STUDENT SUSTAINABILITY COMMITTEE

Funding Application – Step 1

Please submit this completed application and any relevant supporting documentation by the deadline listed on the SSC website 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 SSC at Sustainability-Committee@Illinois.edu.

General Information

Project Name: Temple Hoyne Buell Hall as an Energy Learning Laboratory

Total Amount Requested from SSC: $300,000

Project Topic Area(s): ☒Energy ☒Education ☐Food & Waste ☐Land ☒Water ☐Transportation

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Contact Information

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Project Team

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Project Information

Please provide a brief background of the project, the goals, and the desired outcomes:
Temple Hoyne Buell Hall (TBH) houses three academic departments focused on design, planning and technology: the School of Architecture, Department of Landscape Architecture, and Department of Urban and Regional Planning. Built as a model for architectural excellence, this award-winning building is a leader in design and function. However, there are still significant opportunities to reduce the building's environmental impact.

The Smart Energy Design Assistance Center (SEDAC) has identified energy savings measures that would result in annual savings of 81,000 kWh, 320 klbs steam, $13,000 energy costs, and 76 tonnes CO_2 emissions. SEDAC, in partnership with the School of Architecture, the Department of Landscape Architecture, and the Department of Urban and Regional Planning, proposes to implement these energy savings measures. In the process we will engage student participation, so that the overall project becomes a real-world energy learning laboratory within TBH.

The energy savings projects include demand control ventilation with low-leak dampers, upgrading classrooms and offices to LED lighting with daylight harvesting control, and improved window closure hardware. Additionally we incorporate a student-led project that would automatically detect faulty HVAC system sensors and actuators so that they can be easily identified and repaired – such problems routinely go undetected for years and negatively affect energy use and building function. Finally we seek to increase transparency in building energy use and building energy systems, through the installation of an interactive digital display.

These projects would reduce energy use, improve building performance, reduce deferred maintenance, and contribute to campus energy, carbon and greenhouse gas (GHG) reduction goals. Since students use TBH as a place to learn about building design and technology, there is a natural opportunity to engage students of all backgrounds and concentrations in learning and innovation opportunities that pertain to these improvements and overall building efficiency.

The project goals include: 1) reduce the energy footprint of TBH and contribute to campus sustainability initiatives; 2) engage student learning in the process of installing energy savings projects; and 3) develop innovative automatic fault detection techniques that F&S could apply across the entire campus to for improved building operation and maintenance.

The project outcomes include: 1) TBH building improvements with annual savings of 81,000 kWh, 320 klbs steam, $13,000 energy costs, and 76 tonnes CO_2 emissions; 2) approximately five student projects; 3) progress towards automated detection of faulty HVAC system sensors that F&S could use across the entire campus; and 4) an interactive digital display, or "dashboard," visible and usable by students, staff, and visitors.

Please provide a brief summary of how students will be involved in the project:

Temple Hoyne Buell Hall (TBH) houses three academic departments focused on design, planning and technology: the School of Architecture, Department of Landscape Architecture, and Department of Urban and Regional Planning. Students will be engaged through a series of class projects and potential engagement with student groups.

1. Demand control ventilation with low-leak dampers: The design and installation of demand control ventilation in any building involves compromises that relate to the system cost and complexity vs. tightness of control and efficiency. After the system is installed in TBH, there will be a class project(s) that analyzes the resultant data streams to develop possible optimization schemes, for example, in terms of system operation and cost. The findings could be applied to TBH and other buildings across campus.

2. LED lighting and daylight harvesting control: Cost-effective installation of LED lighting in the classrooms and offices will require consideration of fixture redesign, and thus building stakeholder input. There will be a class project(s) that develops preliminary designs and collects stakeholder input.

3. Window hardware: The building is equipped with operable windows, but the geometry of the existing building hardware makes it difficult to operate the windows. As a result, windows stay open at inappropriate times and waste energy. There will be a class project(s) that evaluates functional, aesthetic, and cost considerations, along with stakeholder input for alternate window hardware on the north and east-facing windows, and develops recommendations for implementation.

4. Automatic detection of faulty HVAC system sensors and actuators: Currently, the only way to determine whether a sensor or actuator is not working is to have a trained specialist study the system and its functionality, which takes significant time and funding to uncover critical maintenance needs. When these components are broken or not functioning properly, it negatively impacts the building systems and overall efficiency. There will be a class project(s) to design and develop algorithms for automatic fault detection that could be potentially incorporated into the F&S digital building control systems and notify F&S staff of problems needing repair. This type of alert system would increase proactive maintenance and help to maintain efficiency by addressing system deficiencies when they occur.

5. Interactive digital display of TBH energy and building energy systems: There will be a class project(s) to collect stakeholder input, design, and build an interactive energy dashboard that would be housed in the main atrium or student project gallery of TBH. The interactive energy dashboard would show the building's current energy use and building system operations in real time, as well as graphs and charts of use over time. We would use the campus dashboard system as a base, but enhance the user interface through increased educational data and add the BAS system to the available charts and graphs to view. We envision that viewers could click on certain parts of the dashboard to learn about components of a building system, the meaning of energy units, and more to truly understand whether the building is performing at an optimal level, based on real data.

The opportunity for continued investigation and monitoring of these building systems can also lead to long-term learning and student engagement opportunities. Project research, studies, and student work would be highlighted in the TBH gallery as exhibits, listed online at the SEDAC website and, if possible, the College of FAA website, and highlighted through student groups across campus.

Please provide a brief summary of the project timeline:
The proposed project would be a two-year project from May 2018 to April 2020. Key milestones include:

- Installation of the following energy efficiency recommendations and technologies for TBH:
    - Demand control ventilation with low-leak dampers
    - LED lighting fixtures and daylight harvesters
    - Window closure hardware
    - Interactive digital display, or "dashboard," visible and usable by students, staff, and visitors
- Studies conducted by students on the following topics based on energy efficiency opportunities at TBH:
    - HVAC optimization schemes for demand control ventilation systems with low-leak dampers
    - Lighting design and stakeholder input for classrooms and office spaces
    - Automated fault detection system for HVAC sensors and actuators
    - Investigation of window closure hardware, including stakeholder input
    - Stakeholder input and design of interactive building energy displays that serve functional, educational, and aesthetic purposes

Additional comments
SEDAC will lead the execution of this project. For implementing the building improvements SEDAC will coordinate between the departments and Facilities & Services. The key contact for the departments and the building will be Professor William Sullivan, head of Landscape Architecture. SEDAC will also engage with faculty to engage in class projects. Professor Brian Deal will be the key contact for coordinating with faculty. SEDAC has worked with F&S on campus projects in the past and with numerous faculty members across campus on energy related class projects.