Krannert Center for the Performing Arts / University of Illinois at Urbana-Champaign Proposal Submission for the Student Sustainability Committee Sustainability Grant: KRANNERT CENTER GREEN ROOF INITIATIVE (PILOT PLOT)

APPLICATION INFORMATION

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I. Detailed Project Description:

Project Goals and Introduction

Krannert Center for the Performing Arts, a component of the College of Fine and Applied Arts at the University of Illinois at Urbana-Champaign, respectfully submits this full proposal to the Student Sustainability Committee regarding the installation of a pilot portion of a green roof at Krannert Center. This installation of a pilot green roof is the next step in moving forward with Krannert Center's Green Roof Project. Situated on the campus of the University of Illinois at Urbana-Champaign, Krannert Center boasts a 187,000 square foot roof area and results of a feasibility study conducted by Soodan & Associates, Inc. concluded that the Center's current roof structure has the capacity to support an extensive green roof system (April 29, 2009).

Situated on the campus of the University of Illinois at Urbana-Champaign, Krannert Center boasts a 187,000 square foot roof area and results of a feasibility study conducted by Soodan & Associates, Inc. concluded that the Center's current roof structure has the capacity to support an extensive green roof system (April 29, 2009).

Green roofs are a very new addition to the University of Illinois campus with the most recent installation on the Business Instructional Facility (BIF). However, the installation on BIF encountered difficulties due to structural capacity of the building as well as the method of installation of the green roof using layers. This method is both cost inefficient and lacking in plant coverage, and as such the true benefits of a green roof will not be seen for years to come and the installation will need more maintenance.

Based on the results of the feasibility study, the probable construction cost for a green roof system to be installed at Krannert Center is estimated to be approximately \$50 per square foot (total of \$9.3 million).

The Urban Enviroscapes versatile green roofing module addresses all of these problems with a near maintenance-free design that is pre-made to be easily installed onto any rooftop. This installation will address the problems seen in conventional green roofing systems and prove the feasibility of such a system on the Krannert Center. Furthermore, the estimated cost of installation of this green roof is estimated to be a fraction of Krannert Center's original estimate.

Krannert Center continues to take a leadership role in energy conservation and sustainability, and is committed to further strengthening this role in order to become a national model for architecture and facilities retrofitting and sustainable practices in the arts. The recent retrocommissioning of the Center's HVAC systems resulted in a 32.4% decrease in energy consumption. The Center upgraded theatrical lighting equipment and organizes a series of concerts around a green theme every summer. In December 2009 (with the help of a loan from the SSC), the Center will embark on an LED lighting upgrade in the Lobby – upgrading from normal 150 Watt / 2000 hours incandescent lamps to 32 Watt / 50,000 hours LED fixtures. This indoor architectural LED lighting upgrade will be the first of its kind on this scale (25,000 square feet) and will be an example for many to follow. The green roof project hopes to achieve the same, if not greater visibility and reach.

Already, a number of University of Illinois campus units and companies such as John Deere, Abbott Labs, Baxter, and Procter and Gamble are eagerly awaiting Urban Enviroscape's first installation on Krannert Center for the Performing Arts to move forward with their own green initiatives.

Short-Term Goals

- 1. Determine practical feasibility of a green roof installation at Krannert Center
- 2. To showcase an example of a more affordable green-roof system to other units at the University of Illinois and the Champaign-Urbana community.
- 3. To explore plant varieties that could be grown using modular green roofs. This installation will likely include plants that are normally sustainable on rooftops, and plants that could be sustained (but will need testing).

Long-Term Goals

- 1. Urban Enviroscapes would like to work with Krannert Center to make additions to its installation in the future that will show off more innovative modules such as modifications to allow the green roof to grow vegetables like tomatoes, lettuce and herbs, and sub-irrigation units that do not require outside water. This is important since Krannert Center runs Intermezzo (a small restaurant within the facility) and the possibility of producing locally grown food items is one of the green goals of Intermezzo.
- 2. To continually expand the green roof to cover a greater area of the Center's 184,000 square foot roof.
- 3. To achieve greater energy savings, offset carbon expenditure and reduce rain runoff as a result. Given the expanse of the Center's rooftop, the Center is anticipating that these results will be very significant.
- 4. After this breakthrough installation and pilot phase, less expensive installations will be more viable as the system can be produced in a larger scale once proven.

Sustainability and the Krannert Center Pilot Green Roof Initiative

Sustainability is defined as the capacity to endure. It includes any process that is implemented for the purpose of protecting our wellbeing on Earth. Green roofing is the ultimate building modification that can be performed to work towards increasing our sustainability. The benefits of green roofs go beyond the building's energy savings of 30%+. Green roofs can actually remove toxins and greenhouse gases from the air while replacing them with oxygen. They also reduce the urban heat island effect by cooling the surrounding area, extend the lifetime of the rooftop by 2 to 3 times, reduce surrounding noise levels, and they can contribute to LEED certification points. This project will demonstrate all of these benefits on a smaller scale with the partial roof installation on KCPA while highlighting sustainability in a very visible way on campus.

Feasibility Evaluation

If funding is received, the team at KCPA and Urban Enviroscapes are positive that this installation is entirely feasible for the Spring of 2010. The rooftop at KCPA has already been evaluated for weight load capabilities and meetings are taking place with F&S to make sure all concerns are addressed. Compared to other systems, the Urban Enviroscapes modules are built stronger and are designed to be maintenance free, allowing for a full and colorful green roof the day of installation.

Longevity and/or Permanence of Project Results on Campus

The system under question is perfect for this installation due to its ability to create a permanent look with the benefits of a modular, non-permanent system. The Urban Enviroscapes trays are designed in

such a way that they will grow together and create a seamless green roof within weeks, but remain versatile and modular in case repairs need to be made on the roof or changes to the green roof need to be made.

The installation of 960 ft² will be projected to remain on the roof until the roof itself is replaced. The permanence of this project's results on campus is much greater, however. This installation will demonstrate to the campus and community the simplicity of sustainable building and be a launch pad for green roofing and green innovation across campus and Champaign-Urbana. The feasibility and public attention from this system will be a great motivator for other projects such as Krannert Art Museum, the Foreign Languages Building, the iHotel and other projects in a preliminary stage that will result in large energy savings, water management, and pollution reduction around campus. Also, the success of this project will prove the ability of this system for the future full green roof that will be installed on KCPA.

Project governance structure

This project will be fully installed by Urban Enviroscapes under a limited warranty stating that any issues or problems with the system due to faulty manufacturing, or naturally dying plants will be replaced and/or fixed at no cost. This system is designed to include very little maintenance. The only maintenance needed will be quarterly drain and system checks to make sure there are no obvious aesthetic or structural problems with the system. These checks will be performed by University of Illinois Department of Facilities and Services (discussed in the following paragraph).

Summary of Communications

Urban Enviroscapes has been in close contact with Krannert Center's leadership since the feasibility of installing a green roof at Krannert Center became a reality. Krannert Center has also consulted the facilities Building and Operations department throughout this process.

On February 25, a meeting with University of Illinois Department of Facilities and Services (F&S) regarding this project and potentially other units on campus using the Urban Enviroscapes's green roofing system was discussed in full detail to address all concerns. F&S was pleased with the engagement and understands the installation process and maintenance requirements of the system. Staff in attendance included Facilities & Services members Fred Hahn, Cynthia Cope, Bradley Ellison, Matthew Edmonson, Tom Abram, Ryan Welch, and Tony Battaglia. Also present were Sandra Yoo and Valerie Oliveiro. F&S was satisfied with the presentation and are now moving to obtain the necessary signatures needed for approval.

Location



The current (planned) location for the pilot green roof project is the southwest roof area of the facility, indicated in the photograph above. This area is right by one of the main entrances to the main lobby level of the facility and visible from street level in some areas of Goodwin Avenue and Oregon Street. It is above conditioned space, so some energy benefits will be seen even from this small project. The green roof will cool the surrounding area by the main entrance to the building. This area is also visible from a higher plane – the upper level roof area (The roof the Krannert Center Lobby). This outdoor area is a gathering space for the public, The

amphitheatre and the area directly in front of it is sometimes a performance space, a festival/opening night celebration space (tents and chairs and set up serving food and entertainment), a classroom (voice and combat classes occasionally take place here in good weather) On the main lobby level is access to all of Krannert Center's theatres, main offices, the ticket office, the Intermezzo Café and the Promenade Gift Shop. Since Krannert Center is a space for both the campus as well as the community, and a partner in a great number of local and regional businesses and campus units, the impact of locating the green roof at this location will be undeniable and will also allow for sustainability issues and efforts at the forefront of both our campus and community.

Comparisons to other University Campuses

Multiple campuses are gaining momentum on the green movement and green roofs are slowly making their way onto buildings at universities such as Michigan State, Southern Illinois University, Colorado State, and University of Florida. However, these projects are setup more as research projects and are not public, rather than sustainability showcases as we plan to do. I have spoken with researchers on the Southern Illinois campus as well as the University of Illinois campus with Susan Morgan and Charlie Werth, respectively. Based on these conversations I have obtained data and potential research instrumentation that can be used on conjunction with our project if it is able to receive funding. The instrumentation can directly compare the installed green roofing systems across campuses and the different effects from installing our fully grown system as opposed to the layered system on BIF, or the system shown below at the Southern Illinois campus.

Furthermore, many campuses, including the University of Illinois' Krannert Art Museum, are resorting to sub-par technologies such as the Green Grid system. Shown below, Green Grid cuts corners by using cheap trays and sedum pods which has been proven to be very ineffective and needs lots of attention to grow in. The trays will not grow in for a few years, meaning they will not give the benefits associated with green roofs, they will need weekly to biweekly maintenance and watering otherwise the plants will die and weeds will take over, and the system simply looks messy. The Urban Enviroscapes system clearly improves upon this at every level. This comparison was scrutinized in detail by F&S as well as horticulturalists and accepted to be fully sustainable with various considerations in mind.

Green Grid System Weeks After Installation



Urban Enviroscapes System
Day of and Weeks After Installation



II. Budget & Fundraising:

The breakdown below details the full cost of the project. Since each tray will be laid on top of the existing gravel roof at Krannert Center, there is minimal roof preparation required. There are also little direct maintenance costs involved as these trays do not need watering. Indirect maintenance costs could consist of damaged tray replacement from extremely strong weather, theft or vandalism (since the general public has full access to the installation site) and possible trimming should the plants pose any sort of safety hazard or for aesthetical reasons.

Item	Quantity	Unit Cost	Total Cost
Module Preparation – Manufacture + Production	240 (960 ft ²)	\$11.35 + MFG	\$10,024
Engineered GR Soil	252 ft ²	\$4.70	\$1,185
Sodium Varieties	480 bags (Fully Grown)	\$7.25	\$5,825
Sprinkler System (Nozzle, Pipe, Timer)	2 Rotors, 1000 ft ²		\$1,230
Installation	Shipping & Labor		\$4,825
Maintenance	4 hr / wk, 2 years	\$20	\$2,400
			\$25,489

At this time, if the student sustainability committee does not provide the initial \$12,500 requested. Krannert Center is not certain that the project will continue at its intended scale. It is possible that the project may continue on a much smaller scale, however, it would seem that it would be harder and less

viable to gauge progress and results/success if the Center proceeded with a smaller test installation. Krannert Center and Urban Enviroscapes would have to explore other possibilities for the project, which may include putting the project on hold until funding becomes available.

The rate of return for this installation will be due to savings of about \$100 during the summer for KCPA and about \$5,000 per year for the sewer system relief. From water management and low energy savings the rate of return will be about 5 years. For a full installation on KCPA with savings exceeding \$10,000 per year, the rate of return will be much quicker from energy savings alone.

Fundraising

Due to stringent economic circumstances at this time, Krannert Center will not be able to provide any financial commitment, including matching funds to this project. Krannert Center will work very hard to raise funds for this project in three possible ways:

- a. Given the prospect of Krannert Center being the recipient of an Illinois DCEO grant for the recently completed Krannert Center LED Lobby Lighting Installation, Krannert Center would like to use part or all of that incentive to match funds for this pilot Green Roof Initiative.
- b. Krannert Center has identified some donors who may be interested in supporting this project. Gifts to Krannert Center for the purposes of this project will be highlighted on the site of the pilot Green Roof Initiative.
- c. If the above two fundraising initiatives are not successful, Krannert Center will seek help from the community using each 2' by 2' tray. A small donation sum will be attached to each tray (for example \$40). Members of the community can "own" their own slice of greenness and therefore feel personally supportive of the community and campus's greening initiatives this is similar to how some theatres raise funds by offering to engrave to attach names of fundraisers to seats at the theatre.

Timeline

A large benefit of the Urban Enviroscapes system is the low lead time required to install a green roof. Additionally, since a roof analysis has already been performed, upon receiving a 50% down payment for funding, the project can begin immediately.

If funding or a minimum 50% down payment is received by April 1, 2010, the trays will be ordered and growing can begin in greenhouses. On this schedule, the modules will be ready around May 15, 2010 and available for installation. Once installed, the green roof will be fully grown and self sustaining. A firm project completion date, assuming funding availability on April 1, 2010, would be June 30, 2010.

The project will continue to thrive until the rooftop of KCPA is replaced, at which time the modules can be easily relocated.

IV. Energy, Environmental, Social and Economic Impact

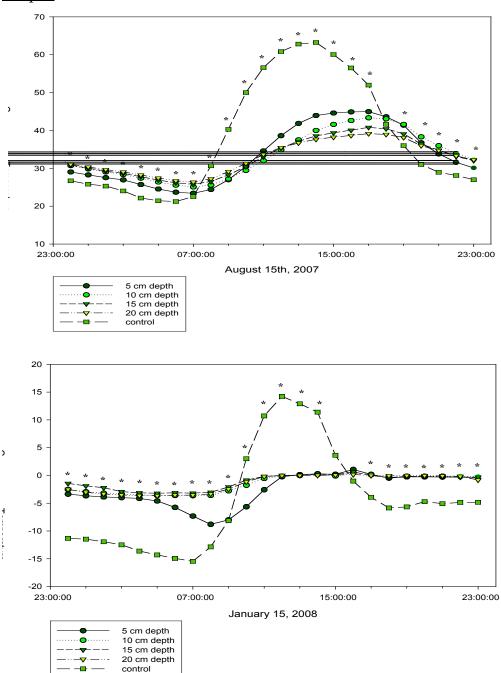
Based on the University of Illinois' 2010 Climate Action Plan, or iCAP report, the University is dedicated to reducing energy costs around campus and an overall decrease in the University's carbon footprint. This green roof installation will address many of the goals that are outlined in the iCAP report.

The installation is above conditioned space and surrounds an area that sees significant heat fluctuations through the summer months which also has an effect on the main entrance of the building. There has been extensive research performed in the past year to justify the claims surrounding the benefits of similar green roofing systems, and this project will contribute to that as the energy effects will be analyzed throughout the years. Below is a graph from a study performed at Southern Illinois University showing the heat fluctuations in the summer and winter comparing multiple depths of green roofs and a control area with no green roof. Take note that the systems used we similar to the green grid system shown above. This means that the surface of the green roof was <u>not</u> fully covered with vegetation and the results seen from our installation will be even <u>better</u> than those seen here.

As the graphs show, green roofing systems can drastically stabilize temperature fluctuations near the installation and maintain a low temperature range. The installation on Krannert Center will be closest to

the "15 cm depth" installation seen in the graph. Fully grown systems see even greater heat maintenance and can keep steady temperatures around $70^{\circ}F$ to $75^{\circ}F$.





Results

Due to the coverage of the installation in comparison to the size of the building, similar to the BIF installation, there will be small energy savings seen directly from insulation and cooling. Based on the Southern Illinois University studies, an approximate $1000 \, \text{ft}^2$ partial installation can expect to see about \$100 in savings from cooling bills. However, with a full installation using this system over the $100,000 \, \text{ft}^2$ roof, savings of over \$10,800 over the summer months will be easily seen. More savings will be shown below from water management and air pollution.

No energy inputs will be required during or after the installation of this system.

Carbon Dioxide Absorption

Per 1000 square feet of normal low lying plants and grasses you can absorb about 350 kg CO_2 per year. The plants being installed are also known to reduce levels of smog and other greenhouse gases. Additionally, the plants will produce oxygen at a rate of about 300 ml per hour per ft². This translates to 300 L oxygen per hour, or enough oxygen to keep about 6 people alive for the rest of their lives with the 960 ft² installation.

Water Absorption

The extensive, lightweight green roof soil mix has a maximum water absorption of about 0.29 g/cm^3 , or 18.1 lb/ft^3 of soil. This means that per 960 ft² of green roof being installed, the equivalent absorbed amount of rain will be 4,623 lb of rain water.

Annually, the city of Urbana receives an average of 41.06 inches of rain. An inch of rain over 960 ft^2 is equal to 4,994 lb of rain, so over the year the green roof installation will absorb about 204,754 lbs, or $3,281 \text{ ft}^3$ of rain. This will be rain that does not need to be processed by the sewer system, saving the city \$5,873 per year from this partial (0.5% of the rooftop) installation.

V. Outreach and Education

A green roof installation will have educational, environmental, economic and energy impact wherever they are installed. There is no doubt that this project will be visible to the people who come through Krannert Center daily. Krannert Center is very deeply committed proponent of sustainability and the Center will seize any possible partnership to promote our current efforts in the hopes that others will see the benefits, learn from processes, innovate new ideas, and follow suit. Since the HVAC retrofit and the LED lobby lighting installation, Krannert Center has already begun and will continue in efforts to organize outreach for both campus and community and will always cite our supporters and partners in the process. These include:

- 1. Connecting with the local Don Moyer Boys and Girls club the Don Moyer Boys and Girls club is interested in starting a green after school program with the hopes that it would be the most interesting and educational sustainability-based after school program in the state. Early conversations include tours surrounding the topics of arts and sustainability at the facility and if the green roof pilot project takes off, some initial conversations include involving educating students in the documentation and execution of such a project, highlighting the benefits and shortfalls (if any) of installing such a system.
- 2. Krannert Center recently hosted a CCNet meeting at Krannert Center with the hopes that other facility managers in town will be able to share information and connect with each other about their ideas and discoveries about the facilities that they manage. The meeting included a full tour of the facility, highlighting all the sustainability efforts that Krannert Center has undertaken thus far (full LED lighting demo included).
- 3. Krannert Center has already begun including the Center's green initiatives in the facility tours given to members of the public, visitors, classes and campus and community groups (e.g. rotary clubs) and a detailed inclusion of the Center's initiatives will be detailed in the tour's manual this summer 2010.
- 4. On February 18, 2010, Krannert Center hosted "Innovator's Improv" which is a campus based event. This is an open-mic style event that allowed a free flow of new ideas and innovations to be proposed to the crowd attending the event. The topic for the event was sustainability and Krannert Center's Senior Associate Director, Rebecca McBride took the opportunity to elaborate on the efforts that the Center has taken in the area of sustainability. Krannert Center will take these opportunities to promote the cause in every way possible and events like these are an ideal platform for this to happen.
- 5. New design elements have been incorporated at Intermezzo Café highlighting the café's greening initiatives in food selection (organic food choices and fair trade coffee), containers and cutlery.

6. What is Pecha Kucha?

Pecha Kucha Night was devised in 2003 by Astrid Klein and Mark Dytham of Tokyo's Klein-Dytham Architecture (KDa), as a way to attract people to Super Deluxe, their experimental event space in Roppongi. Pecha Kucha Night events consist of around a dozen presentations, each presenter having 20 slides, each shown for 20 seconds. Each presenter has just 6 minutes 40 seconds to explain their ideas before the next presenter takes the stage. Conceived as a venue through which young designers could meet, show their work, exchange ideas, and network, the format keeps presentations concise, fast-paced and entertaining.

At the most recent Pecha Kucha, the University of Illinois Board of Trustees included a presentation of the Krannert Center HVAC retrofit as part of a "greening" section of the presentation. Also, since the University of Illinois invented LED technology photos of the new LED installation were also part of that presentation.

For this pilot Green Roof Initiative, the center will continue on the path of it's current efforts as well as forge ahead with new campus or community partnerships as they arise. There is so much possibility for students to be involved in the installation process – Landscape architecture students and professors have already been given presentations and will be able to witness (first-hand) the process of this green roof initiative. Other possibilities include:

- Press release from Urban Enviroscapes
 - o To PR firms in Chicago, Chicago Tribune and other local media
 - To many companies such as Abbott Labs, Wal-Mart, State Farm, Baxter, BP, John Deere, Motorola, Boeing, P&G, and GM – all of whom have an interest in the process and success of this pilot Green Roof Initiative.
- Press release from KCPA
 - Krannert Center has established media outs locally and regionally. Also, the Center always
 includes a highlight section on KrannertCenter.com with the latest news from the center and
 the
- Classes in architecture, landscape architecture, horticulture and others will be interested and can integrate the installation into their real-world related coursework
 - Landscape architecture class has already been working on green roofs and would be deeply interested to track and follow up on this installation

b) KCPA Funding Commitment: We ask that as the project beneficiary, KCPA make a financial commitment to the project

Due to stringent and severe economic circumstances at this time, Krannert Center will not be able to provide any financial commitment, including matching funds to this project.

c) Reroofing: Given that the roof at KCPA needs replacement, what will happen to this installation at that point? What costs will be associated with dismantling and reinstalling the green roof? What will the expected lifetime of the installation be? Can the installation take place in an area that will not be replaced?

There are multiple options for this phase in time. The construction of the tray allows for very easy transportation and carrying. The same goes for moving the trays post-installation. A few years after installation, if KCPA moves forward with replacing the roof the current modules can either be moved to a different part of KCPA or, a different part of campus. Other campus units may be interested in a test green roof at their facility at a very low cost and these options could be strategically discussed when the opportunity arises. If another location on campus is not possible, the trays can be efficiently moved back to a green house area for storage while the roof is being replaced. The only costs associated with dismantling the green roof will be some time and labor – to physically pick up the trays and move them.

The estimated time and labor commitment needed to move these trays would be 8 - 12 hours with the labor of approximately 5 - 6 people. Therefore, the cost associated with moving the trays would be approximately \$1000. The cost of shipping the trays back to greenhouses would likely be

approximately \$500 and the cost of reinstallation at another campus facility will depend on the work needed to prepare that roof, accessibility, customization and the time and labor it would take to install the trays of that roof. Ideally, it would be another well-accessible and highly visible location, similar to the location currently chosen for Krannert Center.

d) Roof Impact: It is unclear from the Letter of Inquiry whether the roof lies atop conditioned space or parking. If the roof does not lie atop conditioned space, no benefit will be seen from the green roof on HVAC energy use. Can the installation take place atop conditioned space?

The installation area has been confirmed to lie atop conditioned space, not above the parking garage. This area will not only insulate the conditioned space below the roof, but also the surrounding area of the building. Since this area is mostly glass as the main entrance for KCPA, this will be a very beneficial placement for a green roof. According to many studies, a typical, insulated gravel covered rooftop can vary between 140 °F and 176 °F in the summer heat. Summer green roof temperatures have been observed as low as 77 °F. This drop in temperature will help the roof below as well as the surrounding entrances maintain a comfortable temperature.

e) Cost Estimates: Does the \$50/sq. foot cost estimate for a conventional green roof result from a need to replace underlying roof membrane, etc? What is the additional cost / sq. foot of a green roof vs. a conventional roof at KCPA? What is the additional cost / sq. foot of this type of green roof at KCPA?

The \$50+ costs associated with intensive green roof installations is a direct result of the labor and layers involved. This is shown commonly in the illustration.



Photo Source: Low Impact Development Center http://www.lid-stormwater.net/images/greenroof1.jpg The multiple layer system requires many more hours of labor along with methods of irrigation that results in costs of \$50 to \$100 per square foot. The cost per square foot for a regular rooftop is about \$8 to \$10 per square foot without the gravel. For a conventional green roof, the cost would be anywhere from \$50 to \$100 per square foot for a deep layered system. For the Xero flor system (a modular type of green roof) quoted in the KCPA green roof feasibility study by Sudan and Associates the additional cost was \$24 per square foot. The additional cost of the Urban Enviroscapes modular green roof would be likely between \$11 and \$15 per square foot depending on the size of green roof installed, the purpose for the modules (vegetables vs. sedum) etc. Also it should be noted that with a green roof purchase studies have shown that the lifetime of the rooftop is extended by about 2 times. This, along with energy savings, makes the green roof installation much more economical.

Туре	Cost Per Square Foot
Membrane Roof (without gravel)	\$8 - \$10
Conventional Green Roof (Layered)	\$50 - \$100
Xero Flor Green Roof	\$24
Urban Enviroscapes Modular Roof KCPA	\$24 - \$25
UrbanE Modular Roof After Proven KCPA Install	\$11 - \$15

The current cost for this project of \$25 psf is due to the startup costs required for this system to, on a small scale, display its effectiveness. Also, KCPA is a very public installation and we will need to use some funds to create an aesthetic area as well.

Conclusion

At the recent CCNet Meeting, a participant remarked during the facility tour "It would be just so cool for Krannert Center to start having a visible green roof. I mean, it would be right there! People could see it or walk right up to it, see it for themselves and it would be not as far from reality as some would think, you know? If I wanted to convince my bosses (to install a green roof), I could walk them over here and show them!"

Krannet Center hopes to make green roofs in our community part of our common culture the way changing out incandescent light bulbs, composting and rain barrels are forging ahead. The societal impact of having a present and visible green roof could very well be phenomenal. Other facilities on campus and other local and regional businesses may be able to shore up the support that they need and take the leap because of the success of this initiative.

Krannert Center respectfully requests \$12,500 from the Student Sustainability Committee to support this project. The Center will work vigorously to raise the matching funds required to see this project to its completion.