon sequestration through Urban Forestry as well as the Carbon Sink and Learning Forest at ASU West, making The Fulton Center carbon neutral for Scope 1 carbon emissions. The Urban Forest is a collaborative effort with Phoenix, Scottsdale, and Tempe to increase tree canopy cover in the Valley.

Scope 2 emissions are indirect greenhouse gas emissions associated with the purchase of electricity, steam, heat, or cooling. The Fulton Center purchases electricity from APS which includes heating, and get chilled water from the ASU Combined Heat & Power Plant.

Using equations and emission factors from the Greenhouse Gas Protocol and the Environmental Protection Agency, The Fulton Center's Scope 2 carbon emissions for FY22 is **1028.93 Metric Tons CO2e, 99.94%** of the Fulton Center's total carbon emissions**.** This is equivalent to 222 gasoline-powered passenger vehicles driven for one year and 2,382 barrels of oil consumed

Current Net-Zero Information:

According to ASU, as the foundation is housed in a building that is part of ASU's campus, the Fulton Center's Scope 2 emissions are matched with Renewable Energy Credits (RECs) purchased through the ASU Red Rock Solar Project, making The Fulton Center carbon neutral for Scope 2 carbon emissions. This includes emissions from chilled water as the chillers are chilled electrically.

While the Fulton Center is technically carbon neutral, there is still room for improvement. For example, the Fulton Center's current HVAC systems use R22 and R410A refrigerants; both have low SEER ratings (average 10 for R22 and 12 for R410A), meaning the Fulton Center has low-efficiency HVAC units. The new highest SEER rating is 24, and the lowest is 13. Additionally, the R22 unit is so damaging to the ozone layer that the EPA is phasing out all production of R22 as well as the R410A refrigerant. This means that the Fulton Center will eventually have to replace its HVAC units before the refrigerants are phased out.

Team Green Impact

Estimated GHG Emissions for NOVUS Building: Purchased Electricity

ASUF's new building at NOVUS required a different approach to calculating emissions than what we did for the Fulton Center. As construction still has not started, there is no physical building to get electricity usage from in order to find Scope 2 emissions.

Because of this, we hand-calculated the potential emissions parameters, considering the estimated square footage of the building, what the building would be used for, and other environmental factors.

Scope 1 was not calculated for the possible NOVUS building, as we could not confirm whether or not natural gas would be used for the building.

Estimated GHG Emissions for NOVUS Building: Purchased Electricity

Determining Equation Parameters

We utilized the EPA and their established spreadsheets to calculate emissions for Electricity usage using; The intended zip code of NOVUS; The climate zone it will be in (in this case it was classified as "Hot/Very hot"); The intended square footage of the building; and The type of building (in this case, it would be used for office purposes).

EPA Energy Intensity calculations for a building over 100,000 sqft;

Hot or very hot climate: 16 kwh/SqFt
Building dedicated to office use: 14.9 kwh/SqFt
Average = 16 + 14.9 / 2 = **15.45 BKWH**

Methodology

Using an EPA spreadsheet, we got the Energy Intensity numbers for a building of this size & purpose. We then took those two numbers and averaged them, as the equation only calls for one energy intensity number, but we felt that both parameters were influential to the results. Following this, we used similar calculations from the Fulton Center's purchased electricity by first multiplying the eGRID Southwest Region EPA Emission Factor by the kWh of estimated purchased electricity. Then, we converted those numbers to kilograms so we could multiple by the global warming potentials for C2O, CH_4, and N_2O. Using those results, we added the kilograms of CO_2e, then multiplied by the metric ton conversion (0.001) to get **957.84 metric tons of CO_2e**.

Purchased Electricity CO_2e Calculation

EIA Equation = 15.45 x 166,070 GSF
= **2,565,781.5 kWh**

Emission Factor Conversion using eGRID for AZMN:

- **CO_2: 371.80967 kg/MWh**
  - 371.80967 kg/MWh * 12,565,781.5 kWh = 953,982,372.8 grams * 0.001 (kg conversion) = **953,982.37 kg**
- **CH_4: 0.023586803 kg/MWh**
  - 0.023586803 kg/MWh * 2,565,781.5 kWh = 60,518.58 grams * 0.001 (kg conversion) = **60.52 kg**
- **N_2O: 0.0031751466 kg/MWh**
  - 0.0031751466 kg/MWh * 2,565,781.5 kWh = 8146.73 grams * 0.001 (kg conversion) = **8.15 kg**

2. Emissions are converted to CO_2 equivalent emissions using GWP factor:

- **CO_2: 1**
  - 953,982.37 kg x 1 GWP = 953,982.37 kg CO_2e
- **CH_4: 28**
  - 60.52 kg x 28 GWP = 1,694.52 kg CO_2e
- **N_2O: 265**
  - 8.15 kg x 265 GWP = 2,158.88 kg CO_2e

3. Metric Ton Conversion (1 kg = 0.001 metric ton)

(953,982.37 + 61,694.52 + 2,158.88) kg CO_2e * 0.001 (metric ton conversion) =

957.84 metric tons CO_2e from purchased electricity

Team Green Impact

GHG Emissions Reduction Recommendations

One deliverable that was assigned to Team Green Impact was to develop recommendations for near-term, mid-term, and long-term GHG emission reductions. The following slides detail our general recommendations to help ASUF reduce its Greenhouse Gas Emissions. Our emission reduction practices are based on best practices from other organizations, such as calculating carbon emissions, upgrading to energy-efficient products, and engaging in rating systems. We also developed low impact relocation recommendations for the foundation's future building, as well as potential reduction challenges.

Short-Term Recommendations: Basic Efficiency

LED Lighting

Lighting makes up 17% of commercial building electricity (Upgrade Your Lighting, n.d.), making upgrading to more efficient lighting an essential step in being more energy efficient. Upgrading lighting to LEDs can improve lighting lifetime, lasting 15+ times longer than fluorescent, incandescent, halogen, HID, or T12 lighting – depending on the bulb (Upgrade Your Lighting, n.d.). ENERGY STAR LEDs are preferred for many organizations, as ENERGY STAR protocol requires LEDs to be tested by accredited labs to meet strict efficiency guidelines and criteria (Upgrade Your Lighting, n.d.). In general, upgrading to LED lighting can reduce expenses and advance the organization’s dedication to being more energy efficient.

KEY POINTS

- Utilizing system performance through employee education and engagement can ensure social sustainability as ASUF assesses and manages its business impacts on its internal stakeholders.
- Making simple short-term adjustments to lighting and system operations can incentivize larger energy efficiency practices in the future

Utilize System Performance

Having better operation and maintenance practices can ensure that all utilities are working efficiently and effectively. Routinely assessing, implementing, documenting, and tracking savings can ensure that operations run smoothly, especially when installing new technologies or appliances. It is suggested that automatic controls and scheduling equipment to operate only when needed will be key to optimize efficient operations, ensuring the organization takes full advantage of the system's capabilities. Performing periodic reviews of system schedules, after–hours walk-throughs, seasonally adjusted strategies, and tracking performance are all ways to improve maintenance and efficiency measures (Operation and Maintenance Best Practices for Energy-Efficient Building, n.d.).

To ensure all equipment and appliances are running efficiently and effectively, Team Green Impact recommends partnering with GreenCircle Certified. GreenCircle is an unbiased third party company that verifies sustainability claims surrounding products and operations. This company can be utilized as an auditing step, and evaluate the state of the Fulton Center’s current HVAC systems, water fixtures, waste practices, etc. ASU does not measure refrigerant leakage from their HVAC units on a specific building scale, so GreenCircle can help find ways to save money in daily operations or invest in more sustainable alternatives.

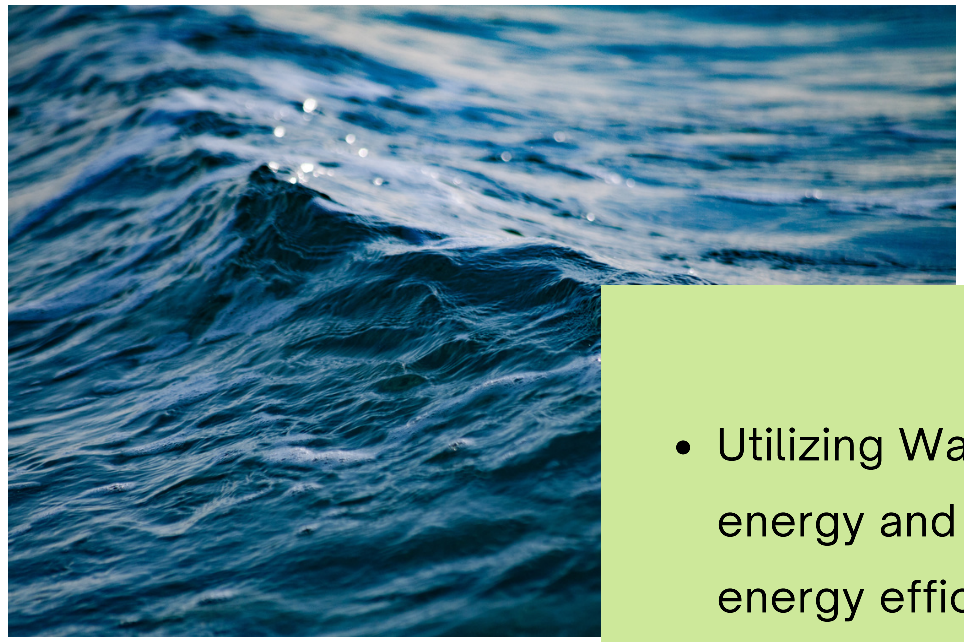
Mid-Term Recommendations: Efficient Equipment & Appliances

ENERGY STAR

A best practice for ensuring an efficient building is adopting ENERGY STAR products like efficient lighting, refrigerators and dishwashers, water heating appliances, and other office equipment. It is important to consider budget when purchasing more efficient systems, especially when considering ENERGY STAR products, as they are top-performance rated systems. ENERGY STAR labeled appliances use 10%-50% less energy, which can save organizations money. This assessment, paired with GHG emission inventory, can lead organizations to make more energy efficient product/system decisions that pair nicely with ENERGY STAR guidelines. Additionally, buildings with ENERGY STAR certification use, on average, 35% less energy and generate 35% less greenhouse gas emissions than similar buildings (Media FAQs about ENERGY STAR for Commercial and Industrial Buildings, n.d.), so it is recommended that the foundation get ENERGY STAR Building Certified in their new building.

WaterSense

As part of our deliverables, we were instructed to identify strategies to implement sustainability on other environmental levels such as water conservation. It is important to consider improving water efficiency as it lightly relates to energy use, specifically Scope 2 GHG emissions. Water use, including irrigation and indoor water practices, requires electricity to operate; thus, improving water efficiency will improve energy efficiency. Toilets, urinals, and outdoor water use can all be made more efficient through WaterSense's best management practices and products. WaterSense at Work is partnered with the EPA and offers ways for customers to identify and improve their water efficiency. The WaterSense labels on products are certified to use at least 20% less water while saving energy and improving performance metrics (About WaterSense, n.d.). Installing WaterSense-certified toilets, faucets, dishwashers, and irrigation equipment can save organizations hours of electricity, gallons of water, and money. Additionally, implementing water-efficient best practices can achieve cost savings, increase competitive advantage, reduce risks, and demonstrate leadership (WaterSense at Work, 2012).



KEY POINTS

- Utilizing WaterSense and ENERGY STAR products can reduce energy and water use, facilitating water conservation and energy efficiency efforts.

Mid-Term Recommendations: On-Site Renewable Energy

Solar

To ensure their new building is efficient, ASUF should receive energy from renewable sources. There are several best practices for renewable energy technologies that make buildings more energy efficient. Renewable energy is generated from wind, solar, geothermal, or hydro sources, though solar is the renewable energy source that would be most beneficial to ASUF. ASU already has a comprehensive solar program that includes 89 solar panel systems across four campuses that produce 24.1 megawatts of solar energy. ASU's solar panels produce enough energy to power 3,366 homes. ASUF could join ASU and install solar panels on the roof of their building to reduce their dependence on fossil fuel-generated electricity and reduce their energy use significantly.

Reports have shown that commercial buildings can reduce their energy cost by up to 75% by installing solar panels. Solar panels' added benefit is that they reduce companies' reliance on the electrical grid. If a storm causes a power outage on the electricity grid, solar-powered companies will not be affected. The upfront cost of installing solar panels may deter businesses from investing in solar technology. However, a lowered energy bill because of solar panel implementation is an almost immediate return on investment. Solar panels could propel ASUF to becoming a zero-energy building. Zero-energy buildings are highly efficient commercial buildings that produce enough renewable energy to meet or exceed their energy consumption, making the energy created and consumed balance out to zero (Zero Energy Buildings: Offices, n.d.). In addition, if ASUF makes too much energy, they could sell that excess energy to energy companies, thus creating a small profit.

KEY POINTS

- Installing a renewable energy source to the foundation's building can significantly reduce the amount of greenhouse gas emissions released into the atmosphere. This paired with other energy efficient practices can reduce impacts on biodiversity and GHG emission responsibility.

Long-Term Recommendations: Offsets and Renewable Energy Credits (RECs)

Carbon Offsetting and RECs

Offsetting emissions is an incredibly common, and valued practice, but it should not be the sole “solution” for reducing emissions. Relying whole heartedly on offsetting is not effective in reducing your emissions; the building will still emit the same amount as it would have before offsetting, the only difference being outsourcing responsibility for reducing the greenhouse gases has been emitted to others, i.e., by planting trees or supporting research for renewables (Greenpeace, 2020). But those who become responsible for these emissions are not reducing or absorbing them fast enough to make a difference in the atmospheric makeup. And in fact, it allows for the emitter to shift the responsibility onto the consumer, while continuing the unsustainable behavior that brought them to explore this outlet in the first place.

Currently, ASU's Scope 1 GHG emissions are offset through carbon sequestration through urban forestry and the Carbon Sink and Learning Forest at ASU west. ASU's Scope 2 GHG emissions are matched with Renewable Energy Credits (RECs) purchased through ASU's Red Rock Solar Project. These two practices have given the university their carbon neutral standing. The foundation can implement similar strategies as ASU's, although offsetting alone distracts from the key deliverable - reducing the carbon emissions entering the atmosphere (Greenpeace, 2020).

KEY POINTS

- Participating in offsetting and renewable energy credits comes with large responsibility both environmentally and socially as greenwashing can occur if emissions are released into the atmosphere faster than they are offset.

Offsetting Practice

A common carbon offset is planting trees. This practice is important in ASU's Net-Zero strategy, and they hope to increase tree canopy cover in Phoenix, Scottsdale, and Tempe. Although, reforestation and increasing natural vegetation is a positive contribution to reducing carbon, those effects will not be seen for many years to come as tree growth takes a long time. With this being said, using tree planting as an offset will eventually contribute to reducing greenhouse gas emissions but will have no immediate action especially if emissions are not being actively reduced in the years leading up to the tree's capabilities.

Greenwashing

Greenwashing occurs when an organization makes commitments to more sustainable practices for marketing purposes, but fails to implement those solutions. A leading trend in greenwashing is offsetting and the use of carbon credits. Offsetting does not actually cancel out emissions and are often seen as a distraction from real climate solutions. Likewise, participating in carbon credit purchasing does not reduce emissions, but instead pays to reduce an already occurring greenhouse gas. Making pledges and reaching Net-Zero goals is vital to show stakeholders how organizations will reduce their GHG emissions, but it is essential to be aware of deceit and greenwashing.

Low Impact Relocation Recommendations

A key deliverable assigned to Team Green Impact was to identify strategies for the foundation to reduce their GHG emission impact as part of their relocation. To identify strategies that align with ASU's, we compiled recommendations based on ASU's Student Pavilion (the university's first attempt at a Net-Zero building). In addition to these findings, our team recommends the foundation utilize building certifications like LEED and ENERGY STAR.

To create a net zero building, ASU focused on a few key areas: water efficiency, materials, energy performance, design, construction, and building operations. A Net-Zero building aims to produce more energy than it consumes annually. ASU implemented several green building technologies such as "low-flow" sinks and toilets; dynamic glass, which will self-tint at certain times of the day to reduce heat flow into the building; and roof materials and landscaping that do not absorb and store heat, which helps keep the building and surrounding area cooler. Team Green impact recommends that ASUF utilize the strategies used in the construction of ASU's Net-Zero building as part of their greenhouse gas reduction strategy in both their current and future building.

(ASU's first Net Zero Energy Building, n.d.)

ASU Net-Zero Building Features

Water Efficiency

- Low-flow sinks and toilets (WaterSense)
- Purple pipe to capture and reuse gently used greywater
- Landscaping bioswales allow water to soak into the ground rather than go down a drain.

Energy performance

- Solar panels to provide electricity and shade
- Highly insulated walls and roof
- High-efficiency, self-tinting, dual, and triple-pane windows reduce the heat moving through the building and the glare
- Solar tubes- highly reflective skylights that bring in natural light reducing the need for electrical light.
- pre-cooled air and chilled beams to reduce heating, cooling, and ventilation energy use
- LED lighting
- Building monitoring equipment to help understand energy consumption patterns.

Construction

- Zero waste construction- using recycled materials and materials sourced locally and regionally to divert waste away from landfills.
- Exterior shading of walls and windows to reduce heat and glare.

Challenges with Reducing Emissions

Short Term

Potential challenges when implementing Team Green Impact's recommendations in the short term is the lack of a current employee education programs by which to teach the occupants of the building how to properly conserve energy when they. are not in/not using certain areas. Being proactive about encouraging environmentally friendly habits and behavior can be very beneficial in trying to improve utility usage. As such, it is in ASUF's best interest to create a means of educating their employees on sustainable habits to maintain in the workplace (i.e. turning off lights when leaving a room, bringing a reusable water bottle, etc.). This coupled with our recommendations will help ASUF reach optimal energy efficiency and improve general company sustainability practices.

Mid Term

Potential challenges when implementing Team Green Impact's recommendations in the mid term are the high construction costs and the current downward trend into an economic recession. Solar prices are getting cheaper and cheaper, but as we've discussed with ASUEP stakeholders, the cost of construction materials (specifically concrete) is only going up. This may result in cost saving decisions needing to be made. We are hoping that the investment into solar isn't sacrificed because of this, but it is a possible barrier that ASUF should be aware of. We are on track to head into a recession very soon, and it's important that sustainability be kept in mind through this time. Sustainable alternatives are often the best option when it comes to continuously cutting costs, so prioritizing them when money is tight is a great opportunity to ensure you see a good return on investment.

Long Term

Potential challenges to inputting these recommendations include having a lack of a dedicated sustainability position within ASUF, and the potential for possible inaccurate data which can ultimately lead to greenwashing, Having so much opportunity for prioritizing sustainability within the foundation, the lack of doing so shows what can slip through the cracks when internal sustainability isn't built into applicable roles for ASUF. Having a dedicated sustainability role, or delegating responsibility for various sustainability tasks to team members, can ensure that there are people continuously on top of accurate data reporting or maintaining efficiency for ASUF. Given our experience with Persefoni, the platform as is may cause some problems for ASUF in terms of maintaining carbon accounting, as it is rather difficult to use the platform and accurately report numbers without substantial prior knowledge. Without pouring in the proper resources to ensuring it is done accurately, there is a potential for ASUF to GreenWash with inaccurate data points.

Team Green Impact

Internal Stakeholder Engagement

A key deliverable was to engage with internal stakeholders to gain greater buy in for sustainability and emission reduction initiatives. To tackle that, we developed this infographic that the foundation can use to communicate with their internal stakeholders, such as their board members or employees, to increase awareness of ASUF's sustainability efforts, and create greater buy in for any related improvements that can be made to the Fulton Center.

The infographic discloses Team Green Impact's carbon emission findings but puts them into more common terms, like passenger vehicles driven per year, so the scale of the emissions are more tangible to everyday concepts. Additionally, the infographic provides the foundation with general emission reduction recommendations, and more personal actions that employees can take to reduce their carbon footprint as well, such as using reusable water bottles, carpooling, mindful energy use habits, and supporting local businesses when catering.

Infographic for Internal Stakeholders

Team Green Impact
For ASUF

THE PATH TO NET-ZERO

For ASUF & Fulton Center

Written By
Lesley Austin, Lauren Boss, Carissa Fowler
Masters of Sustainability Solutions, Arizona State University

2035 NET-ZERO TARGET

To limit global warming below 2°C compared to pre-industrial levels, organizations across the globe have been making drastic commitments to reduce their methane and greenhouse gas (GHG) emissions, and the ASU Foundation is no different. ASUF is the philanthropic arm of Arizona State University (ASU) but is legally a separate entity. ASUF manages ASU's endowments and aligns the investments with the university's mission. Because ASUF is a separate entity from ASU, the foundation is not included in ASU's sustainability reporting, and must set its own sustainability goals.

ASUF has set a target of becoming net-zero on its Scope 1, Scope 2, and Scope 3 emissions by 2035. To meet this goal, they have partnered with Team Green Impact to assess and develop a strategy to reduce their Scope 1 and Scope 2 emissions - below are their findings.

To further analyze on what ASUF's biggest emission categories are, Team Green Impact recommends making further efforts to calculate Scope 3 emissions, and replicating similar projects to this one for Scope 1, 2, and 3 for any future buildings the ASU Foundation makes home.

Summary of Fulton Center Scope 1 and Scope 2 GHG Emissions

<1%

Scope 1

Scope 1 emissions are direct greenhouse gas emissions that occur from sources that are controlled or owned by an organization. The Fulton Center has two refrigerants, R22 and 410A, and one diesel generator.

The Fulton Center's Scope 1 carbon emissions for FY22 is **47.14 Metric Tons CO2e**, or **0.046%** of the Fulton Center's total carbon emissions. This is equivalent to 10.2 gasoline-powered passenger vehicles driven for one year and 109 barrels of oil consumed.

Currently, as we are housed in a building that is part of ASU's campus, our Scope 1 emissions are offset through carbon sequestration through Urban Forestry as well as the Carbon Sink and Learning Forest at ASU West, making The Fulton Center net-zero for Scope 1 carbon emissions.

>99%

Scope 2

Scope 2 emissions are indirect greenhouse gas emissions associated with the purchase of electricity, steam, heat, or cooling. The Fulton Center purchases electricity from APS which includes heating, and get chilled water from the ASU Combined Heat & Power Plant.

The Fulton Center's Scope 2 carbon emissions for FY22 is **1028.93 Metric Tons CO2e**, or **99.95%** of the Fulton Center's total carbon emissions. This is equivalent to 222 gasoline-powered passenger vehicles driven for one year and 2,382 barrels of oil consumed

Currently, as we are housed in a building that is part of ASU's campus, our Scope 2 emissions are matched with Renewable Energy Credits (RECs) purchased through the ASU Red Rock Solar Project, making The Fulton Center net-zero for Scope 2 carbon emissions.

GENERAL EMISSION REDUCTION RECOMMENDATIONS

- **Upgrade Lighting to LED:** lighting generally makes up 17% of a commercial building's electricity use.
- **Utilize System Performance:** perform routine maintenance checks and ensure optimal use of appliances when necessary utilizing timers.
- **Upgrade Appliances:** using ENERGY STAR appliances and equipment can improve energy performance.
- **Install Solar:** commercial buildings can reduce their energy cost by up to 75% by installing solar panels, reducing carbon emissions from purchased electricity.
- **Offsetting:** while greenwashing can occur, nature-based offsetting should be prioritized and actions should occur along side the recommendations above.
- **Energy Attribute Certificates:** While all electricity can be matched with renewable energy credits, this does not mean that the energy consumed does not emit carbon, so large responsibility comes with the purchase of EACs.

LOW-IMPACT RELOCATION

The ASU Foundation is considering relocating to a new building within the next few years, so a key deliverable assigned to the master's team was to identify strategies for the foundation to reduce their GHG emission impact as part of their relocation. Below are recommendations based on ASU's Student Pavilion (the university's first attempt at a net-zero building) to identify strategies that align with ASU's. In addition to these findings, our team recommends that the foundation utilize building certifications like LEED and ENERGY STAR.

Energy Performance

- Solar panels for electricity and shade - Installing solar can reduce commercial building energy consumption by 75%.
- Highly insulated walls and roof
- High-efficiency, self-tinting, dual, and triple-pane windows reduce the heat moving through the building and the glare
- Solar tubes
- LED Lighting

Water Efficiency

- Low-flow sinks and toilets (WaterSense) - Use 20% less water
- Purple pipes to capture and reuse gently used greywater
- Landscaping bioswales allow water to soak into the ground rather than go down a drain

Construction

- Zero waste construction – Recycled material & locally sourced
- Exterior shading of walls and windows to reduce heat.

REDUCING EMISSIONS

While The Fulton Center is considered carbon neutral as it is factored into ASU's carbon neutral practices, Team Green Impact recommends that offsetting and RECs should play a small, and ideally nonexistent, role in ASUF's emission reduction strategy. Below are some large and small-scale efforts that can help reduce carbon emissions, and truly get the foundation to net-zero.

LARGE SCALE EFFORTS

- Retrofitting the Fulton Center parking garage to have more EV chargers.
- Creating an incentivization systems to promote Sustainable workplace habits like using a reusable water bottle with rewards like gift cards or PTO.
- Doing another project or using another carbon accounting platform to calculate Scope 3.
- Upgrade HVAC equipment with higher SEER rating refrigerants.

PERSONAL EFFORTS

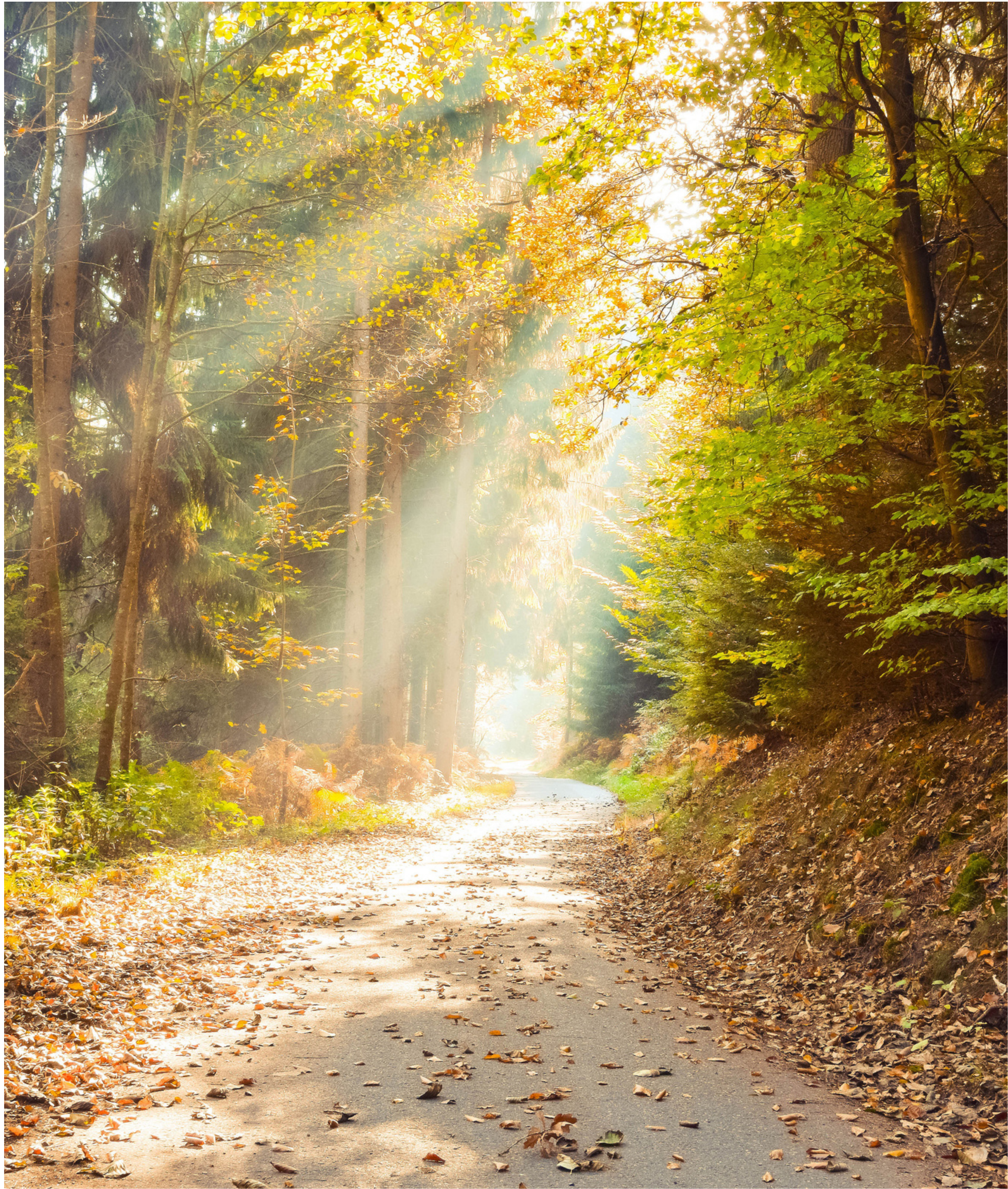
In the mean time, as the foundation strategizes a low-imapct relocation and new large-scale efforts, we can take action on reducing our carbon footprint by:

- Using reusable water bottle
- Carpooling
- Limiting food waste
- Turn off lights when leaving a room
- Consider vegetarian catering options
- Support local businesses

Team Green Impact

The Path to Net-Zero

To align Arizona State University's carbon neutral strategy with the foundation's, Team Green Impact has developed an example of a Net-Zero strategy the foundation can implement in their future building at NOVUS based on other organizations' Net-Zero goals. Although, it is important to note that this is a generalized strategy based on the Fulton Center's Scope 1 and Scope 2 emissions. It is recommended that ASU Foundation use their first year in their new building, 2024, as their emission baseline year, along with calculating Scope 3 emissions as soon as possible to develop an official strategy with set emission reduction targets to reach their Net-Zero 2035 target.



Net-Zero Strategy

2023

- Assess current Scope 1 and Scope 2 GHG emissions for the Fulton Center
- Calculate foundation's Scope 3 GHG Emissions
- Research emission reduction best practices for NOVUS
- Set up organizational and operational boundaries for future emission accounting based on NOVUS information

2024-2025

- Establish GHG emission base year (2024)
- Determine budget for emission reduction initiatives
- Develop official Net-Zero strategy with yearly goals based on 2024 NOVUS base year.
- Set near-term science-based targets.
- Establish progress report timeline for stakeholders and donors to stay accountable (pulled from prior MSUS project Team LESGO's supporting report)

2026-2030

- Develop Net-Zero report to disclose to stakeholders and donors to gain greater buy-in.
- Evaluate progress, make changes if needed to ensure 2035 target is met (pulled from prior MSUS project Team LESGO's supporting report)
- Begin to upgrade appliances to ENERGY STAR certified equipment to maximize efficiency

2030-2035

- Finish upgrading to more efficient appliances
- Install Solar Panels
- Offsetting remaining emissions with nature-based solutions such as urban forestry
- Match remaining emissions with Renewable Energy Credits (RECs) or Energy Attribute Certificates (EACs)

2035-

- Share lessons learned (pulled from prior MSUS project Team LESGO's supporting report)
- Develop report for other University Foundations to follow when reducing their carbon footprints to remain a model university foundation

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