GREEN FUND

Sustainability Through Student Innovation

Project Application

Green Fund Mission Statement: "The NAU Green Fund promotes student participation in and provides funding for projects that reduce NAU's negative impact on the environment and create a culture of sustainability on-campus."

Requirements for Funding:

- The project must be implemented on campus.
- The person submitting the project must be a NAU student, faculty, or staff member.
- Projects must provide all necessary documents, letters of support, and authorizations prior to submission.
- The Green Fund distributes funding on a **reimbursement basis**. Project teams should partner with an administrative office to provide upfront funding for the project. Once the project has been successfully completed, the Green Fund will reimburse the administrative partner.
- All project applications should be submitted to greenfund@nau.edu for review.

Disclaimer: All applications will go through a comprehensive vetting process. We highly recommend meeting with a Green Fund Committee member prior to submitting the application. The Green Fund Committee member will assist you with every step of writing your project application. If your project is approved, you may be asked to provide more detailed information regarding specific deliverables. The Green Fund is not responsible for acquiring the necessary permits, permissions, or approvals for a project, although we are happy to assist with this process if needed. Additionally, the Green Fund does not provide any ongoing maintenance costs. A sponsoring department must take responsibility for operations and management.

Review Process: Upon project application submission, the Green Fund will review your project within two weeks. At this time, the Green Fund will provide comments on the project. Incomplete applications will not be reviewed until all components are submitted. **Note:** The Green Fund Committee only meets during the academic year. All projects submitted outside of the regular academic year will be reviewed at the start of the next academic session.

Contact Information

Project Leader Name: Cole Jennings Phone: 623-337-6140 E-mail: crj245@nau.edu

Project Advisor Name: Jennifer Wade Phone: 928-523-1528 E-mail: jennifer.wade@nau.edu

Sponsoring Department: Mechanical Engineering

Project name: NAU Solar Capstone

NAU Department/Unit for funding reimbursements (Attach letter of commitment from departmental representative): Mechanical Engineering Capstone, see attached letter from ME Chair

Project Overview

Executive Summary

Please provide a brief overview of your proposal. Please address how this project will support the goals of the Green Fund (student involvement, creating a culture of sustainability, and lessening NAU's impact):

This proposal is seeking funds to support the testing and analysis of existing NAU solar thermal technology that is not currently in operation. The goal of the tests is to determine the performance of the system, on a BTU/day basis, in order to inform the economics of future solar thermal designs. This analysis can in turn inform future decisions regarding the approach to carbon neutrality and other emission reductions of NAU's campus heating systems.

The NAU Solar Capstone team has been working throughout the Spring 2020 semester to design a solar thermal system for the Engineering building that can heat the internal hydronic loops, offsetting some of the heating load from our centralized natural gas boiler plants. The main goal is to decrease the use of natural gas and associated emissions from the South Campus boiler plant, thus promoting NAU's goals of becoming more environmentally friendly. At the current stage of the project, the exact performance of a solar thermal system has been estimated using a government based, System Advisory Model. The purpose of the testing is to validate the online modelling software and hand calculations to best inform the performance and economics of this renewable energy technology on the Flagstaff Mountain campus.

Please answer the following questions detailing the components of your project:

1. Does your project require space or construction on campus? If so, where? Please review the "Space Committee Document" located on our webpage and follow the steps to begin requesting a location.

   The project requires testing space. Currently the solar thermal panel is stored within the Mechanical Engineering Renewable Energy Test Facility. We have received permission to carry out the testing in this facility barring first being trained in the safety standards and rules of the facility. Please see the attached letter of support regarding this permission. .

2. Have you obtained all necessary approvals for this project? Please attach all letters of support to this application. Letters of support should include confirmation from the sponsoring department that the sponsoring department will cover all upfront expenses and work with the Green Fund Business Manager to acquire reimbursement after project completion. If any ongoing operations and maintenance is required of your project, provide a letter of support from the entity that will be covering those costs and/or services.

   The Department of Mechanical Engineering's Capstone program will sponsor the project and directly purchase all needed materials and supplies if the work in this proposal is approved. Please see the letter of support from Dr. Ciocanel, chair of Mechanical Engineering. The scope of this proposal is for one-time testing and analysis and will not require ongoing support. Any equipment acquired in this project will be given to the Renewable Energy Test Facility and the Mechanical Engineering thermal fluids teaching laboratory (ME 495) for future work in this area.

3. Will this project provide funding for student wages?

   No.

4. Please list all additional sources of funding you have pursued. Include departments, grants, ASNAU, Graduate Student Government, etc.

   No other sources of funding have been pursued at this time. The project was purely analytical until the team acquired an existing solar thermal panel from the rooftop of the Health and Learning Center building. After acquiring this one solar thermal panel, the team has decided the project will be most impactful if real tests are run to estimate future solar thermal system performance.

   However, the solar panel itself has been donated to the project, and the Mechanical Engineering department will allocate space and most instrumentation to collect all necessary measurements in order to analyze the solar thermal panel performance. This proposal is requesting equipment and supplies to mount the solar thermal array at the optimal angle, a pump to circulate water through the panel, as well as any ancillary equipment to accommodate all the necessary plumbing and instrumentation taps.

5. Have any of the Green Fund Committee members been involved in this project?

   No, Green Fund members have not been involved in this project.

   a. If Yes, please identify all committee members:

Project Specifics

Please address the following questions. One or more of these questions may not apply to your particular application. Answer as many questions as are applicable to your project.

Relationship to NAU Climate Action Plan (CAP)

1. How does your project align with one of the seven CAP categories (Energy, Water, Transportation, Waste Minimization, Sustainable Landscaping, Environmental Justice, Communication)?

The project aligns with the Energy CAP category. Utilizing solar thermal energy can offset natural gas burned in the central plant boilers, which in turn offsets associated emissions like carbon dioxide and nitrous oxides.

This project will specifically measure the incoming solar irradiation incident on the solar panels, as well as measure water flow rates, temperatures and pressures of water entering and leaving the solar panel to calculate useful energy captured and mechanical energy loss via pressure drop through the system. This data will verify how much energy could be saved through natural gas offsets with these solar thermal panels installed in Flagstaff.

Community

2. Is there a public outreach plan? How will faculty, staff, and students learn about this?

Students will present work at departmental capstone events, which includes an audience of an industrial advisory committee who oversees the engineering academic departments. Additionally, the team is developing a website detailing the specifics of the project to document it for future student use. The website will be available to other capstone students beginning in the fall semester.

3. Are you working with other groups on or off campus? If so, describe your partnership.

The project is being overseen and advised by a fellow alumni, Erich Gemballa, Jon Heitzinger in Facility Services and Jennifer Wade in Mechanical Engineering.

Project Parameters

4. What are the environmental costs and benefits associated with your project?

Costs are in the materials associated with testing, lumbar and pipe fittings, and electricity to circulate water through a water pump. In terms of environmental costs, the testing portion of the project will be minimal.

Benefits include using existing University capital equipment to determine efficacy of the solar thermal technology for domestic hot water heating and extend this to hydronic loop heating in our campus buildings. The overall purpose of the project is to offset the use of fossil fuels and natural gases from the central boilers on campus. This is one of the most complicated areas to convert to non-fossil energy sources.

5. Provide an economic cost/benefit analysis for your project. Focus on identifying specific cost savings.

   One economic benefit of the testing component of this project is the use of existing capital equipment that is not being used. By using the current panel found on the HLC, the team is saving approximately $2,500 in costs. The purpose of the testing is to determine the performance, and in turn the natural gas savings from the technology in Flagstaff weather conditions.

6. Is this a one-time expense or will you require future funding?

   This testing is a one-time expense that will be used to support learning about the future feasibility of using this technology depending on the current cost of natural gas heating.

7. When your project members no longer attend NAU, who will be responsible for running the project?

   The Mechanical Engineering Department will continue running the project.

8. How will you monitor the impact of your project after implementation?

   This is for a one time study, rather than a new install of a solar thermal system. The impact of the data analysis will be used for future capstone or Greenfund projects if the solar thermal designs are economically viable to execute.

Project Budget

Please include a thorough breakdown of all project costs, **as well as a 5% line item for contingency**.

Item	Quantity	Cost (After Tax)
Wood	1	$122.28
Water pump	1	$129.92
Hose	1	$32.72
Valve	1	$16.70
Misc. fittings	1	$218.36
5% Contingency	1	$26
Total Cost		$545.99

Project Timeline

The timeline should include significant implementation dates for your project. Please add information such as shipping time and consider any holidays or breaks.

Solar Thermal Capstone Timeline		
Action	**Parties Involved**	**Month/Year**
Order supplies from Home Depot	Team members	August 2020
Construct mounting system for solar panel	Team members and Advisors	August 2020
Conduct testing process	Team members and Advisors	August-October 2020

Project Checklist

Please ensure you have completed all of the following items before submitting your application:

- ☐ Meet with a Green Fund Committee member
- ☐ Obtain all necessary letters of support (sponsoring department, ongoing maintenance, etc.)
- ☐ Project Overview
- ☐ Project Specifics
- ☐ Project Budget
- ☐ Project Timeline
- ☐ Complete Project Checklist

Thank you for your submission. We deeply appreciate your commitment to sustainability at NAU, and we look forward to working with you.