*Please submit this completed application, the supplemental budget spreadsheet, and any relevant supporting documentation by the deadline indicated in your Step 1 notification letter 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):** [x] Energy [x] Education [ ] Food & Waste

 [ ] Land [x] Water [ ] Transportation

# Contact Information

### Project Lead

Applicant Name: Todd Rusk

Unit/Department: Smart Energy Design Assistance Center (SEDAC), Department of Landscape Architecture

Email Address: trusk@illinois.edu

Phone Number: 217-333-8955

### Financial Contact *(Must be Full-time University of Illinois Staff Member)*

Contact Name: Greg Anderson

Unit/Department: Director of Business Services; College of Fine & Applied Arts

Email Address: gnanders@uillinois.edu

Phone Number: 217-265-0930

Organization Code: 569000

### Facilities Management Contact *(If Applicable)*

Contact Name: Name of Applicant or Project Lead

Email Address: Preferred Email Address

**Primary Project Team**

|  |  |  |
| --- | --- | --- |
| **Name** | **Department** | **Email** |
| Todd Rusk | SEDAC/Department of Landscape Architecture | trusk@illinois.edu |
| Brian Deal | SEDAC/Department of Landscape Architecture | deal@illinois.edu |
| William Sullivan | SEDAC/Department of Landscape Architecture | wcsulliv@illinois.edu |
| Cassie Carroll; Ryan Siegel | SEDAC/Department of Landscape Architecture | ccarrol2@illinois.edu; rwsiegel@illinois.edu |

# Project Description

**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, $13,100 in energy costs, and 214,000 lbs CO2 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 students through a real-world energy learning laboratory within TBH.

The energy savings projects we propose 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 will 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 with these students, teaching them about energy systems and technologies, and providing students opportunities to implement innovative energy solutions.

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 for improved building operation and maintenance.

The project outcomes include: 1) TBH building improvements with annual savings of 81,000 kWh, 320 klbs steam, $13,100 in energy costs, and 214,000 lbs CO2 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.

**How will the project improve the sustainability of the Illinois campus and how will the project go above and beyond campus standards?**

According to the iCAP, building energy retrofits are a critical step in moving the campus toward carbon neutrality. The project will contribute to long-term campus sustainability by demonstrating a model for future campus energy retrofit projects. In this project we propose a retrofit model that engages with campus units, identifies and incorporates energy efficient technology and innovative monitoring systems, and involves students in the design, monitoring and evaluation of building systems.

The project goes above and beyond campus standards by looking at whole building functionality and inviting students to assist with design, development and monitoring of improvements made at TBH. It also addresses the Illinois Strategic Plan and iCAP goals of increasing building efficiency, reduce building energy use intensity, and creating a comfortable and efficient learning environment for students.

The project will address environmental sustainability directly by reducing TBH’s annual carbon impact and increase operational sustainability through decreased utility costs. The project will also create unique campus-wide opportunities for students to learn about sustainable building design and serve as a model for other colleges and departments as they address sustainability in their facilities. SEDAC has the capacity to expand this project across campus. We will leverage project outcomes and lessons learned to assist other buildings on campus to implement similar energy efficient initiatives, increasing overall campus sustainability and moving the campus closer to iCAP goals.

**Where will the project be located? Will special permissions be required to enact the project on this site? If so, please explain and submit any relevant letters of support with the application.**

The project will be located at Temple Hoyne Buell Hall, 611 Lorado Taft Dr. in Champaign, IL. The Temple Hoyne Buell Hall (TBH) Governing Board will oversee and approve all activities related to the project. The TBH Governing Board is comprised of members from all three academic departments located in the building: the School of Architecture, Department of Landscape Architecture, and the Department of Urban and Regional Planning. SEDAC will work closely with the Board for review, discussion and approval for all aspects of the project, including cost, design, management, project implementation, and student engagement.

**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 will be benefitting from this project. Please attach letters of commitment or support at the end of the application.**

The primary organizations that will have a stake in the project are the departments housed in Temple Hoyne Buell Hall (TBH), listed above. These departments will provide ongoing support and oversight through the TBH Governing Board, as described above. Facilities and Services also has a stake in the project, since they will be completing energy efficiency retrofits and upgrades throughout the building.

Entities that will benefit from the project include students, faculty and staff that reside in and use TBH, and the departments housed in TBH. Students have a major stake in the success and evaluation of work completed, in addition to benefitting from increased comfort and better lighting to learn. Additionally, opportunities to learn about sustainable building design in an applied building setting will provide students with real-world experience that they can use in their future careers. Faculty and staff will benefit from increased comfort and better lighting in offices and common areas, and departments housed at TBH will benefit from decreased energy costs. Facilities & Services will also benefit from the upgrades, as maintenance time and costs at TBH will be reduced. Additionally, the fault detection system, if piloted, could increase maintenance efficiency and help manage utility costs.

**Please indicate how this project will involve or impact students. What role will students play in the project?**

The project will directly involve and impact students across campus through a series of multi-disciplinary class projects. Some students will assist with the design of project initiatives, while others will analyze and monitor building systems to ensure the project’s energy efficiency initiatives are functioning properly. Our intent is to provide an engaging learning experience where students can explore building sustainability. Note that students will not be responsible for final project designs. SEDAC, in consultation with the TBH Governing Board and with F&S, will develop final project designs. Student project findings will be used as preliminary input as appropriate.

All students who take classes, attend lectures, and complete projects at Temple Buell Hall will benefit from and be exposed to the project. The improvements will increase the comfort of the learning environment. A dashboard displayed prominently in the TBH atrium will allow all students to learn about building systems, performance, and energy efficiency standards in real time.

Some students will have an opportunity to directly investigate and monitor these building systems through class projects. Alternatively, a student organization could be responsible for one or more of the projects. Students involved in the projects will design, test, evaluate and monitor energy efficiency initiatives, with the support of SEDAC staff. Student projects will focus on the following initiatives:

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. Before and after the system is installed in TBH, a class project(s) will analyze the resultant data streams to develop possible optimization schemes 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 and daylight harvesting controls in the classrooms and offices will require stakeholder input on fixture redesign. One or more class projects will develop preliminary designs; collect stakeholder input from students, faculty and staff, and the TBH Governing Board; and make recommendations for implementation.

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. One or more class projects will evaluate the functional, aesthetic, and cost considerations of alternative window hardware on the north and east-facing windows, solicit stakeholder input, and make 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. When these components are broken or not functioning properly, it negatively impacts the building systems and overall efficiency. One or more class projects will 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: One or more class projects will design and build an interactive energy dashboard that would be housed in the main atrium or student project gallery of TBH, as well as online. 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 starting point, but enhance the user interface through increased educational data and availability of BAS system data. Viewers could click on certain parts of the dashboard to learn about components of a building system, the meaning of energy units, and building performance based on real data.

Students who participate in these class projects will have a long-term impact on TBH’s building energy use, contributing to a more comfortable, better lit environment for learning. These improvements will help TBH become an “exemplary facility,” a goal of the College of Fine and Applied Arts’ Illinois Strategic Plan. Additionally, this project will provide a model for student engagement in sustainable building systems across campus through F&S, iSEE, and individual departments.

# 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?**

The Smart Energy Design Assistance Center (SEDAC) has not applied for funding from SSC before, although there has been an SSC project at TBH, the “Temple Buell Hall Lighting Project.”

**If this project is implemented, will there be any ongoing funding required? 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.**

Building operation and maintenance will continue as usual with the support of F&S after project completion as many of the initiatives are covered by routine maintenance. The TBH Governing Body will continue to support and investigate future opportunities to increase sustainability of the building.

The only ongoing funding required will be to maintain the dashboard system, which we will explore with the TBH Governing Body during the duration of the project to ensure that the system will be maintained and updated after the project period is complete.

**Please include any other sources of funding that have been obtained or applied for. Please attach any relevant letters of support as needed in a separate document.**

There are no other funds that have been obtained or applied for, with regard to the initiatives or TBH building improvements proposed here. The items requested in this SSC application are not dependent on the completion of any projects that may be funded separately.

# Environmental, Economic, and Awareness Impacts

*In addition to the below questions, please indicate specific measurable impacts as applicable on the supplemental budget spreadsheet.*

**Which aspects of sustainability does your project address, and how? Does the project fit within any of the iCAP goals? If so, how does the project go beyond the university status quo standards and policies.**

The project primarily addresses energy efficiency. All equipment-based initiatives in the project, as well as the fault detection system, are energy reduction strategies. Reducing energy use will also reduce water, CO2 emissions and steam, and lower operational and maintenance costs. Energy is reduced in the following ways:

1. Demand control ventilation with low leak dampers will reduce the amount of heating and cooling energy needed to provide ventilation (outdoor air) when classrooms or building spaces are empty. Low leak dampers improve the effectiveness of the DCV by keeping undesired air from leaking into the system. This initiative not only reduces energy use, but also improves indoor air quality.
2. LED lighting and daylight harvesting controls will reduce the amount of electricity associated with lighting. Daylight harvesting controls will allow lights to turn off or be dimmed when outdoor lighting can sufficiently light a space.
3. Improved window hardware will reinforce the building envelope, reducing air leakage and the demand on heating and cooling systems from open windows.
4. The automatic fault detection system will identify faults in the demand control ventilation system (such as the CO2 sensors), prompting building engineers to proactively fix the problems.
5. The dashboard initiative does not save energy directly, though it can help building engineers identify problems in building efficiency when they occur and take steps to solve these problems.

All project initiatives will yield cost savings, which increases the economic sustainability of TBH operations. Social sustainability will be enhanced as we create a comfortable environment that is more conducive to learning and as we educate students at TBH about energy efficiency operations. The dashboard will educate students about energy efficient building designs and practices and inspire them to implement energy efficiency in the buildings they will one day design. Students across campus will work together on the TBH energy efficiency class projects to better understand the benefits of energy efficient operations.

By reducing emissions and energy, this project contributes to iCAP goals. Specifically, the project will help the campus meet EUI reduction goals through TBH energy conservation measures. The project will help the campus meet maintenance goals by addressing energy efficiency items at TBH that may fall under the Deferred Maintenance Program. The project will help the campus meet lighting conservation goals by retrofitting older fixtures in classrooms and offices with more energy efficient LED lighting. The project will also help the campus meet sustainable education goals by educating students about building energy use. The project will expand and enhance the Illini Energy Dashboard project by building a mobile interface where students can better understand and interpret the information displayed.

The project also addresses a goal of the Illinois Strategic Plan for the College of Fine and Applied Arts, which is where TBH departments are located. Goal 2 states that FAA should “Strategically invest in facilities that address immediate and short-term needs in the college, addressing physical structures, program logistics, as well as classroom and performance technology shortcomings.” One of the metrics of success is to measure “Staff thermal comfort.” The demand control ventilation with low leak dampers will increase building comfort, while saving energy and money.

The project goes beyond the status quo by introducing innovative new technologies that increase building efficiency, and piloting efficient building standards that can be replicated across campus. The iCAP plan recommends improved standards for new buildings and renovations, and while TBH is not a new building, SEDAC will be renovating the building with efficient technologies and monitoring systems which can be replicated across campus.

**How will the environmental impacts of your project be measured in the near and long term? What specific monitoring and evaluation processes will you be using to track outcomes and progress?**

SEDAC will measure overall energy use in the near and long-term through data provided by Facilities & Services. After analyzing utility data, we will calculate energy, steam, CO2 and cost reductions both before and after project implementation. Students, through class projects and/or student groups, will help measure the environmental impacts of the project in the near and long-term. Supervised by SEDAC engineers, students will assist in monitoring and evaluating building metrics for the following project initiatives.

1. Demand control ventilation with low-leak dampers: We will measure overall energy use reduction and conduct specific tests. Students will compare data streams from room CO2 monitors and building automation systems, compare energy data to determine cost reduction, and perform indoor air quality tests.
2. LED lighting and daylight harvesting controls: We will measure overall energy use and cost reduction and conduct specific tests. Students will monitor lighting levels and daylight harvesting controls to ensure that equipment is functioning properly and lighting levels are adequate.
3. Window hardware: It is harder to quantify the impact from improved air sealing, but it can account for 5-10% HVAC energy savings. We will analyze building energy data to identify possible correlations between effective window closures and HVAC efficiency.

To monitor and evaluate these initiatives, we will begin by collecting baseline data. We will then set targets for each initiative and monitor results throughout the duration of the project to ensure that targets are met.

SEDAC will monitor project progress through bi-weekly internal meetings and regular meetings with faculty or student groups assisting in administering class projects. SEDAC will also communicate regularly with the TBH Governing Board to share the status and timeline of the project. SEDAC will facilitate presentations of student findings and materials to the TBH Governing Board.

Regular project tracking will occur weekly by SEDAC staff. A report will be created every six months to track the status of current and upcoming projects. This report will be provided to SSC and the TBH Governing Board. All primary stakeholders will be informed of progress and will be invited to provide feedback.

If we do find a need to adjust our timeline, we will report this change to project stakeholders. After the project is complete, SEDAC will monitor the building’s energy use yearly and report results and any anomalies to the TBH Governing Board. We will also evaluate the project as a whole, identifying processes and tasks that were successful, as well as key challenges and how they were overcome.

**What is the plan for publicizing the project on campus? In addition to SSC, where will information about this project be reported?**

To publicize the project on campus, we will display an energy dashboard with real-time building efficiency information, as well as an informational project poster, in the atrium of TBH (the gallery of exhibits) to promote the project to students, faculty, and staff that visit the building. We will also promote the project and its results on the School of Architecture, Department of Urban and Regional Planning, and the Department of Landscape Architecture websites and e-newsletters through feature web articles. We also plan to approach the College of Fine and Applied Arts and the Illinois News Bureau and encourage them to highlight the project as an example of sustainability innovation and design.

SEDAC will create a brief case study on the overall project and disseminate it though our outreach channels, which include our website, social media platforms, and our e-newsletter (distribution to 12,000 individuals).

We will work to promote the project through iSEE, possibly hosting a brown bag lunch and learn about the project for students, faculty, staff and community members to learn more about the project and how results can be used across campus for sustainability project planning. We will promote the project to various student groups to broaden student impact in sustainable building design.

**What are your specific, measurable outreach goals? How will these be measured?**

SEDAC expects project outreach and promotion to reach about 10,000 people across campus, Illinois, and nationally. Our specific, measureable outreach goals are as follows:

* Three web-based articles featuring the project, produced by campus units such as the Illinois News Bureau, FAA, or the Department of Landscape Architecture
* One case study produced by SEDAC to be disseminated as follows: SEDAC will send copies to 75 campus units and individuals, link it to our e-newsletter, post it on our website, and promote it on social media. We expect 250 views from these online outreach channels.
* One project lunch and learn through iSEE, and two presentations to student organizations and groups

We will measure project reach through article and case study website views and attendance at events. We will also track the number of unique views and clicks on SEDAC’s social media platforms to estimate overall reach.

**Do you have any additional comments or relevant information to aid in evaluation of this application?**

SEDAC understands SSC’s interest in funding multiple projects and realize that they may not be able to fund all of our initiatives at this time. We have prioritized our initiatives to help the SSC and the Energy Efficiency Committee determine which initiatives to fund. We have included cost for each initiative, as well as energy, steam, CO2 and cost savings to help inform the decision. When “SEDAC Staffing Support Cost” is listed, this notes our SEDAC Staff and Student labor cost for each project. Our prioritization of initiatives is as follows:

1. Demand control ventilation with low-leak dampers

**Installation Cost SEDAC Staffing Support Cost Total Cost Savings ($/yr)**

$40,000 $20,000 $60,000 $7,600

**Kwh Savings klbs Steam Savings CO2**

9,900 kwh 320 klbs 95,000 lbs

1. LED lighting and daylight harvesting controls

**Installation Cost SEDAC Staffing Support Cost Total Cost Savings ($/yr)**

$130,000 $20,000 $150,000 $5,300

**Kwh Savings klbs Steam Savings CO2**

71,100 kwh 0 klbs 119,000 lbs

1. Window hardware

**Installation Cost SEDAC Staffing Support Cost Total Cost Savings ($/yr)**

$20,000 $18,000 $38,000 Unquantified

1. Automatic detection of faulty HVAC system sensors and actuators: While this initiative may only be piloted in this project, it could significantly impact facility maintenance efficiency, building energy performance and energy savings across campus.

**Installation Cost SEDAC Staffing Support Cost Total Cost Savings ($/yr)**

$0 $16,000 $16,000 Unquantified

1. Interactive digital display of TBH energy and building energy systems: While this project is last on our prioritization, we still feel it could significantly impact student engagement and learning around energy efficiency.

**Installation Cost SEDAC Staffing Support Cost Total Cost Savings ($/yr)**

$20,000 $16,000 $36,000 Unquantified

If you have any questions or need more information about project prioritization, please do not hesitate to reach out to us.