OFFICE OF SUSTAINABILITY
CAMPUS SUSTAINABILITY FUND

Palm Drive District - Shade Sail Installation

Grant Type:
Mini Grant

Application Type:
Final Application

Project Manager 1 Name:
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Fiscal Officer Department Name:
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Requested Funding Amount

Only enter this number after completing the budget sheet (the budget template will round up your request).
Mini Grants may request $250 up to $5,000.
Annual Grants may request $5,001 up to $100,000, and up to three years of funding.

Year 1:
$5000

Year 2:

Year 3:

Official Project Name:
Palm Drive District - Shade Sail Installation

Primary Project Category:
Energy

Secondary Project Category:
Social Sustainability (including Social/Environmental Justice)

Background and Context:

Please provide relevant background about your organization/team including your mission and/or expertise. Lay out the rationale for the proposed project, focusing on the issue that your project would address. This section is meant to give us more information about you and the context for the project, while the questions below provide space to go into detail about your proposal's plan and specifics.

Response:

Environmental, social, and cultural sustainability are important to the Civil and Architectural Engineering (CE) department. However, the civil engineering building, constructed in 1966, does not reflect our department's commitment to these ideas. As is clear from the UA sustainability map, little effort has been placed near or around the building to improve sustainability. In the summer of

2021, a green wall proposed on the west side of Civil Engineering (CE) Building as a research and demonstration facility. Although that concept was rejected, during and since AY21, students working on independent studies introduced the concept to a green Palm Drive District (PDD). The PDD extends from Mountain Ave. around the CE building and other buildings surrounding the Palm Dr. parking lot.
Our team's mission is to develop the environmental and social sustainability of the Palm Drive District on the north side of campus. The overall PDD goal is to develop a greenspace that is livable and appealing as a location to pass safely through and visit. From those efforts, five specific goals were defined: 1. Create research opportunities on sustainable design and construction; 2. Provide physical features that demonstrate sustainability; 3. Create cooler microclimates in the PDD that resemble Sonoran Desert environments; 4. Reduce PDD energy and water use; 5. Improve aesthetic value and pedestrian safety of PDD thoroughfares. Educational signage and visuals describing the implemented sustainability measures would be placed throughout the PDD.

Phase 1 of this effort focuses on the corridor between the Civil and Electrical and Computing Engineering buildings. Our goal for the corridor is to develop an inviting relaxing area for students, staff and faculty to stay and enjoy a coffee, release tension in a quiet micro-biome that demonstrates and applies environmental sustainability principles to reduce energy consumption and reuse wastewater. Under this mini-grant, we will install a shade structure to reduce solar insolation on the ECE building and to provide a shaded sitting area for relaxing. South-facing ECE offices are difficult to cool and work in; often the blinds are closed and lights are kept off. As the shading will only impact a few offices, we will also install monitoring devices to determine its cooling benefit by measuring the time that air conditioning is in use in impacted and adjacent offices. A picnic table for seating that is not available in this area will also be placed below the shade structure. In the long term, we foresee shading to be provided by mature vegetation along ECE's south wall. We will also attempt to stretch our budget through donations to purchase devices to measure incident solar insolation and a bench for additional seating.

Project Description:

Please provide a thorough description and explanation of your project. Be explicit in what your team is proposing. What are the goals of your project? What will your project's outcomes be? Outcomes should be SMART—specific, measurable, achievable, realistic, and timely. Describe how each objective will be achieved with the anticipated timeframes for each, including any key dates for when certain elements must start or be completed.

Response:

This project is to finalize the design and location of a shade sail to reduce the solar insolation on the ECE building while providing benefits of shaded seating. Using an existing building information model (BIM) that includes incident sun daily and seasonally, the sail, tentatively 12' x 20' at a tilt resulting in a near rectangular covered area of 10-11' x 20', will be optimally located to maximize its benefit (current layout in supporting material (SM)). Working with structural engineering faculty and local licensed engineers, the support system will be designed and overall project will be permitted (Nov.-Jan.) and materials for the shade sail installation will be purchased (Dec.-Jan.). Volunteers will clear the area, dig posts, and install the shade system (Jan. and Feb.). Appropriate signage will be designed, purchased and installed (Jan.-Mar.) (draft in SM). We will add the picnic table for seating (Feb.).

We will develop and install continuous flow meters to measure when air conditioning is operating as a surrogate measure for energy savings (Mar.) in impacted and non-impacted offices. They will record and display data on a dedicated website (developed through fall and early spring). We will host open 'tents' to educate campus community on the project and results (post-construction) that will be advertised to building managers and to nearby sororities. If funds can be saved through donations, we will install pyranometers to measure solar insolation at several locations on the face of the ECE building and potentially in the ECE offices (Mar.). A second addition will be a bench or second table to provide more seating.

In terms of objectives, in addition to meeting our time line and accomplishing the defined tasks, we will perform preliminary analysis of early data to estimate energy savings and display those results on the website. Data will be stored and we will seek future students to perform a complete evaluation and modeling effort with a longer record of data of air conditioning use combined with solar insolation, perhaps through the NASA Space Grant program or student volunteer. Website visits will also be tracked as an indicator of project effectiveness.

Budget Narrative:

Use this section to provide supplemental justification for the items you are requesting on your budget sheet. Please break down your justifications into the budget categories: Personnel or operating budget. Do not list out each expense or repeat notes made in the budget template, but instead address why the line items are being requested and the purpose they will serve, providing elaboration when necessary.
If you are requesting funding for personnel, use this section to elaborate on the position you are creating and how the budget and timeline was established for it. If you plan to hire students, describe in what capacity. Describe relevant details thoroughly (wages, responsibilities, duration of job, extent of involvement, how you will solicit/ market these opportunities etc.).
Ensure the descriptions match the line items in the budget sheet.
If matching or supporting funds are secured for the project, identify the source and amount in this section, and detail the impact of the matching funds on your overall budget.

Response:

All funds in this project will be used to purchase field materials including:

1) Solar sail, mounts and connections to supports
2) Posts for support sail
3) Concrete for footings
4) Picnic table
5) Flow sensors, data collection device and cables
6) Gravel material to create walkway to shade structure (available from CAEM)

Sources of estimates from various vendors are included in the supporting materials (CSF Costs).

A used personal computer will be used to collect and display air conditioning use on a web page. If needed, sail mounts will be welded to post by CAEM shop staff.

Lansey will support this project with donations through the UA Foundation for $1040 (equivalent to $1000 after Foundation fee split between 2023 and 2024) to cover any cost overruns or project add-

ons such as an additional seating and/or pyranometers to measure solar insolation. We will seek other donations including materials.

Project Feasibility and Logistics:

The Campus Sustainability Fund will only fund projects that have completed the necessary work to ensure they can succeed, be completed in the grant's timeline, or have an accurate budget.
Please provide a description of the work that has been completed so far to make this project feasible. Have all relevant partners been contacted/coordinated with? Have you received consent or authorization to complete your project (such as from Housing and Residence Life, Facilities Management, Parking and Transportation, etc.)? Please identify them in your response.
If you are making modifications to campus, do you have authorization or official quotes from Facilities Management to accurately identify the cost of labor and supplies?

Response:

Upon CSF approval of an award, our team will complete the campus permitting process that includes Risk Management and PD&C. The latter has approved the project concept (note from Ed Galda in SM). As part of the design process, we have identified professional engineers who will review and sign our final construction plans as a project contribution. The study will include a wind analysis as requested by FM.

Facilities Management (letter in SM) has agreed to allow our team and other engineering students to implement this project including site preparation and constructing the footings for the sail posts and the table. We will clear the site as needed and develop access paths to the shade structure. FM will provide a project supervisor to ensure quality and our team will coordinate with them on locating existing utilities through their plans that FM has provided to our team, blue-staking and collaborating with them on university utilities, notably irrigation lines. During construction, Terracon, the on-call inspector for the UA, has volunteered to serve as construction inspector (email in SM). ECE personnel, led by Greg Book, are enthusiastic in support of this effort.

In terms of logistics, our student-led team will coordinate significantly with FM on construction timing and finalizing the exact location and geometry of the sail to address utility concerns. Of significant import is utility work through on the north side of the ECE/CE corridor as part of a larger project to provide chilled water and other utilities to a renovated nearby building. This project will be let to construction bid with the intent to start in December or later for a 10-month period. As the project includes a number of elements at the building site, it is unclear when the work in the corridor will be completed since this is the responsibility of the construction contractor who has not been defined. This effort may provide significant opportunities to advance other Palm Drive efforts such as rainwater harvesting and revegetating, at least part of the corridor.

Environmental Sustainability Outcomes:

Please provide a description of how you expect your project to advance environmental sustainability on campus. A definition of environmental sustainability is provided on our Guides and Tips page.

Response:

The corridor that runs between the Civil Engineering and Electrical and Computing Engineering (ECE) buildings has little shade cover and protection from sunlight. The south side of ECE is lined with windows that look into offices within the building. These windows face intense sunlight during the day creating an extremely hot and uncomfortable environment.

Installing a shade sail with appropriate supports will provide an aesthetically pleasing and environmentally efficient solution to this problem. Installing the shade sail adjacent to the building will help protect the office windows from intense direct sunlight. This will result in more comfortable conditions within the building, along with a reduced reliance on air conditioning and decreasing energy demands. To quantify the benefits of the sail, an automated sensor system will collect air conditioning use data over time in two ECE offices on the south wall. This data will demonstrate the reduced energy demands resulting from sunlight protection provided by the sail. If funds permit or other sources are identified, we will set up sensors to collect solar radiation inputs to the building and document the reduced insolation with the sail. It will also permit a modeling study to be completed to quantify the impact and potentially develop a general tool to examine benefits of building shading and designing these systems.

Social Sustainability Outcomes:

Please provide a description of how you expect your project to advance social sustainability on campus. A definition of social sustainability is provided on our Guides and Tips page.

Response:

This project is primarily environmentally directed and does not offer significant DEI benefits. However, it can provide some mental health and education benefits to PDD students. On the former, the shade structure will provide a space for all students to de-stress and spend time outside. Classes can be very stressful for students, especially those studying engineering. With so many engineering and STEM buildings around the proposed location, it is especially important that there is a space nearby to relax. It is also vital that there are comfortable places to be outside, as oftentimes students are indoors for much of the day in class and studying. Benches and tables underneath the sail will provide the means for students to eat, study, or simply just sit outside with others.

The shade sail will also benefit staff and faculty inside the ECE building. Offices located on the south wall are noticeably hotter near the windows, particularly in summer. Even with the use of AC, users of these spaces suffer from the increased temperatures and bright sun. These staff and faculty members would benefit from the installation of the shade sail and could enjoy a cooler office.

This project also aims to educate users in how the shade sail benefits environmental sustainability. The sail will partially shade the ECE Building, reducing the amount of solar radiation into the windows and walls. This reduced amount of radiation equates to energy savings as less air conditioning has to be used to cool the building. We will collect air conditioning operation times for neighboring offices that are impacted and adjacent to the shade sail. Our goal is to educate students on the environmental sustainability impact. QR codes and website links posted on site (see signage mock-up in SM) will allow the public to access the AC usage data and plots of using time saved by the sail. CAEM is improving the departmental areas and we foresee streaming this data to a television screen to be placed in our lobby. In the future, we hope to also collect solar insolation data and

move to mathematically modeling the energy needs and displaying that data on our website and in CAEM.

Student Leadership & Involvement:

Please provide a description of how your project will benefit students on campus regarding the creation of leadership opportunities or student engagement. What leadership opportunities exist within your proposal? If you plan to seek student involvement, include relevant details thoroughly and how you will solicit/ market these opportunities.

Response:

From idea formation to installation, this project is student driven. Over the past two years, civil, environmental and Architectural Eng. students have led the planning process with faculty oversight and guidance. Student on the team completed independent studies to develop the Master Plan for the district and focused plans for the west and north sides. They were involved in nearly all exploratory and informational meetings with staff and faculty. In addition to planning products, the students presented their work to the CAEM Dept. industry-advisory council. This summer, three students continued the design process on the overall site and specifically the shade sail. They will be intimately involved in coordinating with FM, PDC, and ECE over the next month and during the project.

During the project, student leaders will also recruit and organize student volunteers to construct the shade sail on volunteer workdays. They will reach out to students in the classes, through CAEM student clubs (ASCE, AGC, DBIA, AEI, WICE) and to other campus groups (e.g., ECE clubs, Engineers without Borders and Students for Sustainability). Team students will also conduct the final analysis for the placement of the shade sail and design of the support structure. They will identify and purchase materials and schedule and rent necessary equipment for each task. This project management effort is career-connected experience for many of our students interested in construction engineering.

Education, Outreach, and Behavior Change:

What opportunities does this project provide for members of the campus/community to learn about sustainability? How will your project educate the campus community and/or incorporate outreach and behavior change, particularly beyond the "sustainability choir?"
Please provide a description of how you expect your project will communicate its impacts to the campus community.

Response:

Our social sustainability efforts are geared partially toward education. We will demonstrate the benefits of shade on solar radiation on the building and quantify the impact on energy demands. Importantly, the results will be displayed in real-time for students and the public. The information can encourage the public to add shading, likely trees, around their homes to gain these benefits. We

will link to the TEP tree planting program and use our forum to promote it to homeowners (https://www.tep.com/trees-for-you/). Our data page will also be linked to this site and other non-commercial links on the energy and heat island benefits of shading.

We will host two 'open tents' below the shade structure that would welcome the campus community to learn about the shade sail. The first will be during construction to let Palm District residents understand what is happening and the sail's benefits. The uniqueness of constructing a sail on campus should attract many individuals to learn about the effort and what is happening including those outside of the sustainability choir.

After construction is complete, a second event will be held after data is collected on the air conditioning operations to document the sail's benefits to educate the community. We will attempt to connect with TEP for literature on their tree planting program. We will also introduce future PDD project directions for the area as a whole in preparation for a spring CSF grant. Last spring, this approach was very successful in viewing the Landscape Architecture Master student plans. Invitations will be sent to nearby sororities, departments and building managers.