STUDENT SUSTAINABILITY COMMITTEE

Funding Application – Step II

Funding Criteria

A. General Rules

1. Students, faculty, and staff are encouraged to submit requests for funding. Student-led projects require a faculty or staff sponsor in order to have funds awarded.
2. Funding can only go to university-affiliated projects from students, faculty, staff, and departments.
3. All SSC projects must make a substantial impact on students. This may be a direct impact or an impact through education and engagement. All SSC funding is 100% from student green fees, so the projects funded by the students must benefit them.
4. SSC encourages innovation and new technologies – creative projects are encouraged to apply.
5. Unless a type of expense is specifically listed below as having restrictions, SSC can generally fund it. The items referenced below should not be taken as comprehensive list.

B. Things SSC Can Fund, On A Case-By-Case Basis

1. SSC can fund feasibility studies and design work; however, it must work toward ultimately addressing a sustainability need on campus.
2. SSC can fund staff positions that are related to improving campus sustainability. Strong preference will be given to proposals receiving matching funding from departments and/or plans for maintaining continuity of the position after the end of the initial grant.
3. SSC can fund outreach events with a central theme of sustainability, provided their primary audience is the general campus community.
4. SSC discourages funding requests for food and prizes but will consider proposals on a case by case basis that prove significant reasoning.
5. SSC can fund repairs and improvements to existing building systems as long as it works toward the goal of improving campus sustainability; however, a preference is shown to projects utilizing new or innovative ideas.
6. SSC can provide departments with loans for projects with a distinct payback on a case by case base. Loans will require a separate memorandum of understanding between SSC and departmental leadership pledging to repay the award in full and detailing the payback plan.

C. Things SSC Will Not Fund:

1. SSC will not fund projects with a primary end goal of generating revenue for non-University entities.
2. SSC will not fund personal lodging, food, beverage, and other travel expenses.
3. SSC will not fund any travel expenses.
4. SSC will not fund tuition or other forms of personal financial assistance for students beyond standard student employee wages.

Your Step 2 funding application should include this application, the supplemental budget form, and any letters of support.

Please submit this completed application and any relevant supporting documentation to Sustainability-Committee@Illinois.edu. The Working Group Chairs will be in contact with you regarding any questions about the application. If you have any questions about the application process, please contact the Student Sustainability Committee at sustainability-committee@illinois.edu.

General & Contact Information

Project Name: Electrical and Computer Engineering Building (ECEB) Interactive, Energy Education/Production/Use Display

Total Amount Requested from SSC: $30,000

Project Topic Areas: ☐ Land & Water X Education ☐ Energy
☐ Transportation ☐ Food & Waste

Applicant Name: Joyce Mast
Campus Affiliation (Unit/Department or RSO/Organization): Electrical and Computer Engineering
Email Address: jmast@illinois.edu

Check one:
☐ This project is solely my own ***OR***
X This project is proposed on behalf of (name of student org., campus dept., etc.): Department of Electrical and Computer Engineering

Project Team Members

Name	Department	Email
Joyce Mast, Coordinator, Grainger Center for Electric Machinery and Electromechanics	Electrical and Computer Engineering	jmast@illinois.edu
Catherine Somers, Assistant Head for Administration	Electrical and Computer Engineering	csomers@illinois.edu
Timothy Newman, Director of Facilities	Electrical and Computer Engineering	tjnewman@illinois.edu
Philip Krein, Professor Emeritus, Head of Building Use Committee	Electrical and Computer Engineering	krein@illinois.edu
Todd Sweet, Director of Communications	Electrical and Computer Engineering	tmsweet@illinois.edu
Vincenzo Spagnola – Illini Lights Out Intern	iSEE	vincenzo.spagnola@gmail.com
Professor Juan Salamanca	School of Art and Design	jsal@illinois.edu
Kate Brewster, Information Tech, Tech Specialist	Facilities and Services	klund3@illinois.edu
Robie Bauer, Management Engineer	Facilities and Services	robbauer@illinois.edu
Sonny Thompson IT Technical Associate	Facilities and Services	cdthomps@illinois.edu
Neil Feuerhelm, Senior Audio Visual Tech Specialist	College of Engineering IT	feuerhe1@illinois.edu

Financial Contact *(Must be a full-time University of Illinois staff member)*

Contact Name: Joyce Mast

Unit/Department: ECE

Email Address: jmast@illinois.edu

Project Information

Please review the proposal materials and online content carefully. It is highly recommended you visit a working group meeting sometime during the proposal submission process.

Please provide a brief background of the project, its goals, and the desired outcomes:

You may copy and paste your Step 1 application answer if nothing has changed.

Because of its super-efficient design and construction materials, ECEB is projected to achieve zero-net energy and LEED Platinum certifications when power from the building's solar panels, expected to be .3 megawatts, is added to 1.2 megawatts, the amount reserved for ECEB from a planned second solar farm, for a total of 1.5 megawatts, the designed requirement to operate ECEB. A multi-disciplinary team from ECE, Facilities and Services, iSEE, Engineering AV IT, and the School of Fine and Applied Arts is coming together to visualize, construct, program, and operate this student-focused display about energy production, utilization and conservation.

The display has three goals. The first is to teach students about energy use while presenting relatable and significant ways they can reduce energy-consumption patterns. This includes 3,000-4,000 students who pass through the lobby daily, faculty, and campus visitors (more than 10,000 from Engineering Open House. These are mostly elementary and high school students), as well as students coming for recruiting. During the Fall 2018 semester, we had a total of 51 corporate visits for either meetings, tech talks, lobby days, or recruiting events that companies held individually. In addition, 19 or so companies, as part of the Corporate Connections program, came to campus for *The Corporate Connections After Hours* recruiting event (This event is wall-to-wall students). Each company brings anywhere from 2 to 10 representatives, depending on the nature of the visit.

The display needs all three elements to engage curious students—the large touch screen and banner in a high-traffic area with two welcoming kiosks so they can learn about energy usage through energy games/questions with their friends (see websites and data below from the Shedd Aquarium).

The second is to show--in real time—energy produced by our solar installation (research panels funded primarily by the SSC and the remainder of the array) and ECEB's allotment from the second solar farm, as well as energy used throughout the building.

The third is to demonstrate ECEB's efficiencies and document its progress toward certification as the first zero-net status building on campus. The display completes the only remaining requirement for ECEB to attain LEED Platinum certification. ECE's historic Energy Heroes also will be featured.

Where will the project be located? Are special permissions required for this project site?

If special permission is required for this location, please explain and submit any relevant letters of support with the application.

The project will be located on the ECEB lobby south wall and space immediately in front of that wall. This is just west of the west lobby entrance to the Grainger Auditorium. The 75" touch screen will cover the space currently occupied by a wayfaring screen. A large poster above the wall screen will highlight SSC involvement in ECEB's arriving at zero-net energy (see attachment).

Permissions have been granted by Tim Newman, Director of Facilities; Catherine Somers, Assistant Head for Administration; Wen-mei Hwu, Acting Department Head; Todd Sweet, Director of Communications; and Kate Brewster, Facilities and Services.

Other than the project team, who will have a stake in the project? Please list other individuals, groups, or departments affiliated directly or indirectly by the project. This includes any entity providing funding (immediate, future, ongoing, matching, in-kind, etc.) and any entities that benefit from this project.
Please attach letters of commitment or support at the end of the application.

Micah Kenfield, Sustainability Programs Manager, assured me that students recruited through iSEE during the regular school year will be following up with email pledges students make using the 22" touch kiosks.
Vince Spagnola, Illini Lights Out Intern, will be working with me to define the terms of the agreements.
Kate Brewster will also be helping Vince by supplying energy-usage data for various appliances over various timeframes to be used in the 22" touch kiosks.
Josh Potts, Software Engineer, Engineering IT Shared Services, will confer with Vince and the iSEE students to make sure the email notification-system programming meets Engineering IT standards.
Randy Reinhart, Foreman of the F & S Sheet metal shop, will be in charge of the enclosure for the 75" touch screen.
Tim Newman, ECEB Facilities Director, will be in charge of installing the touch screen.
Neil Feuerhelm is conferring with Engineering AV IT and Professor Salamanca to make sure his class project in data visualization meets Engineering AV IT standards for FourWinds software. Neil is looking to get programming funding, because this is a multi-disciplinary project (see Supplemental Budget).
Kate Brewster will be working with Professor Salamanca to visualize the locations of the 74 data streams from F&S to ECEB.
Neil has communicated with the kiosk manufacturer, **Jeff Goldstein**, to make sure their Intel Compute Stick and power brick (including adequate space for cabling) will be compatible with FourWinds, the AV software used by Engineering AV IT.
Jeff Goldstein will include hooks on the kiosks for hanging waterproof plastic hangtags printed with energy usage reminders for the students to hang around their showerheads.
Premier Printing representative **Wanda Kanagy** gave the best pricing for the hangtags and poster behind the 75" touch screen.

How will this project involve and/or benefit students?
This includes both direct and indirect impact.
The main objective of the exhibit is to engage students about their energy consumption patterns and the ways these relate to a future dependent on renewable energy, and suggest specific methods they can adopt to help make this happen. Each element of the exhibit is designed for the sole purpose of connecting with our focus demographic: college students. There is significant evidence that the patterns students learn during their time in college follow them throughout the remainder of their life. We believe that once completed, this exhibit will prompt students to re-evaluate the way that they think about energy while energizing them to use the information provided to make decisions that are in the best interest of both their electricity bill and the environment.
The bulk of the interaction will be carried out through use of the two touch screen displays. Identical in information and activities, the two screens will allow for several individuals to interact with the exhibit at one time. The main screen interface will have three options for students to click: Information on how to learn more about their own energy consumption with their electricity provider, information on how to reduce their energy consumption, including participating in Illini Lights Out, and a pledge they can sign to commit to employing tested energy consumption-reduction techniques.

For the option to learn more about their actual energy consumption, students will be taken to a page showing how to access this information with Ameren. It will give an example of the "Load Analysis" under the Usage Option that is to be expected. In order to make this as simple as possible, a QR Code will be generated that they can scan to be taken to their specific page, provided they input their own login information. To make the most of this opportunity, additional questions will be presented for students to ask themselves when analyzing the data in order to understand the underlying reasons for anomalies in their consumption. The Ameren address will also show current Ameren freebies—maybe LED bulbs. In the past, freebies have included smart thermostats for home owners.

The second option for students to click when interacting with the display screen is information on how to reduce energy consumption. This will begin by first asking the student whether they live in a dorm, apartment or home. Depending on the answer given, specifically selected sets of relevant information will be shown. For example, a student living in a dorm could reduce their energy consumption by setting the thermoset to a more ambient temperature while a student in a home they own could potentially upgrade appliances that are more energy efficient. Information provided on utility websites, the Department of Energy and research done based on behavioral energy consumption will serve as the primary resources for this info. Special consideration will be given in all instances to make sure the distinction between power and energy is understood and that all info provided is concise and relevant.

The third and final option when using the interactive display is for students to sign a pledge saying that they will be conscious of their energy consumption patterns and take steps to try to reduce the energy they consume. When signing the pledge, students will be asked for their name, department on campus and email address. This email address will be used as a point of contact, when sending monthly emails which focus on teaching them new ways to reduce their energy consumption, i.e., March = Reducing Energy in the Kitchen, April = Effects of AC and Heating. etc. Another major purpose for this pledge will be to enter these individuals into a raffle to be held around Earth Day when winners receive a solar-powered phone charger. Not only will this raffle incentivize signing the pledge and interacting with the exhibit in the first place, it will serve as a reward for those that ideally will be making major changes in their consumption patterns.

Another element will be to provide information that students can take away from the exhibit that will remind them of major steps they can take to be conscious of their energy consumption. This will be a unique waterproof plastic hangtag that could be clipped onto the student's shower nozzle. Looking very similar to a parking pass that would be clipped onto a car's rearview mirror, this item is selected specifically for its potential to give daily undistracted exposure to students.

When testing the success of the program, we will ask students 6-12 months after signing the pledge to what extent are they still conscious above their energy consumption. This will include questions about how often they check their energy bill, if they have learned any tips they would like to share on reducing energy consumption, and how the program could be improved. Based on the results from this poll, we will continuously update the program as is appropriate.

We feel that in initiating this program, a special emphasis must be given to make sure that the information can be comprehended by individuals of all technical and cultural backgrounds. In doing so, a particularly exciting additional benefit will be its potential to interact with those K-12th grade students who visit campus during Engineering Open House.

How will you bring awareness and publicize the project on campus? In addition to SSC, where will information about this project be reported?

The project will be publicized in the following ECE Department publications: "Resonance," a print publication published twice a year for alumni and friends; email newsletters, "The Wire," sent weekly to faculty, staff, and students; "Alumni Update," sent monthly to alumni; "My ECE" website https://my.ece.illinois.edu/, for staff,

faculty and students; the Electrical and Computer Engineering Department website: http://www.ece.illinois.edu/; The Grainger Center for Electric Machinery and Electromechanics (CEME) website: http://ceme.ece.illinois.edu/; and the Power and Energy Group website: http://energy.ece.illinois.edu/. This display will also be featured in printed Grainger CEME annual and interim reports, at Power Affiliates Meetings (for industry contributors to research in the power area) held each May, and in printed Power Affiliates reports distributed at those meetings.

Digital plaques placed next to the door exiting the building to the roof where the solar panels are located AND on the first floor of the building. When digital plaques are touched, they will describe SSC involvement and monitor energy produced by panels funded by the SSC. We could measure the times these screens are touched.

SSC support will be highlighted in the overall building zero-net-energy context and in the extensive energy metering and interactive educational displays.

Financial Information

In addition to the below questions, please submit the supplemental budget spreadsheet available on the Student Sustainability Committee website. Submission of both documents by the submission deadline is required for consideration of your project.

Have you applied for funding from SSC before? If so, for what project?

1) In 2012, we received $150,000 for a feasibility study to install solar panels producing 1.2 megawatts of power on the adjacent north parking deck. The study showed that the rack to support the panels above the cars parked on the top floor of the parking deck was, in itself, so expensive, it made the cost per solar kilowatt hour prohibitive.
2) We were awarded $225,000 from the SSC, one element of a $900,000 package (June 2015), which included $249,999 from the State of Illinois Department of Commerce and Economic Opportunity (DCEO) to fund the solar panels and installation on ECEB. The SSC funds were for panels primarily to be used for student research. When the State of Illinois had no budget, DCEO suspended (rescinded) $149,999.
3) About $85,000 from the SSC was returned to them in March 2016 when ECE was unable to spend the money in a timely manner.
4) Fall 2018, ECE applied for $200,000 from the SSC to help offset funds rescinded from the State of Illinois and returned to SSC. Our application was rejected.

If this project is implemented, will you require any ongoing funding? What is the strategy for supporting the project in order to cover replacement, operation, or renewal costs?

Please note that SSC provides funding on a case-by-case basis annually and should not be considered as an ongoing source of funding.

Costs for the 75” screen and two 22” kiosks include 3-year warranties, the maximum time companies will guarantee hardware. The equipment is expected to last longer than the warranty period. After three years, we will survey the ongoing state of computer hardware to decide how best to maintain the display. We plan to keep it functional for the projected life of the building (100 years).

Please include any other obtained sources of funding. Have you applied for funding elsewhere?

Please attach any relevant letters of support as needed in a separate document.

Environmental, Economic, and Awareness Impacts

How will the project improve environmental sustainability at the Urbana-Champaign campus? If applicable, how does this project fit within any of the Illinois Climate Action Plan (iCAP) goals?

ECEB solar panels will produce about 1350 kWh per day or about 495,000 kWh per year, measured on the ac side. Over a 40-year life span, this is 19,795,000 kWh. Together with a 1.2 MW (peak) solar array from the second solar farm, the total 1,500 kW solar arrays will generate about 100% of the building's net energy needs—ECEB will achieve zero-net certification.

With GHG Emissions impact based on the following, the reduction is more than 220,000 lb CO_2lb/year Electricity - 1.672 CO_2lb/kWh, Diesel - 22.2 CO_2lb/gallon, Steam - 244.9 CO_2lb/klb, Gasoline - 19.4 CO_2lb/gallon, Chilled Water - 144.6 CO_2lb/mmbtu

The University's retail electricity cost averages about $80/MWh today, so the monetary value of 19795 MWh is about $1.58 million. The annual production value is almost $40,000, which can be treated as the offset energy cost associated with the rooftop array.

ECEB's becoming a zero net energy building will contribute to the iCAP FY20 goals (ending on June 30, 2020) of:

1) Energy Utilization: 30% improvement from FY08 baseline
2) Energy Emissions: 30% reduction from FY08 baseline

Our ECEB Interactive, Energy Education/Production/Use Display will document these energy savings and show the world that ECEB is a model energy-efficient laboratory building.

LEED Platinum certification documents that the building design and construction contained a strong emphasis on energy efficiencies and the environment. Following are these design elements.

- Enhanced building envelope: 5% energy savings. An R-30 wall system was identified as the best tradeoff between desired performance and cost.
- Passive solar design: 3% energy savings. The building orientation, overhang and shade elements, and a successive height configuration were selected to minimize solar heat load in the summer (80% shading) while harvesting light in the winter.
- Chilled beam cooling system: 10% energy savings. This system is a modernization of conventional hot-water heat, providing natural convection cooling flow in an overhead system. It enhances energy performance since the cooling load is carried by water rather than air, and the much higher heat capacity reduces pumping energy.
- Ventilation energy-recovery wheels. These heat exchangers reduce loss in air exchange to the outside environment.
- Displacement ventilation. Large spaces in the building not suitable for chilled beams use a low-pressure high-volume displacement ventilation system to provide efficient environmental control.
- Heat recovery chillers with net metering: 23% energy savings. This heat pump system provides local chilled water for cooling. The rejected heat is delivered into the campus system for use throughout the campus.
- Air-side economizer. This equipment takes advantage of outside air temperature when appropriate to reduce heating and cooling requirements as weather allows.
- Ventilation occupancy sensors: 1% energy savings. The intention is improved occupancy sensors that can be used to tailor air flows into spaces in an active manner.

- Premium efficiency electric motors. Available off-the-shelf premium efficiency motors reduce energy consumption by several percent. The design effort also involves "right sizing" of motors to keep them relatively close to rated operating conditions, at which efficiency is maximized. Most motors in the facility operate from electric drives to support speed adjustment and better matching to operating requirements.
- Reduced plug load. The department is committed to metering and reduced electricity consumption.
- Low-flow plumbing fixtures. These have an indirect energy impact through reduced pumping and handling needs. They contribute to substantial water-use reductions.
- Photovoltaic array: 55% energy creation. The building roof supports a 300 kW solar array. This power will be augmented by 1200 kW solar power from the second UIUC solar farm.
- Reduced lighting and extensive use of LED lighting and efficient fluorescent lamps: 5% energy savings. The intention is to be sure that lighting needs are met with daylight to the greatest possible extent.
- $C0_2$ lighting occupancy control sensors and switches to minimize unused lighting.
- Daylight harvesting through window placement and access to exterior light.
- Native landscaping: Plant material selected is primarily native, which can sustain itself without an irrigation system. It also will restore local habitat.
- Recycling. Recycled and regional building materials are used in addition to recycling centers distributed throughout the building.
- Science on display. One example of science on display is the cutting-edge instructional clean room, enclosed by a transparent glass wall and located in the main lobby for optimum visibility.

The expected energy consumption is less than 50% of the most recent ASHRAE benchmark without photovoltaics (PV). When the PV resources are included, the facility is expected to reach zero net energy consumption.

How will you monitor and evaluate the project's progress and environmental outcomes? What short-term and long-term environmental impacts do you expect?
Some examples include carbon emissions, water conservation, green behavior, and reduced landfill waste.
The goals of our display in changing energy behavior are similar to those of a display at the Shedd Aquarium in Chicago https://www.bridgewaterstudio.net/projects/iseif-museum-kiosk-shedd-aquarium/

https://www.mightybytes.com/blog/earth-day-games-exhibit-at-shedd-aquarium/

Kris Nesbitt, Senior Director, Exhibits and Experience Development at the John G. Shedd Aquarium
p 312.692.2710 said this exhibit has a lot of "draw power."

Usage from their report dated July 1, 2016
Since its opening on Earth Day, 2016, the exhibit kiosk has registered 11,280 pledges from guests who have agreed to join Shedd in efforts to reduce our collective impact on the environment by making simple changes in their homes to reduce energy and water consumption. In addition to these pledges, approximately 3,000 guests opted into receiving emails to get energy saving tips and learn more about ways they can make a difference. The emails will serve to remind guests of their pledges; share resources, such as smartpowerillinois.gov, where they can learn more about smart meters and how they can utilize this technology to save energy; and keep them engaged with sustainability efforts at Shedd and in their communities.

We expect the ECEB kiosks' programming/games/cool info designed by Vince and other iSEE students to produce results as inspiring as these, based on our student population. Of course, we have the benefit of the Illini Lights Out Connection, our very own on-site opportunity to practice energy conservation. We will be featuring ECEB as a zero-net building throughout its projected 100-year life. Energy usage results will be continuously monitored.

What are your specific outreach goals? How will this project inspire change at UIUC?
Raised consciousness about energy conservation for all who interact with exhibit, reduced utility bills for students making and following up on energy-saving pledge, and higher visibility for iSEE Illini Lights Out, leading to energy savings across campus. Also see answer to **"How will this project involve and/or benefit students?**

If applicable, how does this project impact environmental injustice or social injustice?