Abstract

This research project aims to quantify and address NAU's Scope 3 Category 1 (Purchased Goods and Services) and Category 2 (Capital Goods) emissions, which are likely both significant contributors to the university's overall greenhouse gas (GHG) emissions profile. Understanding the environmental impact of these purchases is crucial for NAU to achieve its Climate Action Plan goals.

In this proposed effort, we will quantify the cradle-to-gate GHG emissions associated with NAU's purchases of goods, services, and capital equipment using recognized standards and protocols, along with emission factors from the US EPA's Environmentally Extended Input-Output (EEIO) model. We will also develop an inventory management plan (IMP) focused on Scope 3 Category 1 and 2 emissions to ensure a robust, transparent, and consistent methodology for quantifying these emissions moving forward.

The results will be included in a report detailing the findings, offering insights into high impact purchasing categories, and providing guidance on effective engagement with vendors for emissions reduction. These findings will inform the development of a sustainable purchasing policy and aid NAU in meeting its climate objectives. Moreover, the results will contribute to identifying areas of further investigation to support the reduction of the university's carbon footprint and NAU's larger carbon neutrality goals.

The broader impacts of this project on the wider NAU campus community include fostering a greener mindset among campus organizations and groups, promoting informed decision-making in purchasing, and encouraging vendor engagement that promotes overall emissions reductions. Additionally, the project supports the development of efficient data tracking methods for Category 1 and 2 Scope 3 emissions, streamlining ongoing monitoring and progress evaluation in line with NAU's Climate Action Plan and sustainability goals.

Detailed Project Proposal

NAU has committed to achieving carbon neutrality on its Flagstaff Mountain Campus by 2030. In order to do so, NAU must either eliminate or offset all of the greenhouse gas (GHG) emissions that result from direct campus operations (e.g., heating and cooling, vehicle fleet), as well as emissions that result from NAU's value chain. GHG emissions are divided into three categories: (1) Scope 1 - direct emissions from owned or controlled sources, such as fuel combustion in campus vehicles; (2) Scope 2 - indirect emissions from the consumption of purchased energy, like electricity for campus buildings purchased from outside utilities; and (3) Scope 3 - all other indirect emissions occurring in an organization's value chain, including emissions from purchased goods & services, waste disposal, and business travel. NAU has been tracking its Scope 1 and Scope 2 emissions since around 2007. However, although required to support NAU's 2030 carbon neutrality goals, a full accounting of NAU's Scope 3 emissions has yet to be completed. Sources of Scope 3 emissions are diverse, and identifying and tracking the data needed to account for Scope 3 emissions is often a major barrier for many organizations.

The World Resource Institute has defined 15 distinct categories of Scope 3 emissions to help organize and streamline accounting efforts (WRI, 2011). Although more difficult to quantify, Scope 3 emission inventories are crucial for fully understanding and addressing an organization's climate impact and often account for a majority (>70%) of an organization's overall emissions

(SBTi, 2018). While NAU has estimated emissions for three (commuting, business travel, and waste) of fifteen Scope 3 categories, many of the Scope 3 emission categories likely to be the largest contributors to NAU's overall Scope 3 emission profile have yet to be quantified. Two of these are Category 1 – Purchased Goods and Services and Category 2 - Capital Goods. Emissions associated with purchased goods and services include all of the upstream (grade-to-gate) emissions associated with the production of products purchased or acquired by NAU in a given year. These products can be tangible goods or more intangible products like services. For many organizations, the GHG emissions embodied in purchased goods and services constitutes a significant (if not the most significant) share of the organization's overall emissions.

While NAU has taken a bold step towards transitioning to carbon neutrality, a full quantification of NAU's Scope 3 emissions is needed to make this goal a reality. The foundation of any carbon neutrality commitment is robust GHG accounting, which is described in detail in NAU's CAP. The CAP also states the importance of quantifying Scope 3 emissions to NAU's overall carbon neutrality goals clearly in the introduction:

> *"The university recognizes that addressing Scope 3 emissions is necessary for complete carbon neutrality and will develop a plan to address these emissions. However, at present, the university lacks an accounting infrastructure for these emissions. Additionally, many of the units or departments whose activities generate these emissions have not, heretofore, been aware of or valued emissions reductions through their activities. Therefore, this plan makes the practical, yet ambitious commitment that within five years after development of the CAP, the university will generate reliable data on its Scope 3 emissions and commit to means for neutralizing Scope 3 emissions towards a stated end date." (NAU, 2021 - pg. 7)*

The overall goal of this project is to quantify NAU's Scope 3 emissions associated with Category 1 (Purchased Goods and Services) and Category 2 (Capital Goods). The methodology for calculating Category 1 and 2 Scope 3 emissions is the same. Therefore, it makes sense to tackle these two Scope 3 emission categories at the same time. In addition, as part of this project, we will create a data management and methodology plan to support the future tracking, reporting, and comparison of emissions associated with NAU purchases. The approaches, methods, and expected results are described for each objective below:

Objective 1: Develop a Data Management and Best Practices Plan

As part of this proposed effort, we will develop an Inventory Management Plan (IMP) for NAU focused on Scope 3 Category 1 and 2 emissions quantification. This IMP will serve as the primary governance document for Scope 3 Category 1 & 2 GHG management. It will outline processes for data collection, boundaries for reporting, and quality assurance measures. The IMP will include: (1) a description of quantification methodologies and emission factors; (2) data sources, collection process, and quality assurance; and (3) recommended procedures for auditing, management review, and corrective action.

Objective 2: Quantification of NAU's Scope 3 Category 1 and 2 Emissions:

When it comes to quantifying Scope 3 emissions from goods and services (Category 1), collecting data directly from suppliers can add considerable time and administrative cost to conducting an inventory. It is therefore best practice to apply a more simplified methodology (e.g., average data or spend-based) first to estimate Scope 3 emissions from different purchased

goods and services. The results from this more simplified approach can then be used to prioritize accounting methodology and actions moving forward (see Objective 3).

Therefore, to quantify NAU's Scope 3 Category 1 and 2 emissions, we will apply the spend-based method for Scope 3 emissions accounting outlined by the WRI and GHG Protocol (WRI, 2011). The spend-based method pairs procurement information ($ spent per product/service) with emissions factors (average emissions per monetary value of a given good) that are typically derived from environmentally-extended input output (EEIO) models. We will work with NAU's Office of Sustainability to obtain procurement information for the most recent full fiscal year. This purchasing data will be imported into Excel and each purchase will be categorized according to commodity type based on the North American Industry Classification System (NAICS). We will then apply supply chain emission factors from the US EPA's EEIO model which provides industry-wide information on product greenhouse gas emissions based on category spending.

Objective 3: Identification of largest contributors to Category 1 & 2 Emissions

We will use the estimated Scope 3 emissions from Objective 2 to identify specific types of purchased goods and services that make up a significant share of NAU's category 1 (and 2) emissions. We will also provide recommendations to NAU's Office of Sustainability for prioritizing data collection to improve future emissions inventories moving forward (Objective 1). NAU can then use this information to engage with high emission vendors/suppliers to identify potential ways to reduce emissions over time. As a result, the outcomes from this proposed effort will directly support the creation of sustainable purchasing policies at NAU.

Conclusion:

In conclusion, quantifying NAU's Scope 3 Category 1 and 2 emissions is a critical component of NAU's commitment to carbon neutrality. This project directly addresses this critical need and will provide essential insights into NAU's Scope 3 emissions profile that will inform sustainable purchasing policies, vendor engagement, and the university's overall emissions reduction strategies. Furthermore, the outcomes from this project will contribute to the development of more effective data tracking methods, supporting NAU's broader sustainability goals and fostering a greener campus culture.

Contact Information

Project Leader Name: Ross Priehs

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Expected Graduation Date: December 2023

Project Advisor Name: Dr. Deborah Huntzinger

E-mail: Deborah.huntzinger@nau.edu

Position: Professor, Climate Science

Department: School of Earth and Sustainability

Project Name: Categorizing NAU's Scope 3 Category 1 & 2 Emissions

Date of Application Submission: Apr 4, 2023

Questionnaire

Please select the focus of your research project, then address the following questions.

☐ Renewable energy/Energy efficiency

X Emissions reduction

☐ Environmental justice/Intersectionality

☐ Waste Minimization

☐ Understanding sustainability behavior/perspectives of NAU students

☐ Transportation

☐ Other:

1. How will your research promote the purpose of the Green Fund and further sustainability on NAU's campus?

> This project will quantify and report the value chain emissions of NAU's purchased goods, services and capital goods. At the same time creating an Inventory Management Plan, and identifying our largest contributors of emissions in these categories. This project directly addresses NAU's critical need of quantifying Scope 3 emissions and will provide essential insights into NAU's climate action plan, as well as the university's emissions profile. The products of this work will inform sustainable purchasing policies, vendor engagement, and emissions reduction strategies.

2. Will your research require the utilization of any spaces or infrastructure on campus? If so, identify the specific locations and/or infrastructure, how much of the space you require, and what each space will be used for. Please review the "Space Committee Document" located on our webpage and follow the steps to begin requesting a

location.

Meetings will take place in NAU's Bury and Ashurst Halls. No additional physical space and/or infrastructure will be needed

3. Will other departments on campus be needed to assist in this project (i.e. Facility Services, Campus Transit)? If so, identify department partnerships.

NAU's Office of Sustainability; Procurement office.

4. How will you monitor the impact of your research after completion? What do you plan to do with the results of your research?

Ideally this will be a yearly project, with other project leads chosen through NAU's Office of Sustainability and Huntzinger's carbon accounting lab (CARML) to keep track of NAU's progress towards carbon neutrality.

Project Budget

Item	Justification	Quantity	Price per Unit
Graduate Student Research Hours	The Project Lead will dedicate 200 hours to manage project objectives, organize stakeholder meetings, analyze data, and write up results for the research project.	200	$27

Total Funding Requested: $5400

Project Timeline

Action	Parties Involved	Month/Year
Funding Award Announced	Green Fund	April 2023
Data Collection	Sustainability Office, Procurement, Project Lead	May 2023
Data Cleansing / Categorization	Project Lead / Faculty	May/June 2023
Creation of Inventory Management Plan	Project Lead / Faculty	June-August 2023
Emissions Calculations	Project Lead / Faculty	September 2023
Analysis of emissions	Project Lead / Faculty	October 2023
Create Report and Presentations	Project Lead / Faculty	November 2023
Final Report and Presentations	Project Lead / Faculty	December 1, 2023

Expected Project Completion Date: Dec 2023

Commitment to Present Research

Please read and sign the statement below, acknowledging your commitment to present the findings of your research.

If selected as a recipient of the Green Fund Student Research Grant, regardless of the outcome of my research project, I, Ross Priehs commit to presenting the status of the research as describe in this application in the form of both an oral presentation to the Green Fund Committee and the poster exhibit presentation at the Undergraduate or Graduate Research Symposium, no more than 1 year after receiving notification of funding.

The oral presentation to the Green Fund Committee will consist of an approximately 10 minute long PowerPoint that includes the following aspects of your project:

- Original goal and purpose of research
- Conflicts or changes to the original purpose
- Results/Conclusion
- All relevant graphical displays of data

Project Leader Signature: Ross Priehs

References

Northern Arizona University (NAU). (2021). *NAU_cap_report_draft2.pdf*. https://in.nau.edu/wp-content/uploads/sites/136/2022/10/NAU_cap_report_draft2.pdf

SBTi. (2018). *Value Change in the Value Chain: Best Practices in Scope 3 GHG Management*. https://sciencebasedtargets.org/resources/files/SBT_Value_Chain_Report-1.pdf

World Resource Institute (WRI). (2011). *Corporate Value Chain (Scope 3) Accounting and Reporting Standard*. https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf