Student Sustainability Council

Meeting Minutes

9/11/18

1) Beginning of Meeting
    a) [7:31] - Reading of the Preamble and Introductions
2) Proposal Presentations
    a) [7:35] - Lab Energy Savings Presentation Begins
    b) [7:43] - Lab Energy Savings Presentation Ends and Q&A Begins
        i) Do you already have permission from labs?
            (1) Already has approval.
        ii) Are the stickers high quality?
            (1) Yes, they have seen first hand the quality of the stickers.
    c) [7:49] - Lab Energy Savings Q&A Ends
    d) [7:50] - Troubadours Presentation Begins
    e) [7:59] - Troubadours Presentation Ends and Q&A Begins
        i) The reason for this proposal, and why it was accepted last year, was because it was encouraging students to spend more time outside. Why were there performances inside?
            (1) The classical instruments can't be played in the cold
        ii) Have you petitioned for money from other sources?
            (1) No

iii) Why have they come to receive money from the environmental stewardship fee?

(1) The suggestion from the Tracy Farmer Institute.

iv) Motion to extend by Zoe, 2nd by Sophie

f) [8:06] - Troubadours Q&A Ends

g) [8:07] - Water Bottle Filling Stations Presentation Begins

h) [8:12] - Water Bottle Filling Stations Presentation Ends and Q&A Begins

i) [8:17] - Water Bottle Filling Stations Q&A Ends

i) How to go about selecting which buildings receive grants?

(1) Promote the opportunity.

ii) Is the price difference enough to encourage departments to pay that money?

(1) Not sure.

j) [8:17] Financial Update Begins

k) [8:22] Financial Update Ends

Proposal Discussions

l) [8:23] - Discussion of Lab Energy Savings Begins

i) UK has goal to reduce emissions, and this is a cool way to do it

ii) Good project

iii) Changed the budget, and didn't let us know.

m) [8:25] - Discussion of Lab Energy Savings Ends

n) [8:25] - Motion to vote on Lab Energy Savings (Motion by [Rachel], 2nd [Viktor])

VOTE RESULTS - **PASSED** - Yes [23] No [0] Abstain [0]

Name	Y/N/A	Name	Y/N/A	Name	Y/N/A
Cameron Baller	Y	Cameron Luker	Y	Emily Hall	Y
Sophie Beavin	Y	Celia Ritter	Y	Ahmed Hamad	Y
Adam Bourque	Y	Maria Sanchez	N/A	Keely Kohen	N/A
Maya Collins-Paterson	Y	Megan Von Son	Y	Cody Jones	Y
Julianna Dantzer	Y	Evan Batty	Y	Laura McAllister	Y
Zoe Gabrielson	Y	Evan Bartley	Y	Tiana The	Y
Macy Hagan	N/A	Nickie Cashdollar	Y		
Viktor Halmos	Y	Rachel Cook	Y		
Claire Hilbrecht	Y	Claire Crosby	Y		
Joel Huether	Y	Ashlee Edmonson	N/A		
Isabel Jenkins	N/A	Rachel Finefrock	Y		

o) [8:25] - Discussion of Troubadours

i) Changed up answer for sustainability from last year to this year.

ii) Whether or not it relates to environmental stewardship

iii) Concerns about spending this much money on questionable links to sustainability

iv) Needs to look for other ways of funding

v) Paid more than any student on campus

vi) No plan on how to approach getting more funding

vii) Good for campus environment, not within our scope

viii) Is there a way to limit them to only performing outside?

p) [8:35] Motion to extend by Zoe, 2nd by Rachel.

q) [8:41] Motion to extend by Zoe, 2nd by Viktor.

i) Not our responsibility to find them funding, or worry about their program.

r) Motion to amend the budget, cut the budget in half and award them funding that is contingent on whether or not they match it.

i) Motion to amend by Sophie, 2nd Rachel.

ii) Amendment passed.

s) [8:48] - End Discussion of Troubadours

t) [8:48] - Motion to vote on Troubadours (Motion by [Viktor], 2nd [Julianna])

VOTE RESULTS - **FAILED** - Yes [6] No [17] Abstain [0]

Name	Y/N/A	Name	Y/N/A	Name	Y/N/A
Cameron Baller	N	Cameron Luker	N	Emily Hall	N
Sophie Beavin	N	Celia Ritter	N	Ahmed Hamad	N
Adam Bourque	Y	Maria Sanchez	N/A	Keely Kohen	N/A
Maya Collins-Paterson	N	Megan Von Son	N	Cody Jones	Y
Julianna Dantzer	Y	Evan Batty	N	Laura McAllister	N
Zoe Gabrielson	N	Evan Bartley	N	Tiana The	Y
Macy Hagan	N/A	Nickie Cashdollar	N		
Viktor Halmos	N	Rachel Cook	N		
Claire Hilbrecht	N	Claire Crosby	Y		
Joel Huether	Y	Ashlee Edmonson	N/A		
Isabel Jenkins	N	Rachel Finefrock	Y		

u) [8:48] - Discussion of Water Bottle Filling Stations Begins

   i) Good way to get outreach

   ii) Collaboration

v) [8:50] - Discussion of Water Bottle Filling Stations Ends

w) [8:50] - Motion to vote on Water Bottle Filling Stations (Motion by [Rachel], 2nd [Viktor])

VOTE RESULTS - **PASSED** - Yes [23] No [0] Abstain [0]

Name	Y/N/A	Name	Y/N/A	Name	Y/N/A
Cameron Baller	Y	Cameron Luker	Y	Emily Hall	Y
Sophie Beavin	Y	Celia Ritter	Y	Ahmed Hamad	Y
Adam Bourque	Y	Maria Sanchez	N/A	Keely Kohen	N/A
Maya Collins-Paterson	Y	Megan Von Son	Y	Cody Jones	Y
Julianna Dantzer	Y	Evan Batty	Y	Laura McAllister	Y
Zoe Gabrielson	Y	Evan Bartley	Y	Tiana The	Y
Macy Hagan	N/A	Nickie Cashdollar	Y		
Viktor Halmos	Y	Rachel Cook	Y		
Claire Hilbrecht	Y	Claire Crosby	Y		
Joel Huether	Y	Ashlee Edmonson	N/A		
Isabel Jenkins	N/A	Rachel Finefrock	Y		

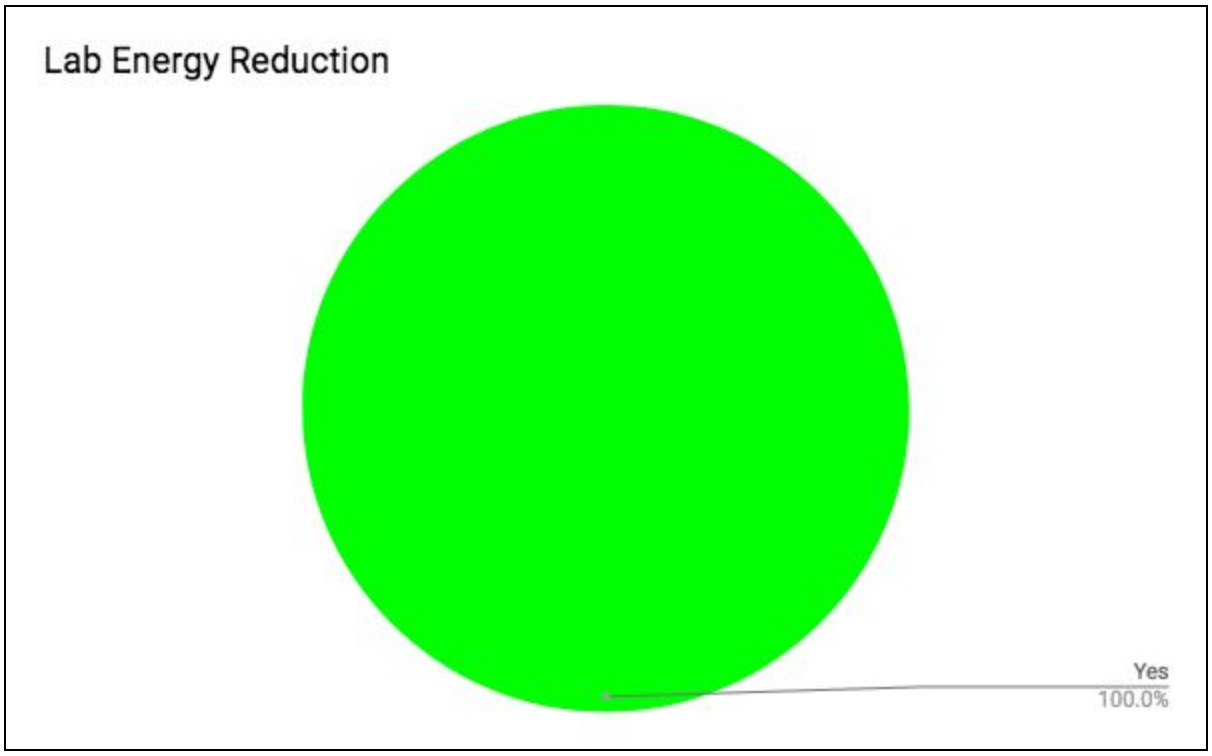
3) Sustainable Manufacturing Conference
    a) Sophie will email about the opportunity to go, 2 paragraphs on why you should go.

4) End of Meeting
    a) [9:00] - MEETING ADJOURNED

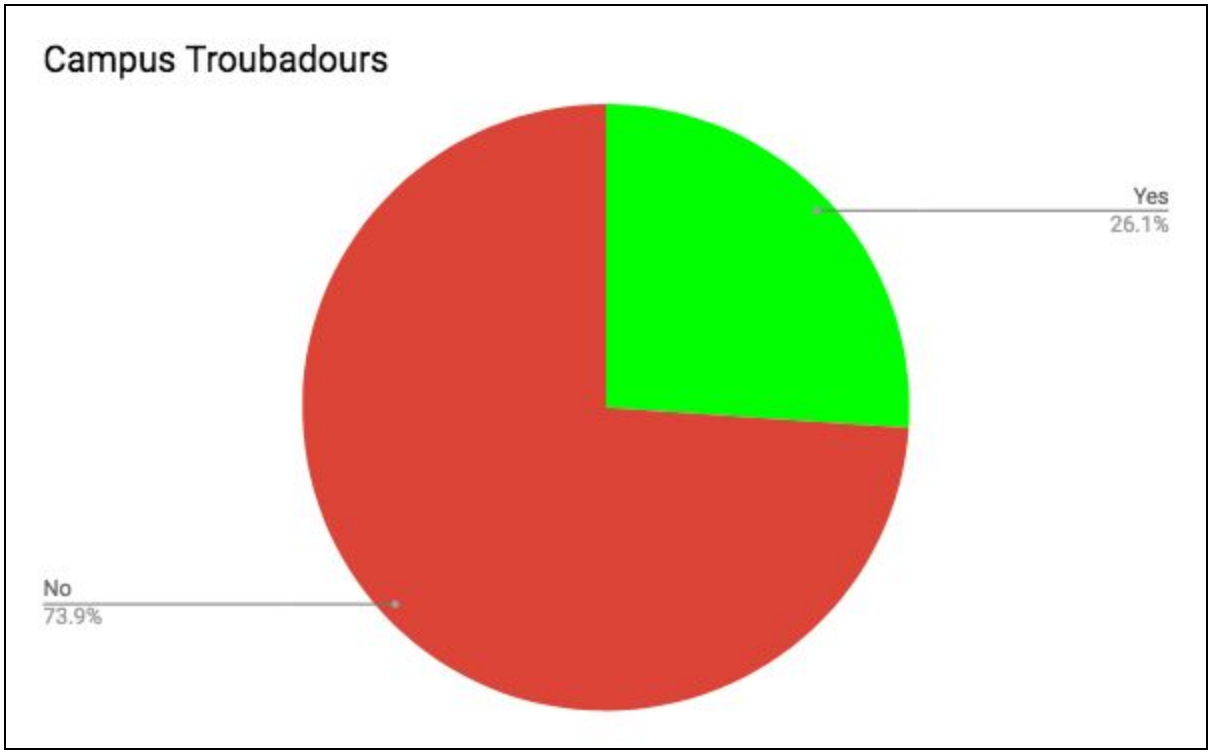
5) Voting Report & Proposals from Meeting

Student Sustainability Council

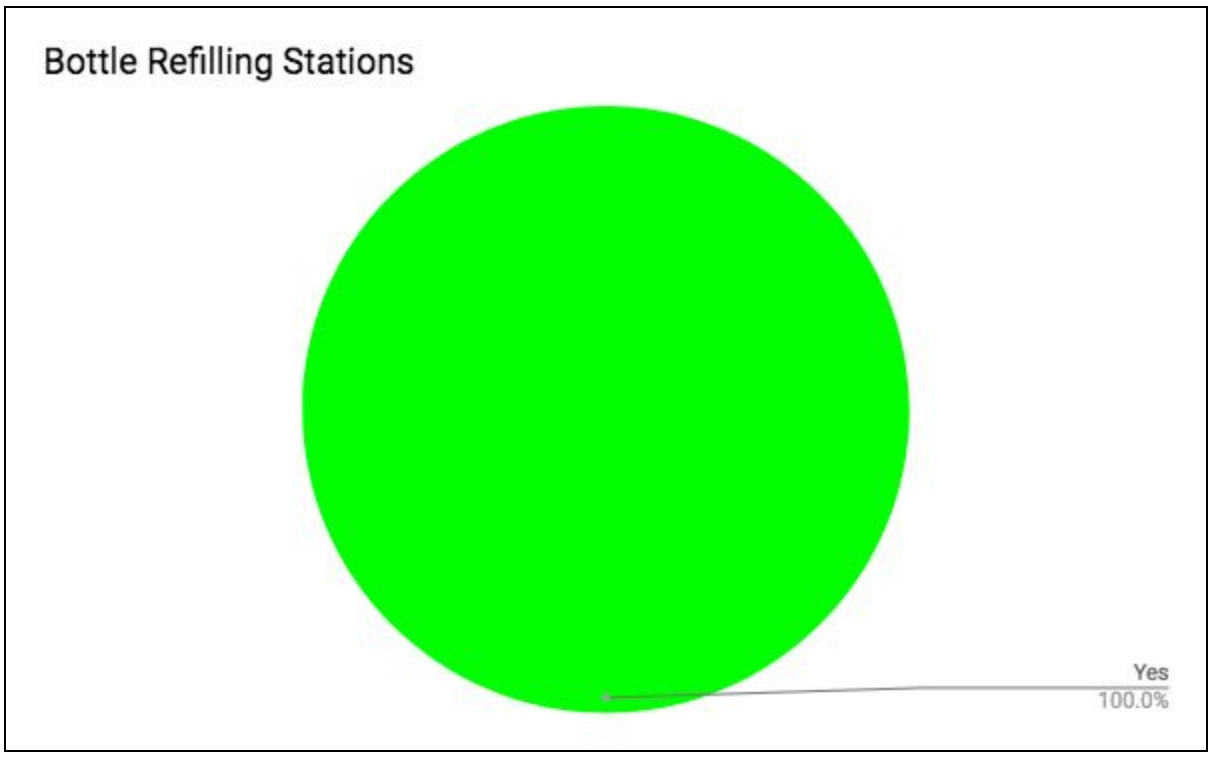
Voting Report



Dissenting arguments: None.



Dissenting arguments: This program does not have a plan for its future to acquire funding from other sources, making it financially unsustainable. It isn't linked to sustainability enough to warrant a grant from the environmental stewardship fee.



Dissenting arguments: None

Members Present:

Name	P/A	Name	P/A	Name	P/A
Cameron Baller	P	Cameron Luker	P	Emily Hall	P
Sophie Beavin	P	Celia Ritter	P	Ahmed Hamad	P
Adam Bourque	P	Maria Sanchez	A	Keely Kohen	A
Maya Collins-Paterson	P	Megan Von Son	P	Cody Jones	P
Julianna Dantzer	P	Evan Batty	P	Laura McAllister	P
Zoe Gabrielson	P	Evan Bartley	P	Tiana The	P
Macy Hagan	A	Nickie Cashdollar	P		
Viktor Halmos	P	Rachel Cook	P		
Claire Hilbrecht	P	Claire Crosby	P		
Joel Huether	P	Ashlee Edmonson	A		
Isabel Jenkins	A	Rachel Finefrock	P		

Funding Application

Before beginning the application process, please verify that you understand the terms and conditions for receiving funding from the SSC:
• The SSC cannot apply retroactive funding, all budget items must occur after the meeting date where the proposal is reviewed.
• Proposals are accepted on a rolling basis and the due date for consideration at each meeting is one week prior to that meeting.
• If approved, the project leader has twelve months to spend the funds. If the project requires an extension beyond this timeline, the project leader will need to submit an extension request.
• The money disbursed from this fund comes from student fees, so sustainability-related student impact is a necessary component for any proposal.
• Presenting the project to the Council is mandatory.
• In order to preserve the Council's ability to effectively review and consider proposals we are limited in the amount of proposals we may review per meeting. In the case that more proposals are received than can be reviewed for a given meeting, Council directors will decide which proposals are heard based on project timeline and order of submission.

By checking the box below, I verify that I understand and accept these terms and conditions.
: Yes

Project title: Laboratory Energy Savings Initiative - Fume Hood Sash Stickers

Project leader name: Hannah Dvorak

Project leader email: hannah.dvorak@uky.edu

Project leader additional contact information:

Contact type	Contact info
Phone	920-621-2338

Total amount requested from the Council (round up to the nearest whole number): 800

Would you like to present to the council?: Yes

UK affiliation: Student Organization

Name of organization: International Society of Pharmaceutical Engineers (ISPE)

What is your role in the organization?: Vice President (2018)

Brief description of organization: Serves to educate students about opportunities in the pharmaceutical industry and connect them to industry professionals via plant tours and networking opportunities. This year, to increase involvement and campus presence, we would like to execute a green initiative each semester that targets energy savings in campus laboratories. We welcome engineering and pharmaceutical science undergraduate and graduate students.

Approximately how many active members does your organization have?: 20

Who is your organization's staff/faculty advisor?:

Name	Email
Tom Dziubla	thomas.dziubla@uky.edu

To the best of your knowledge, has your organization had any previous involvement with the SSC? This may include membership, funding requests, or involvement with an organization affiliated with the SSC.: No

Please provide an in depth description of your project. You will likely want to copy and paste your response into the text box.: In order to increase ISPE's presence at UK and encourage involvement in our membership, we came up with a laboratory energy saving initiative that has the potential to significantly reduce energy consumption in our labs and save thousands of dollars per year. Most pharmacy and chemical engineering labs at UK have fume hoods, which allow the researcher to perform potentially hazardous work in an enclosed space. It typically is 6 feet long, ensures proper ventilation, and removes contaminated air. The major component that a researcher manipulates is the hood sash, a glass panel that can raise and lower to provide access to the fume hood. Many people are not aware that leaving the sash open with a height of 18 inches exhausts nearly 1.5 million cubic feet of conditioned air daily. Though the exact savings varies based on hood type and usage, keeping the hood sash closed 65% of the time can save $6,000 of energy per year, per hood. Many hood sashes are left open overnight or when not in use. To address this problem, we would like to duplicate an approach used at UC Davis in 2012 that was very successful at encouraging researchers to close the sash when not in use. They partnered with the U.S. Federal Energy Management Program and created an 18 inch vertical sticker with a red to green gradient design to encourage sash closure. We would like to purchase these stickers as well and work with all of the labs in the Department of Chemical and Materials Engineering and College of Pharmacy to implement them Fall 2018. We plan to measure a baseline value for sash height and measure it at three months and one year after implementation to track the outcome of the initiative. Not only will this encourage our labs to be more sustainable, it will serve as a team-building activity for our organization and increase our presence on campus. We are requesting $800 to cover the cost of the stickers, food for our members on the day of installation, and a reward for the labs that show the most improvement in energy reduction. If successful, these stickers could be placed in all of the hoods on campus.

Who will this project primarily impact?: Please select the groups that your project is intended to impact.:
Faculty/Staff
Graduate Students
Undergraduate Students

What type of project is this?:
Campus Infrastructure

Please select up to three disciplinary categories that best describe your project.:
Campus Sustainability
Energy Saving

The SSC is always seeking further outreach opportunities. Please consider doing one or all of the following with your project to help us reach more people. :
Green Talks Radio segment (recommended)
Feature SSC logo on promotional material
Social Media Promotion

Does this project require the approval of any outside or UK entity? If so, please check the box and include documentation of support at the end of this document.: Yes

Have this, or any related project, been funded by the SSC in this or previous years?: No

Please fill out an itemized budget for your project as it stands. Indicate line items that could be reduced with a check mark. Round up to the nearest whole number for numerical entries.:

Category: Supplies
Item name: Fume Hood Stickers
Amount requested from the SSC: 600
Amount requested from outside the SSC: **Name of other funding source**: **Total cost**: 600
Would you be willing to accept reductions in your line items? (Leave blank if the answer is no): Yes

Category: Food
Item name: Food for Installation
Amount requested from outside the SSC: **Amount requested from the SSC**: 100
Name of other funding source: **Total cost**: 100
Would you be willing to accept reductions in your line items? (Leave blank if the answer is no): Yes

Category: Food
Item name: Foor for Lab Reward
Amount requested from the SSC: 100
Amount requested from outside the SSC: **Name of other funding source**: **Total cost**: 100
Would you be willing to accept reductions in your line items? (Leave blank if the answer is no): Yes

Please describe who will be in charge of dispensing the funds. If it is not a UK department, how will the funds be dispensed?: ISPE (UK Student Chapter)

Does this project have any additional funding partners? If so please list them and briefly describe their contribution and involvement.: No

Estimated project completion date: 11/01/2019

Please provide a list of the major milestones of your project.: -Gain funding and EHS approval. -Install stickers with lab approval. -Check sash heights at 3 months to check progress. Check sash heights at 1 year to check progress.

Include the date (mm/dd/yy) and a brief description of the event. This should include all relevant events to your proposals, such as dates for completion of key project milestones, presentations, or final project completion.:

Date	Event title	Brief description
09/30/2018	Gain all necessary approval	Finalize funding source and purchase stickers. Conduct first chapter meeting and get list of student volunteers.
11/03/2018	Fume Hood Sticker Installation	Installation will occur sometime in October, ideally on a weekend that most of our membership is available. We will also measure an initial sash height and communicate with researchers about the goals of our initiative.
02/01/2019	3 Month Check	Check 3 month sash height and compile findings
11/01/2019	1 Year Check	Check 1 year sash height, compile findings and come up with energy and cost savings estimate for initiative

If your project timeline is greater than a month, please provide a date around the middle of the project when sufficient progress will have been made to update the SSC.:
02/21/2019

Please attach supporting documents such as promotional material, letters of collaborative funding, or a budget spreadsheet, in addition to the budget provided previously. If you are working in partnership with a UK entity such as the Physical Plant Division, an academic department, etc., their letter of support should be uploaded here as well. Please only attach documents necessary to your proposal, so documents such as individual resumes or cover letters should not be included. All supporting documents should be in PDF format.:

In order to continue with the Fume Sash Sticker project, we needed to receive support from EHS (Environment, Health, and Safety). Below are copies of e-mail communication between the president of the ISPE student chapter Matthew Defrese and EHS. The first e-mail is regarding an initial meeting on August 29th and the second e-mail is the minutes from that meeting. EHS was very supportive both before and during the meeting and is potentially willing to support us financially if the SSC is not able to fully fund the project.

From: Defrese, Matthew
Sent: Wednesday, August 22, 2018 10:23 AM
To: Eggum, Janet <jghamo2@email.uky.edu>; Claar, Melissa <melissa.claar@uky.edu>
Cc: Moore, Kristi <KRISTI.MOORE@uky.edu>
Subject: ISPE Project - Fume Hood Stickers to help reduce energy consumption -

Hello Melissa and Jan,

My name is Matt Defrese and I am a graduate student in the College of Pharmacy and also the President of our student chapter for the International Society for Pharmaceutical Engineering (ISPE).

Our student chapter would like to incorporate some green initiatives as part of our goals for the year and one potential opportunity is to help reduce energy consumption of variable air volume fume hoods by installing guidance stickers to remind researchers to keep the sash shut and/or as low as possible to reduce energy loss and increase safety.

Similar programs have been implemented on college campuses around the US with great success and ROI for such a small effort - so it seems a great opportunity to do the same for UKY within the College of Pharmacy and Chemical Engineering laboratories. I have attached an article describing these projects and an example sticker that would be utilized below:

Our goal would be to install these stickers in October, but we wanted to connect with the right people to ensure that this can be done and is supported. The stickers are 1.25'' x 23.0'' and would indicate a maximum working height of 18.0'' for each sash. After installation, we would communicate with the labs (through email, seminar/EHS announcement or similar) to explain the sticker purpose and to encourage better fume hood sash behaviors. We will follow up to record changes in fume hood sash positions with time to determine their effectiveness in encouraging proper sash positions.

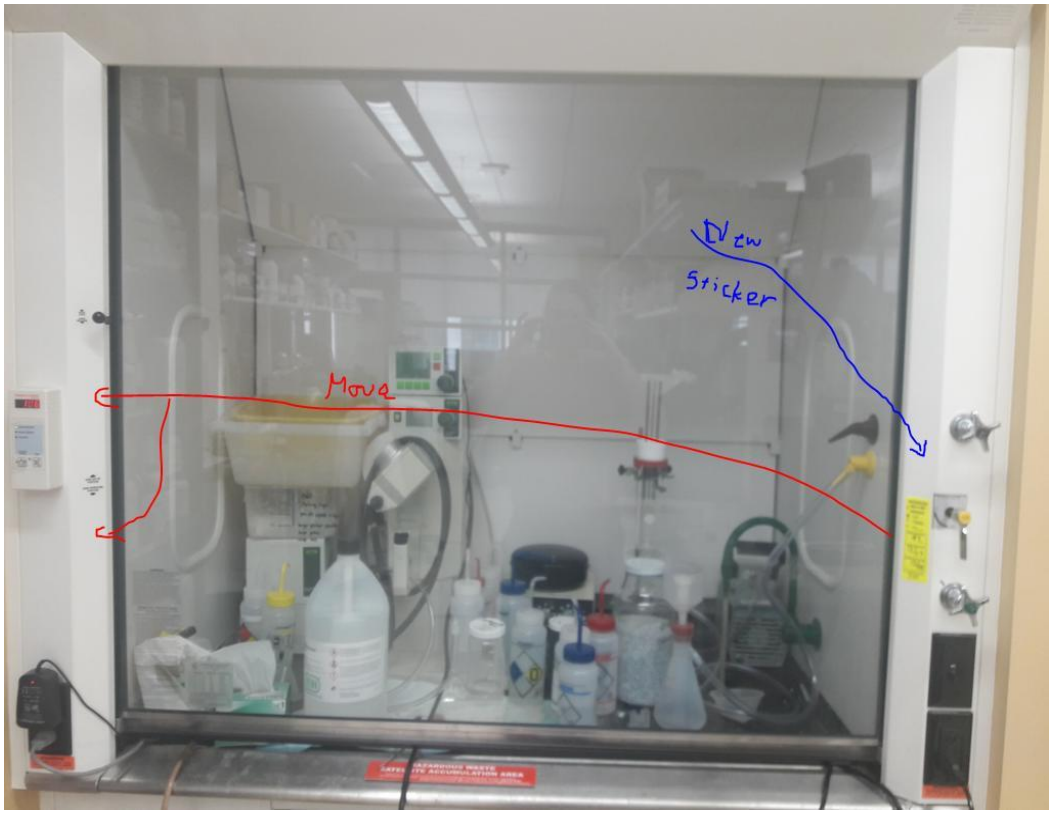
A couple complications/steps I foresee in this implementation:

- The verification stickers on the fume hoods would need to be place on the opposite side of current locations to provide room for the larger stickers (photo example below signature).
- Getting access/approval to the laboratories within the building to install the stickers.

Please let me know your thoughts on the ability to execute this project.

Thank you for your time and consideration!

- Matt



From: Eggum, Janet
Sent: Wednesday, August 22, 2018 10:36 AM
To: Defrese, Matthew
Cc: Moore, Kristi; Claar, Melissa; Poore, Lee
Subject: RE: ISPE Project - Fume Hood Stickers to help reduce energy consumption -

Hi Matt,

Thank you so much for contacting us about this initiative.

We are interested in partnering with you on this. We would like to set up a meeting so we can hammer out the details, and let you know what information we have available.

Please give us a couple of dates and times, I don't forsee needing more than about an hour to and an hour and half.

Thank you again, for reaching out to us.

Jan

From: Defrese, Matthew
Sent: Wednesday, August 29, 2018 3:02 PM
To: Poore, Lee; Claar, Melissa
Cc: Moore, Kristi
Subject: Fume Hood Sticker Meeting Summary

Hello Lee and Melissa,

Thank you again for meeting with me to discuss implementation of the ISPE Shut the Sash program, it is very helpful and much appreciated to have EHS support.

Meeting Summary:

- There are ~1400 fume hoods on campus; with older bldgs likely to have greatest energy benefit of closed sash due to lack of stand by mode functions when not in use.
- Less effective energy impact of sash position on modern fume hoods with standby mode (Biopharm/TODD Bldg), still beneficial due to safety considerations and possible minor energy gains.
- Stickers should have a 12" target working height and maximum 18" working height.
- ISPE goals for this year are installation of stickers in Biopharm/TODD, FPAT, RGAN, and ASTecc Bldgs in October (~ 170 fume hoods), with periodic checks for sash positions through end of academic year
- A competition between labs for best sash control will award pizza party / lunch outing for the winning labs to encourage lab engagements in the program
- Estimated or actual metrics of energy savings and improvements in sash position will be conducted and revealed at end of academic year (Connect with Brittney Ragland).
- Low temperature freezer clean up targeted for Spring semester, will reconnect with EHS for waste guidance and freezer clean up protocols/considerations
- If EHS can offer funding support for stickers and/or pizza party/dining budgets for winners & installers, would be much appreciated (if needed, will follow up if so). Likely $400-700 range max, pending sticker quotes
- If project is found to be helpful/successful, ISPE will prepare to expand the program further on campus in the next academic year

- Please reach out to ISPE with campus green initiatives for implementation as ideas/projects arise and mature

Next steps for the fume hood stickers:

- Matt will schedule a date late Sept on a Wednesday with Melissa to prepare fume hoods (move velocity stickers as necessary) in the Biopharm/TODD, FPAT, RGAN, and ASTecc Bldgs.
- Matt will follow up with funding needs for stickers/food budget as necessary
- ISPE installation in October

Thanks again for your time and support!

- Matt

Fume Hood Sash Stickers Increases Laboratory Safety and Efficiency at Minimal Cost:

Success at two University of California Campuses

Fume hoods represent the first line of worker safety measures in a research laboratory. Providing supply and exhaust air to fume hoods is highly energy intensive. A typical six-foot hood exhausting air at 100 linear feet per minute (LFM) and open 18 inches exhausts almost 1.5 million cubic feet of conditioned air every day. As opportunities for energy and resource conservation are found in laboratories, the clarion call of "shut the sash" goes forth, yet still many researchers don't hear the call or forget the message. It is not unusual to find unattended hoods opened beyond 18 inches and remain that way for weeks.

Case Study at a Glance

Technology used at UC Davis and Santa Barbara

Installed colorful sash position stickers on fume hoods that:

1. Reminds workers to close the sash after use.
2. Maximizes VAV system efficiency and worker safety.
3. Increases sash closure persistence.
4. Builds professional work habits.

Savings Achieved at UC Davis

Project effort with student assistance

- Approximately 600 stickers were installed.

Per hood installation cost = $5

Simple Payback at UC Davis

- Estimated, at $7/CFM/yr = **~15 hours!**

Return on Investment (ROI) = ~599!

Fume Hood Sash Sticker Technology Overview

In response to this obvious waste of energy, elaborate campaigns achieve essentially 100% compliance to close fume hood sashes during initial publicity efforts and from a period of incentives. However, following this initial state of heightened worker awareness, some decay in their diligence follows within a month or two.

It is not surprising that researchers do not habitually close sashes. They are very focused on their research, not laboratory building performance and energy conservation. Even when instructions on sash use are given, they are often combined with many safety lessons. There is a mixed message of "the hood is certified safe when open" and "close the sash for energy savings" that can be further confused by labels placed at 18 inches that say "Place Sash here for Maximum Safety." The authors of these labels have confused "maximum" and "minimum", not realizing that a hood is least safe when fully open.

A Basic Solution

To address the confusion at the University of California, a lab manager and a hood safety specialist designed a bold vinyl sticker to attach on the exterior sidewall of a fume hood (Figure 1). The sticker cleverly uses the ubiquitous traffic light color scheme, with a red zone above 18 inches, and a large arrow pointing down with the words, "More Safe, Less Energy" changing from yellow at the midpoint to green at the bottom when the sash is closed completely. Interestingly, a nearly identical sticker was designed without words and installed at the Danish Technical University in Copenhagen, where utility companies give rebates for its placement. Since 2009, the design has been shared with many campuses from Denmark to Singapore. As a public service, UC Davis prints and can provide this copyrighted sticker. From this case study, it appears the sticker promotes safe and efficient operation of fume hoods.

Implementation

In summer 2009, about 600 stickers were deployed in ten buildings at UC Davis and about 200 stickers in seven buildings at UC Santa Barbara. UC Davis hoods were chosen with safety and energy priorities. To improve safety awareness, two UC Davis chemistry buildings were recipients of the stickers even though they predominantly had constant air volume (CAV) fume hood systems and, thus, would see negligible energy reductions compared to a variable air volume (VAV) fume hood system. For safety and energy savings, all buildings with VAV systems were "stickered." At UC Santa Barbara, only VAV lab buildings were stickered.

Survey efforts

At UC Davis, visual surveys of sash-position status were conducted: before sticker deployment; about 2 months after sticker installations; and again in spring, 2011, to assess persistence. The survey method estimated sash status by benchmarks in approximate quartiles to streamline the survey effort. This also helped capture information on VAV-system response. These benchmarks were assigned values as follows:

- **24 inches:** anywhere above the 18 inch sash stop
- **18 inches:** at the sash stop
- **13.5 inches:** between 9 and 18 inches
- **4.5 inches:** between 0 an 9 inches
- **0 inches:** less than 2 inches.

These benchmarks were incorporated into energy savings calculations. Sash positions were averaged by floors at each sample time.

At UC Santa Barbara, surveys were conducted by collecting real-time sash position data provided by the campus' building monitoring system (BMS). Data were collected for 10-day periods prior to sticker installation for select fume hoods, and one, two, and three months following sticker installation. The average sash height for each hood was calculated for each 10-day period.

Technology Safety Benefits

A fume hood's primary purpose is to contain hazards including fumes and eruptive events. It is clear that a closed-sash hood is the safest hood, and for these reasons alone sash closure needs to be a professional standard in all laboratories. The personnel safety savings from one contained event are precious, and will not be assigned a monetary value here. The sash stickers reinforce this training and remind workers of both the safety and the energy implications of inattentive sash management procedures.

Implementation Assessment at UC Davis and UC Santa Barbara

Assessment of implementing the sticker installation project was provided through a number of surveys. At UC Davis, the time of the survey of low-use hoods was not controlled because occupancy was low regardless of time. For high-use hoods, surveys were conducted during the middle of the research day, and before 9 am when occupancy was very light. At UC Santa Barbara, surveys were provided continuously by the BMS.

Energy saving persistence

Surveys at UC Davis of ten research laboratories, with a low-density number of fume hoods, showed 90-100% compliance 22 months after installation with no additional reinforcement of closure. Figure 2 shows typical response before, 2 months after, and 22 months after installation. Averages less than 2.4 inches open indicate essentially 100% compliance. Similarly, sticker installation had a strong impact on sash closure persistence in a building at UC Davis with a high fume hood density, especially overnight.

At UC Santa Barbara, compliance results were similar. In Figure 3, pre-installation average night-time sash positions were 15 inches in the ESB lab and 7.35 inches in the CNSI lab. Following the sticker installation, 23 months later, these night-time sash positions decreased to 9.38 inches and 4.8 inches, respectively. More importantly, hourly sash position data for individual hoods trended in the building control system highlight the wide differences between compliant and non-compliant laboratories, and provide impetus for strategically targeted outreach efforts. The data also provides highly quantitative visual evidence of the problem, which is one of the best ways to motivate behavior change among scientists.

Estimating savings performance

Energy savings estimates based solely on sash position are not straightforward. To understand savings performance, consider that a lab may have either a high-density fume hood count or a low-density fume hood count, based on the number of hoods per unit of floor area. In a high-density situation, the volume of lab exhaust air is dominated by fume hood requirements. In a low-density situation, the volume of lab exhaust air is determined by a required ventilation rate that is provided in combination with a general exhaust. It is clear that sash position in a fume-hood-dominated lab will significantly impact energy use and much less in a low-density fume hood lab.

Fume Hood Density

A simple rule-of-thumb indicates when a lab may be fume-hood-dominated. Many laboratory designs use ventilation guidelines that set minimum airflow at 6 air changes per hour (ACH) with a 10 foot high ceiling, or 1 CFM/SF. Therefore, in a medium size lab of 1,000 SF, the total exhaust would be 1,000 CFM. Interestingly, this is nearly equivalent to the exhaust flow rate of one CAV six-foot hood, calculated as follows: with sash fully raised, the open area is approximately 6 feet x 2 feet face area, or 12 SF; fume hood face velocity rate is

Figure 1: Fumes Hood Sticker.

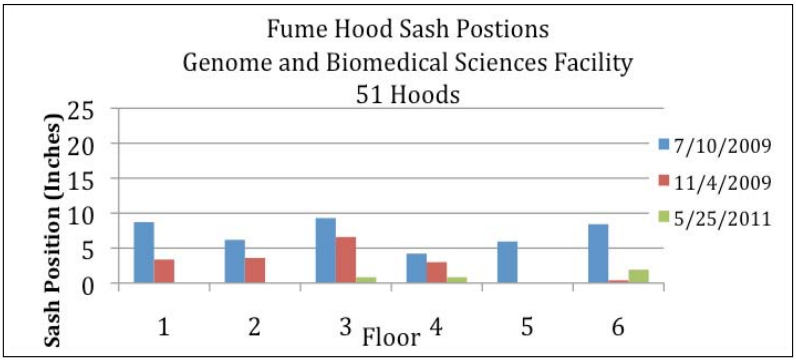


Figure 2: Sash Closing Persistence at UC Davis, Genome and Biomedical Facility.

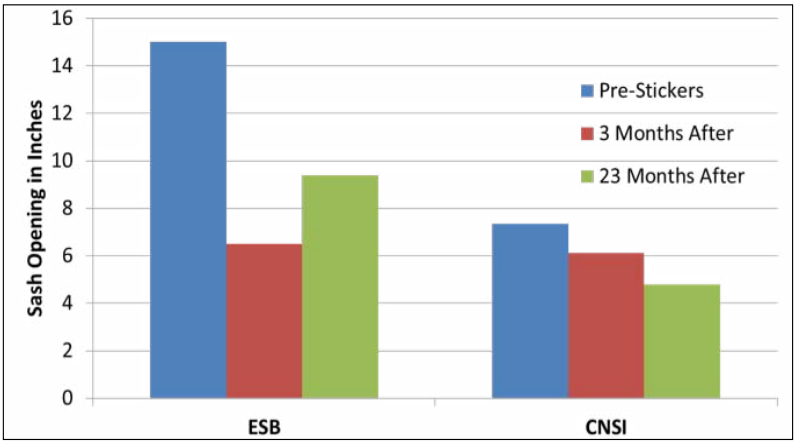


Figure 3: Sash Closing Persistence at UC Santa Barbara.

typically set at 100 LFM. Therefore, the open face area times flow rate = 12 x 100 = ~ 1,200 CFM. Thus, in this generalized scenario, a lab with only one six-foot wide hood in a 1,000 SF lab the airflow volume will not be appreciably affected by sash position.

VAV Energy Saving Benefits

A laboratory fume hood system is usually CAV or VAV. Airflow volume in CAV laboratory buildings will not change appreciably relative to sash position, and thus have negligible energy savings from sash closure. Whereas, in a VAV laboratory building, airflow volume should vary significantly depending on the number of fume hood sashes that are open. Also in a VAV lab space, if fume hood exhaust is less than laboratory air change rate, then fully closing sash(es) will have negligible impact on energy use, such as in the low-density spaces described above. Therefore, not every closed fume hood saves a guaranteed, fixed amount of money. However, at UC Santa Barbara in a lab building with a high fume-hood density, an average reduction of 185 CFM was verified that equates to $1,300 savings annually per fume hood, using the airflow costs presented in the next section.

Airflow Cost

Savings will result by reducing fume hood exhaust that is greater than needed to achieve a required ventilation rate in a lab room. A common metric (in 2011) for the value of conditioned air is $7 per CFM per year assuming 100% once-through outside air. Note that this value would increase with very hot, cold or humid climates. Thus annually, using a 6-foot VAV fume hood at 10% full open for experiment set up, 25% at 18 inch working opening and keeping the sash closed 65% of the time would save approximately $6,000 every year compared to constant fully open hood.

Technology Results

Data collected at UC Santa Barbara by their BMS provides a view into how users interface with their fume hoods and manage sash positions. Figure 4 presents hourly BMS trending of sash positions over two 7-day periods; before and after sticker installation. Non-compliance is indicated by high horizontal lines at night in the uppermost plots. Targeted outreach to improve sash management was implied. Beneficially, BMS trending supports follow-up outreach to be focused in problem labs.

Improvement in night-time sash closure and frequent daytime openings, as well as an apparent increase in day-time use, is fairly are evident. The upper plot of averaged values (red lines) indicates that without sash stickers (uppermost plot for each building), the opening remained large without much daily variation. Conversely, with sash stickers, the averaged plot (blue lines, bottom plots) shows a generally smaller opening that changed greatly between occupied and unoccupied periods.

Lessons Learned

Good worker safety practices, including carefully monitoring sash position, will become increasingly important as laboratory ventilation designs are reduced to minimize operating costs. Some laboratories are already designed or retrofitted with setback ventilation or demand control ventilation making the position of fume hood sashes a critical element of both safety and efficient operation. Data from this case study shows that design diversity factors (number of closed hoods) may be increased substantially, reducing laboratory building cost.

Reinforcement Needed

The case study indicated that persistence in closing the sash was not absolute and may be influenced by fume hood density and type of scientific research. Some decrease in sash closure rates was observed over time at both UC Davis and UC Santa Barbara, highlighting the need for some level of continuous reinforcement of the sticker message. In one facility, there was low compliance

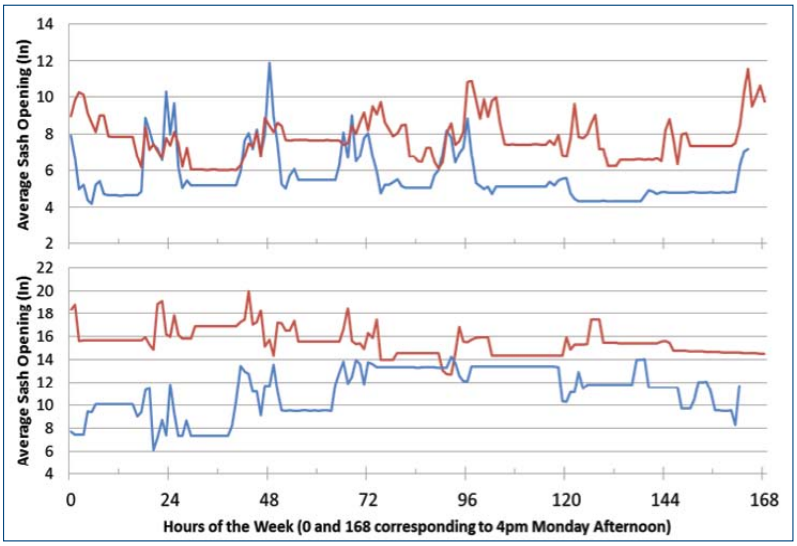


Figure 4: Average sash position before and after sticker installation at two UCSB buildings.

in high-density, high-use hoods regardless of time of day, indicating that additional reinforcement of sash closure behavior is needed. An extra measure of reinforcement is especially important in laboratories that are fume-hood-dominated. Therefore, issues that center on fume hood dominance in a lab will need particular attention during worker training exercises relating the importance to safety and energy savings, with this sticker reinforcing those lessons.

CAV versus VAV

The complexity of CAV versus VAV fume hood system designs need not confuse a hood user during training. From the worker's perspective, all hoods look the same and need to be treated with the same habit: Close the hood sash unless your arms are working inside the hood. The importance of this simple message cannot be stressed enough.

BMS Enhances Compliance

Buildings equipped with BMSs can have alarm tools designed to alert maintenance staff of problems within the buildings. These tools can also be used with minimal effort to provide real-time feedback to fume hood users. Staff can periodically review sash behavior and address problem labs individually, or the system can be set up to send automatic e-mail alerts to laboratory managers or occupants when sashes have been left open overnight. In either case, having real data to present to users illustrating their behavior can be eye-opening; many users close their sashes much less reliably than they think they do.

Next Steps

The energy savings realized from this project exceeded all expectations. The trivial cost to install the sash stickers is dwarfed by the operating cost reductions due to the decrease in airflow in VAV fume hood systems. The safety benefits gained by good sash operating procedures are realized in both CAV and VAV laboratories. Therefore, since the benefits of installing the sash stickers are so dramatic, we believe that this type of sticker should be installed on every fume hood in the U.S.

Acknowledgements

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Student Volunteers included the UC Davis CalPIRG team and Physics major Ziming Li

UCSB Laboratory Research and Technical Staff (LabRATS) interns assisted in sticker installation.

Jesse Bickley at UCSB Environmental Health and Safety collaborated in the initial sticker design

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FEMP Federal Energy Management Program

CSO 23029
March 2012

Funding Application

Before beginning the application process, please verify that you understand the terms and conditions for receiving funding from the SSC:
• The SSC cannot apply retroactive funding, all budget items must occur after the meeting date where the proposal is reviewed.
• Proposals are accepted on a rolling basis and the due date for consideration at each meeting is one week prior to that meeting.
• If approved, the project leader has twelve months to spend the funds. If the project requires an extension beyond this timeline, the project leader will need to submit an extension request.
• The money disbursed from this fund comes from student fees, so sustainability-related student impact is a necessary component for any proposal.
• Presenting the project to the Council is mandatory.
• In order to preserve the Council's ability to effectively review and consider proposals we are limited in the amount of proposals we may review per meeting. In the case that more proposals are received than can be reviewed for a given meeting, Council directors will decide which proposals are heard based on project timeline and order of submission.

By checking the box below, I verify that I understand and accept these terms and conditions.
: Yes

Project title: Campus Troubadours

Project leader name: Andrew Wilder

Project leader email: atwi236@g.uky.edu

Project leader additional contact information:

Contact type	Contact info
Email	Andrewwilder0@gmail.com

Total amount requested from the Council (round up to the nearest whole number): 9000

Would you like to present to the council?: Yes

UK affiliation: Student

Please fill out the following information about yourself and any other students involved on the project. Previous involvement with the SSC may include membership, funding requests, or involvement with an organization affiliated with the SSC. Answer to the best of your knowledge.:

Name	Major(s)/department	Academic year based on projected graduation date	Previous involvement with the SSC
Andrew Wilder	Guitar performance	Graduate Student	Previously funded by the SSC
Ashley Nalley	Guitar performance	Senior	Previously funded by the SSC
Candela Arias Perez	Guitar performance; International Studies	Junior	N/A
Felipe Magdaleno	Guitar performance	Graduate Student	N/A
Geraldo Costa	Guitar performance	Graduate Student	N/A

Please provide an in depth description of your project. You will likely want to copy and paste your response into the text box.: The Campus Troubadours began in the Fall semester of 2017 as a collaboration between the Tracy Farmer Institute for Sustainability and the Environment and the UK College of Fine Arts, specifically in partnership with the UK Classical Guitar Program, out of an interest in social sustainability. This project aims to provide aesthetically pleasing, tranquil, and culturally enriching experiences in an aim to counteract stress inducing noise pollution. This initiative began on October 15th, 2017, with weekly performances by six student members of the UK Classical Guitar Program. These students performed in public, high traffic areas (Bowman's Den, Willy T Starbucks, The 90, etc.) on campus during peak hours. The Campus Troubadours have also been requested to perform at a variety of campus events. The Campus Troubadours project brings live music to campus in an effort to create a more positive and welcoming campus environment, thereby facilitating a higher amount of campus activity as well as a more culturally enriched learning and living atmosphere. The Classical Guitar is particularly useful because of its diverse repertoire, and its suitability in the performance of not only classical music, but also music from many different folk traditions. In the Spring semester of 2018, the project continued with funding from the Student Sustainability Council. This proposal requests funds to allow the initiative to continue. As efforts have been made to improve the physical landscape with new facilities at UK, such as the new student center, our hope is to continue to enrich and cultivate the sonic landscape through musical performances at various locations on campus.

Who will this project primarily impact?: Please select the groups that your project is intended to impact.:
Faculty/Staff
Graduate Students
Lexington Community
Undergraduate Students
UK Community as a Whole
Prospective students

What type of project is this?: Music outreach project

Please select up to three disciplinary categories that best describe your project.:
Arts/Architecture
Music

The SSC is always seeking further outreach opportunities. Please consider doing one or all of the following with your project to help us reach more people. :
Green Talks Radio segment (recommended)
Feature SSC logo on promotional material
Social Media Promotion

Does this project require the approval of any outside or UK entity? If so, please check the box and include documentation of support at the end of this document.: No

Have this, or any related project, been funded by the SSC in this or previous years?: Yes

You indicated this, or a related project has been funded by the SSC in this or previous years. Please answer the following questions about that project. If the SSC has funded multiple projects in the last three years, please provide information for each one.:

Project	Year funded	Amount (round up to the nearest whole number)
Campus Troubadours	2018	9720

Please fill out an itemized budget for your project as it stands. Indicate line items that could be reduced with a check mark. Round up to the nearest whole number for numerical entries.:
Category: Stipend/salary
Item name: Stipend
Amount requested from the SSC: 9000
Amount requested from outside the SSC: **Name of other funding source**: **Total cost**: 9000
Would you be willing to accept reductions in your line items? (Leave blank if the answer is no): Yes

Please describe who will be in charge of dispensing the funds. If it is not a UK department, how will the funds be dispensed?: School of Music

Does this project have any additional funding partners? If so please list them and briefly describe their contribution and involvement.: N/A

Estimated project completion date: 12/10/2018

Please provide a list of the major milestones of your project.: Involving students from all disciplines to engage in musical activities and discussions about music. Enriching and improving the living environment for students and employees on campus. Raising awareness and drawing attention to UK's indoor and outdoor environments through musical performances that invite students and guests to spend more time in those spaces.

Include the date (mm/dd/yy) and a brief description of the event. This should include all relevant events to your proposals, such as dates for completion of key project milestones, presentations, or final project completion.:

Date	Event title	Brief description
10/01/2018	Start date	Musical performances begin on this date
12/10/2018	End date	Musical performances end on this date

If your project timeline is greater than a month, please provide a date around the middle of the project when sufficient progress will have been made to update the SSC.:
11/14/2018

Please attach supporting documents such as promotional material, letters of collaborative funding, or a budget spreadsheet, in addition to the budget provided previously. If you are working in partnership with a UK entity such as the Physical Plant Division, an academic department, etc., their letter of support should be uploaded here as well. Please only attach documents necessary to your proposal, so documents such as individual resumes or cover letters should not be included. All supporting documents should be in PDF format.:

Campus Troubadors Spring 2018

Listen At: The 90, Cooper Tunnel, Willy T Starbucks, Mining and Mineral Resources Building, K Lair, Memorial Hall, Bowman's Den, Boone Center

Brought to you by:

Student Sustainability Council

And the UK School of Music's Guitar Program

Facebook:@UKTroubadors

10 weeks,
5 guitarists,
3 hours each week per guitarist per week,
Hourly rate= $60
Total= $9,000

Other musical supplies are already owned by the guitarists, or have funded and supplied during previous iterations of the project.

Funding Application

Before beginning the application process, please verify that you understand the terms and conditions for receiving funding from the SSC:
• The SSC cannot apply retroactive funding, all budget items must occur after the meeting date where the proposal is reviewed.
• Proposals are accepted on a rolling basis and the due date for consideration at each meeting is one week prior to that meeting.
• If approved, the project leader has twelve months to spend the funds. If the project requires an extension beyond this timeline, the project leader will need to submit an extension request.
• The money disbursed from this fund comes from student fees, so sustainability-related student impact is a necessary component for any proposal.
• Presenting the project to the Council is mandatory.
• In order to preserve the Council's ability to effectively review and consider proposals we are limited in the amount of proposals we may review per meeting. In the case that more proposals are received than can be reviewed for a given meeting, Council directors will decide which proposals are heard based on project timeline and order of submission.

By checking the box below, I verify that I understand and accept these terms and conditions.
: Yes

Project title: Bottle Filling Station Partnership

Project leader name: Shane Tedder

Project leader email: shane.tedder@uky.edu

Project leader additional contact information:

Contact type	Contact info
Email	phillip.tackett@uky.edu

Total amount requested from the Council (round up to the nearest whole number): 15000

Would you like to present to the council?: Yes

UK affiliation: Faculty/Staff

Please fill out the following information about yourself and any other participants involved on the project. Previous involvement with the SSC may include membership, funding requests, or involvement with an organization affiliated with the SSC. Answer to the best of your knowledge.:

Name	Department/major	Title of position/year in school	Previous involvement with the SSC
Shane Tedder	Office of Sustainability	Sustainability Coordinator	Yes, lots. Most recently/notably the Sustainability Challenge Grant Program and the Sustainability Internship Program.
Phillip Tackett	Facilities Management/PPD	Assistant Director of Facilities Managemetn	None

Please provide an in depth description of your project. You will likely want to copy and paste your response into the text box.: In 2010, student managers from the Cats Den in the Student Center led an effort to have bottle filling stations installed in the UK Student Center. In 2011-2012 the SSC provided funding that led to the installation of 17 additional stations on campus. 8 of these were installed in the Whitehall Classroom Building and 9 others were installed in various campus buildings when existing fountains needed to be replaced including 3 in the WTY Library. In 2012-2013 and 2013-2014 the SSC provided funding to continue expanding access to these units. Fast forward a few years, and the bottle filling stations have been integrated with our new construction standards and Student Government is funding the installation of 12 more fountains at WTY Library. There are now more than 120 of these fountains on campus in more than 70 buildings and a new interactive map has been developed to help folks find them. http://ukyfm.maps.arcgis.com/apps/webappviewer/index.html?id=9a5f73f58fb742d9a4967d5651ba1cae The fountains promote health through hydration, assist with waste reduction and save students, faculty and staff money. They are also a strong visual signal of UK's commitment to Sustainability. Despite (or maybe because of) our success at expanding the number of locations with bottle filling stations over the last few years, we still receive regular requests from across campus for these units. Through this proposal, we are seeking to establish a pool of funds that can be used to support the installation of 10-15 fountains this year in targeted locations that meet these criteria: • The area is used by students • There is not a fountain nearby (not on the floor, or the one above or below) • The total cost of installing the new unit is $4000 or less Departments or units that request a fountain would be expected to fund 1/3 of the cost of installation and the remaining funds would come from PPD/SSC. For example, if the Anthropology department wanted to add a bottle filler in their building and the total cost was $3000, Anthropology would contribute $1000, SSC would provide $1000 and PPD would cover the remaining $1000. If a unit cannot afford a full 1/3 of the costs, the UK Office of Sustainability and PPD will review the context and may choose to move forward provided the total cost of the installation does not exceed $3000.

Who will this project primarily impact?: Please select the groups that your project is intended to impact.:
UK Community as a Whole

What type of project is this?:
Campus Infrastructure

Please select up to three disciplinary categories that best describe your project.:
Campus Sustainability
Economics/Behavior
Recycling/Waste Management

The SSC is always seeking further outreach opportunities. Please consider doing one or all of the following with your project to help us reach more people. :
Green Talks Radio segment (recommended)
Feature SSC logo on promotional material
Social Media Promotion
Stickers crediting SSC on any fountains that are installed

Does this project require the approval of any outside or UK entity? If so, please check the box and include documentation of support at the end of this document.: Yes

Have this, or any related project, been funded by the SSC in this or previous years?: Yes

You indicated this, or a related project has been funded by the SSC in this or previous years. Please answer the following questions about that project. If the SSC has funded multiple projects in the last three years, please provide information for each one.:

Project	Year funded	Amount (round up to the nearest whole number)
Bottle filling stations	2011-2014	30000

Please fill out an itemized budget for your project as it stands. Indicate line items that could be reduced with a check mark. Round up to the nearest whole number for numerical entries.:
Category: Supplies
Item name: 10-15 bottle filling stations and installation
Amount requested from the SSC: 15000
Amount requested from outside the SSC: 30000
Name of other funding source: PPD and Requesting units
Total cost: 45000
Would you be willing to accept reductions in your line items? (Leave blank if the answer is no): Yes

Please describe who will be in charge of dispensing the funds. If it is not a UK department, how will the funds be dispensed?: Office of Sustainability and PPD. Projects will be billed directly to the ESF Cost Center

Does this project have any additional funding partners? If so please list them and briefly describe their contribution and involvement.: PPD is willing to match the funding committed by the SSC. Confirmation of support is attached.

Estimated project completion date: 05/31/2019

Please provide a list of the major milestones of your project.: Fall 2018 - Announce Partnership and invite applications for funding. Ongoing- Review applications for funding and coordinate installation of fountains.

Include the date (mm/dd/yy) and a brief description of the event. This should include all relevant events to your proposals, such as dates for completion of key project milestones, presentations, or final project completion.:

Date	Event title	Brief description
09/30/2018	Announce partnership	Social media and Newsletter promotion of program

If your project timeline is greater than a month, please provide a date around the middle of the project when sufficient progress will have been made to update the SSC.: 02/01/2019

Please attach supporting documents such as promotional material, letters of collaborative funding, or a budget spreadsheet, in addition to the budget provided previously. If you are working in partnership with a UK entity such as the Physical Plant Division, an academic department, etc., their letter of support should be uploaded here as well. Please only attach documents necessary to your proposal, so documents such as individual resumes or cover letters should not be included. All supporting documents should be in PDF format.:

From: Tackett, Phillip
To: Tedder, Shane
Cc: Sandford, Harold
Subject: RE: Bottle filler partnership with Student Sustainability Council
Date: Tuesday, September 4, 2018 10:45:06 AM

I think this will be fine…

From: Tedder, Shane
Sent: Tuesday, September 4, 2018 8:52 AM
To: Tackett, Phillip <phillip.tackett@uky.edu>
Subject: Bottle filler partnership with Student Sustainability Council

Good morning Phil,

Just following up on our discussion of this from last week. I will need to provide written confirmation of PPD support for this partnership, so if this looks good to you please respond to confirm. We can also make changes to the concept.

PPD and SSC Water Bottle Filler/Fountain Partnership

In an effort to promote access to cold, filtered drinking water and to promote the use of reusable water bottles in support of UK's efforts to reduce plastic pollution and minimize waste, UK PPD is committed to a partnership with the SSC with the following terms:

- PPD and SSC will provide matching funds to assist departments and units interested in the installation of a water bottle filling/fountain unit. Interested departments will be expected to contribute up to 1/3 of the cost of the installation.
- PPD and SSC will provide a maximum of $1500 each per installation, and $15,000 total.
- Not all locations will be eligible due to cost of new installation and this will be determined by PPD.
- The SSC and the Office of Sustainability will promote this partnership.

Shane Tedder
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www.uky.edu/sustainability