

# Environmental Sustainability Fee Accountability Committee Project Proposal Form for 2024-2025

Any member of the Truman community is encouraged to propose a project idea to the Environmental Sustainability Fee Accountability Committee (ESFAC) for consideration. These projects should enhance sustainability on Truman State University's campus. In particular, we judge proposals by eight criteria:

- **Environmental Benefit** - the true sustainable value of a project
- **Cost-Effectiveness** - cost, potential ability to repay itself
- **Visibility to Students** - the number of people that will see, or know about, the project
- **Student Impact** - amount of positive influence the project will have on student day-day life
- **Student Opinion** - general student interest, Student Government Opinion, has the proposal been submitted more than once
- **Contribution to Truman's Image** - adds to the public perception of the university, ability to produce a claim/comparison to benchmark
- **Feasibility** - how practical is the idea, is it a simple fix or a more complex issue
- **Time Sensitivity** - can the project be implemented quickly, does the university have the ability to implement the project, will there be required installation costs

Most projects approved by ESFAC will receive funding for the 2024-2025 calendar year, and are intended to be completed within that year. However, the committee also allocates funding to one on-going "major project" that will take multiple years to complete. Our last major project, installing solar panels on the University Farm, has concluded and we are welcoming submissions for a new major project.

## ***Examples of past projects:***

**Single-year projects:** Soil Tests for the University Farm, Mason Bee House Posts & Installation, Light Fixtures for the University Farm, Snack Packaging Recycling, Pond Membrane for Save the Bees Club (at Farm), Community Garden Supplies, Climate Inventory Project

**Major projects:** Long Term Solar Project at Farm

The purpose of this proposal form is to introduce the project to the committee. Please include as much information as possible, but know the committee will work with you to refine your submission. This form opens on December 5, 2023, and the proposal deadline is midnight on February 25, 2024. Until then, we are taking applications on a rolling basis. We look forward to hearing from you!

Send any questions, comments, or concerns to Emma Rohrbach at [er5223@truman.edu](mailto:er5223@truman.edu).

**Please describe the project that you would like to see implemented.**

We would like to use funding from the Environmental Sustainability Fee to improve the outdoor lighting on the Truman campus to make the campus safer, aesthetically pleasing, and to reduce the environmental impact of artificial light at night on the wellbeing of students, insects, birds, and other living organisms residing in and around the campus and Kirksville. Specifically, we are requesting a three-year phased installation of light-retrofits on existing “globe light” fixtures around campus. We propose purchasing 75 such retrofits in phase I which will be implemented around dorm buildings on campus at a cost of \$45,000, phase II to constitute the most frequently used paths by students on campus at night (\$45,000), and phase III to cover retrofits on 100 other lights (\$60,000). We estimate that the entire cost for this project will be \$150,000 to retrofit 250 of the 300 outdoor “globe light” fixtures on campus.

With funding from the previous year, we have acquired 7 such retrofits as “proof of concept”. On February 21, 2024, these lights were successfully installed by Physical Plant electricians in a row along the Pershing building starting at the crosswalk between Magruder Hall and the Bike Co-op on Patterson Street. The electricians prefer the new design and have mentioned two of the greatest qualities of these retrofits from their point of view. Firstly, these retrofits are expected to last for ten years or longer, compared to a few months to a couple of years (on average) for the existing lights. Moreover, the retrofits require a consistent 35W of electricity, which is significantly less than the current light requirements, which vary from about 50W-75W. Preliminary measurements conducted using light meters show that despite consuming almost 30%-50% less energy than existing lights, these retrofits provide close to twice as much light on the ground (approximately 1.1 footcandles as against 0.6 footcandles)! These results also show that approximately halfway between successive retrofitted light fixtures, the light intensity is approximately 0.5 fc, whilst with existing lights, the intensity drops to close to 0.05 fc. Thus the new lights will create less uneven lighting. We note that a cornerstone of good outdoor lighting practices is uniformity in lighting.

Taken together, these retrofits are a significant direct saving, on top of the time, energy, and effort saved in constantly ordering and replacing lights; all whilst providing more light where it is needed: on the ground. We are in the process of measuring how much light from these retrofits goes into the sky, but it is evident from visual inspection (see <https://darksky.truman.edu/truman-lighting-pictures/> for examples) that significantly less light is going up into the sky, as compared to existing lights.

Additionally, we will soon be conducting “night walks” and surveys about the new lights to gauge the community response to these new retrofits. This will inform our future

plans regarding specifications for the next phase of retrofits on campus – if there is a need for “brighter lights,” this retrofit design allows for adjusting the wattage (and hence the lumen output) from 35W to 100W. Similarly, if there is a need for changing the color of the lights from orange/amber to more yellow/orange, then that can be accommodated as well.

We note that currently, a majority of outdoor light fixtures at Truman State University are ineffective and harmful to human health, safety, and the environment. This is due to the fact that these fixtures are designed in a way that projects light not just towards the ground where it is needed, but also up into the sky and sideways. Additionally, most of the lights are of blue-white color, which is especially harmful to humans and the environment at night. Many of these lights shine directly into students’ dorm rooms, affecting the students’ ability to sleep by disrupting their circadian rhythm. As mentioned previously, we have over 300 poorly designed “globe light fixtures” on our relatively small campus. Fully replacing these inefficient light fixtures is cost-prohibitive (each fixture can cost well over \$2000), but we have already demonstrated that by wise use of engineering and modern technology (eg. the retrofits proposed here), it is possible to mitigate the ill-effects of these badly designed light fixtures.

Our plan is to reduce the light pollution and trespass around student dorms first, then provide better lighting along frequently used walkways, and then retrofit miscellaneous lights around campus. This will provide a warm, welcoming, aesthetically pleasing, and safe environment for students, while being respectful to the needs of all living things in-and-around our campus.

In summary, the goal of this project is to continue with the work of making the outdoor lighting more efficient (greater lumens on ground per Watt of electricity), more environmentally friendly (decrease in waste production due to longer lifetime, reduced sky glow and light trespass, decrease in harmful blue-white content), and safe (reduced glare, more lumens on the ground and reduced uneven lighting on campus).

**How will this project benefit the Truman community? What do you anticipate the environmental benefit of this project to be?**

Our community is becoming increasingly aware of the diverse issues surrounding light pollution. Poorly designed lights impact more than just the visibility of stars. Whilst nighttime outdoor lighting serves several purposes, poorly designed fixtures and excessive, harsh lighting can be counterproductive and lead to a plethora of other problems that can easily be avoided by the smart use of appropriately designed light

fixtures and LED lights. Some of the problems with current lighting and the benefits of the proposed retrofit solutions are listed below:

- 1) Impact on Human Health: Both humans and wildlife are impacted by exposure to artificial light at night. Exposure to the blue/white lights in the evening/night suppresses melatonin production in our bodies. In turn, this disrupts the natural circadian rhythm of our bodies and contributes to sleeping disorders, which in turn contributes towards obesity, high blood pressure, diabetes and heart disease. We conducted a survey of 140 students in October 2022 and 61.4% said that outdoor light shines into their rooms at night. More than 65% of students surveyed also expressed a preference for lights with color temperatures below 3000K, corresponding to orange or amber colored lights. A similar survey in Spring 2023 (53 students) showed very similar results: 62% students reporting light shining into dorm rooms, 75% students preferring lights below 3000K (yellow or amber colored lights), and 63% students reporting direct glare from light fixtures on campus cause “significant glare and causes discomfort”. More information about the effects of light pollution is available below, but the main takeaway is that light pollution causes real harm to our environment and community.
  
- 2) Impact on Human Safety: One of the negative impacts of Truman’s poorly designed lighting fixtures is that they make campus less safe at night. The glare of poorly shielded lights and consequent shadows that are cast cause uneven lighting. This in turn, makes it difficult for pedestrians to stay aware of surroundings when walking on campus, and glare shining into drivers’ eyes can make it difficult for them to see pedestrians. For example, in the same Spring 2023 survey mentioned above (out of the 29 on-campus residents who participated in the survey), 34% of on-campus resident responses said the lighting was 'too bright', compared to only 7% who said 'too dark'. Similarly, among people who felt 'somewhat unsafe' at night: 69% said the glare was significant; causing discomfort and/or distracts drivers whilst only 31% said there was glare but within acceptable limits. 0% of the respondents said the lights were appropriately directed.  
The appropriate directionality of the retrofit amber-colored lights will cause less glare and will lead to a more uniform light distribution on the ground which is aesthetically pleasing, less stressful to the eye, and allows pedestrians and drivers alike to be more aware of their surroundings.
  
- 3) Impact on other lifeforms: Studies have shown that artificial light (especially, blue-white light) at night disrupts pollinators, insects, migratory birds, and other

wildlife. Most of the current lighting on campus is “blue-white” or “off-white” colored lighting. There is increasing evidence that shows that most lifeforms on Earth consider the presence of blue-white-light in the environment as “daytime”, thus disrupting the circadian rhythm of these organisms. Amber lights, on the other hand, are less disruptive to humans, animals, plants, and insects.

- 4) Impact on surrounding communities: It is not just the campus community that is negatively impacted by poor lighting – the light pollution from the Truman campus has detrimental effects on our extended community. In the past few years, Thousand Hills State Park has been working on getting the “Urban Night Sky Place” designation from DarkSky International (formerly the International Dark Sky Association). To that end, Thousand Hills has already purchased new, dark-sky friendly light fixtures with amber colored LED lights for their park, which will be installed this summer. However, there are very few lights inside Thousand Hills state park; most of the light pollution visible from the park results from sky glow caused by badly designed lights from town - a large fraction of which originates from the Truman campus. Migratory birds that pass through, various pollinators that pollinate our farms and gardens, insects & fireflies, and other wildlife that resides in-and-around Thousand Hills (and other wilderness areas around Kirksville such as Rainbow Basin and even the Truman Farm) will greatly benefit from reduced levels of light pollution and the overall decrease in blue-white light in the natural nighttime environment.

Apart from the environmental benefits of better lighting, the Truman community will also benefit from direct monetary savings due to the efficiency and longevity of these retrofits, and indirect costs that include the labor of purchasing and replacing lights frequently. Physical Plant engineers have expressed their appreciation for the retrofits because they consume 30% - 50% less energy than existing fixtures, and because their expected lifetimes of 10 years are much longer than the average lifetime of the ‘globe light’ fixtures (lasting between a few months and a few years before requiring replacement). The savings that result from our transition to more efficient and durable lighting can then be used for other activities and environmental efforts on campus.

We note that light pollution is an issue that has widespread effects, but is relatively easy to address. Additionally, the solutions to light pollution benefit everyone, including individuals and businesses who stand to save money due to reduced maintenance and overall operational costs.

This project relates closely to other dark sky efforts that are currently underway at Truman. In particular, we are developing a Campus Light Management Plan with the

help of our campus planner, Lori Shook. Once we have crafted a technically sound plan, this plan will be shared with Physical Plant, Truman's finance office, and DPS for their input. We hope to have the LMP finalized by the end of the Spring 2024 semester and approved by Fall 2024. This lighting plan emphasizes on the five principles of responsible outdoor lighting (established by DarkSky International - <https://darksky.org/resources/guides-and-how-tos/lighting-principles/>). These principles outline that the following factors should be considered while installing outdoor lighting:

1. Use light only if it is needed
2. Direct light so it falls only where it is needed
3. Light should be no brighter than necessary
4. Use light only when it is needed
5. Use warmer color lights where possible

Firstly, we note that Student Government Resolution 122.007 ("A Resolution Advocating for Dark-Sky friendly Campus Lighting" was passed last year, supports our overall plan, and specifically urges Truman administrators to update campus lighting to be consistent with these five principles. The retrofit design solution proposed here addresses these principles, and will set a good precedent for future lighting that is installed on campus. Furthermore, these new retrofits in tandem with the new Campus Lighting Plan will set apart Truman State as a leader of environmentally conscious lighting practices and policies. By committing to retrofit the existing fixtures with better lighting options that are more efficient and cause the least amount of negative impacts on the environment, ESFAC and Truman State can set an example for the neighboring communities and other universities across Missouri and indeed the United States.

**Will you or your organization be involved with the project during or after its implementation? If so, how?**

Yes, our group has already made arrangements with the Physical Plant and our supplier (<https://crossroadsled.com/>). We have already been involved in coordinating the installation of the seven retrofits by coordinating visits by the Vice-President of CrossroadsLED and arranging meetings with Physical plant personnel and the city officials in Kirksville. As mentioned elsewhere, this has resulted in a good rapport between the electricians at the Physical Plant, the CrossroadsLED engineers, and what we (dark sky Truman) are pursuing. Moving forward, Dr. Gokhale intends to continue to coordinate between CrossRoadsLED and the Physical Plant with the help of his research students. Additionally, we will conduct surveys regarding campus lighting, develop a Light Management Plan for Truman State, and involve DPS and the campus planner/architect. This plan will clearly define color, wattage and lumen requirements for the lights on campus, and provide direction on the design of lighting fixtures that reduce or eliminate waste, decrease glare, and direct lights towards the ground instead of up

into the sky. This is in addition to the work done by Dr. Gokhale's group regarding public outreach and awareness efforts on the topic of light pollution and related issues.

**If you will be involved with the project, what is your contact info so we can reach out to you once the ESFAC 2024-2025 slate is finalized? If you will not be apart of the implementation of the project, who do you envision that will be and how can we best contact them?**

Dr. Vayujeet Gokhale ([gokhale@truman.edu](mailto:gokhale@truman.edu)),  
Professor of Physics.  
MG 3168

### **Budgetary Information**

**This is to give the committee an idea of the costs associated with the proposed project. Please be as specific as possible.**

**Give an estimated cost of this project. If able, provide an itemized list with sources for each item's cost.**

Cost per retrofit depends on the size of the order. Based on quotes provided by the vendor CrossRoadsLED, here is a breakdown of the approximate costs:

- 1) 0-25 retrofits: \$725 per retrofit
- 2) 26-50 retrofits: \$ 665 per retrofit
- 3) 75-100 retrofits: \$599 per retrofit

For this (Phase I) of the project, we are proposing an order of 75 retrofits costing approximately \$45,000. We will try to negotiate a lower price, in case we can assure the vendor of purchasing, say 250 retrofits, spread over the next 3-4 years.

Note that the Physical Plant has agreed to install the lights as part of their regular maintenance/upkeep as long as the retrofits are paid for from other sources (such as ESFAC).

**Will there be any other sources of funding for this project? If so, explain.**

Due to the scale and costs associated with this project, we will pursue additional funding opportunities to supplement the support that we hope to receive from the ESFAC committee. Given the widespread benefits of this project to the entire Truman and Kirksville communities, we are confident that we can obtain additional funding from the university and other internal and external grants. This will help accelerate the

improvement of lighting on our campus and let students enjoy the benefits of their ESFAC fees when they are still at Truman.

## Other Information

**Include any relevant resources or research here (For websites, simply include the website/article title and the URL)**

- 1) Additional information about the harmful effects of light pollution can be found on the International Dark Sky Association's website: <https://www.darksky.org/light-pollution/>
- 2) A comprehensive report on the impact of LEDs on wildlife (2023): <https://dot.ca.gov/-/media/dot-media/programs/research-innovation-system-information/documents/final-reports/ca23-3696-finalreport.pdf>
- 3) A dated (2004) but shorter summary of "ecological light pollution": <https://esajournals.onlinelibrary.wiley.com/doi/abs/10.1890/1540-9295%282004%29002%5B0191%3AELP%5D2.0.CO%3B2>
- 4) Specific information about the impact of light pollution on human health can be found in the American Medical Association's report, found here: [https://darksky.org/wp-content/uploads/bsk-pdf-manager/AMA\\_Report\\_2016\\_60.pdf](https://darksky.org/wp-content/uploads/bsk-pdf-manager/AMA_Report_2016_60.pdf)
- 5) An example of lighting provided by CrossRoads is here: <https://crossroadsled.com/lighting-products/retrofit-luminaires-for-acorn-and-post-top-fixtures/>
- 6) Webpage outlining our efforts, useful links to off-the-shelf residential and commercial applications consistent with "dark sky principles", and examples of good and bad lighting: <https://darksky.truman.edu/truman-lighting-pictures/>