Rec 9/27/24

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MTSU Clean Energy Initiative Project Funding Request

There are five (5) sections of the request to complete before submitting. See http://www.mtsu.edu/~sga/cleanenergy.shtml for funding guidelines. Save completed form and email to cee@mtsu.edu or mail to MTSU Box 57.

1. General Information

Name of Person Submitting Request Mina Mohebbi	
Department/Office Engineering Technology	Phone # (Office) (615)898- 2106
MTSU Box # 19	Phone # (Cell)
E-mail mina.mohebbi@mtsu.edu	Submittal Date 9/27/2024

2. Project Categories (Select One)

Select the category that best describes the project.

✓	Energy Conservation/Efficiency	✓	Sustainable Design
	Alternative Fuels		Other
	Renewable Energy		

3. Project Information

a. Please provide a brief descriptive title for the project.
b. The project cost estimate is the expected cost of the project to be considered by the committee for approval, which may differ from the total project cost in the case of matching funding opportunities. **Any funding request is a 'not-to-exceed' amount. Any proposed expenditure above the requested amount will require a resubmission.**
c. List the source of project cost estimates.
d. Provide a brief explanation in response to question regarding previous funding.

3a. Project Title

Integrating Life Cycle Assessment for Net-Zero Carbon and Building Energy Efficiency at MTSU

3b. Project Cost Estimate

Energy audit equipment ($2500) + Life Cycle Assessment software and database ($2000)+ Graduate student support ($3200) = $7,700.00

3c. Source of Estimate

LCA: / https://simapro.com/plans/?_types=education // Energy audit: quotes for infrared thermography, sub-metering, blower door test kit, data loggers, energy audit software, smart thermostat, ect. are available

3d. If previous funding from this source was awarded, explain how this request differs?

This research grant is requested for a project related to net-zero carbon, life cycle assessment, and building energy efficiency. The previous project was related to sustainable food waste management on campus

4. Project Description

(Completed in as much detail as possible.)

a. The scope of the work to be accomplished is a detailed description of project activities.
b. The benefit statement describes the advantages of the project as relates to the selected project category.
c. The location of the project includes the name of the building, department, and/or specific location of where the project will be conducted on campus.
d. List any departments you anticipate to be involved. Were any departments consulted in preparation of this request? Who? A listing may be attached to this form when submitted.
e. Provide specific information on anticipated student involvement or benefit.
f. Provide information for anticipated future operating and/or maintenance requirements occurring as a result of the proposed project.
g. Provide any additional comments or information that may be pertinent to approval of the project funding request.

4a. Scope: Work to be accomplished

This project will evaluate the energy performance of selected campus buildings (Science Building and Recreation Center), integrate Life Cycle Assessment (LCA) to assess the environmental impact of materials and operations, and propose decarbonization strategies. The combination of energy audits and LCA will provide a holistic view of how to achieve net-zero carbon emissions in campus infrastructure. The objectives of this study include:
- Conduct an energy audit of selected buildings to identify opportunities for energy efficiency improvements
- Perform a Life Cycle Assessment (LCA) to evaluate the environmental impacts associated with building materials, operational energy use, and end-of-life management
- Propose actionable strategies for reducing energy consumption and carbon emissions

> Phase 1- Energy audit will be carried out in the following steps:

- preliminary data collection: historical energy usage data, building layout, and inventory of equipment
- On-site assessment: evaluation of HVAC system, lighting, insulation, and major appliances for inefficiencies
- Energy performance monitoring: use tools (e.g., install sub-meters and thermal imaging) to measure energy consumption and assess system performance
- Data Analysis and Reporting: estimate potential energy savings and carbon footprint reductions

* Tools and equipment used for energy auditing: Infrared thermography (Thermal Cameras), Smart Meters and Sub-meters, Pulse Testing, Lux Meter, Data Loggers for Temperature and Humidity, and Energy Audit Software

> Phase 2- Life cycle assessment:
- Goal and Scope Definition: Define the LCA boundaries focusing on specific campus buildings
- Life Cycle Inventory: Collect data on inputs and outputs throughout the building's life cycle
- Impact Assessment: Utilize LCA software to quantify environmental impacts
- Interpretation and Reporting: Provide energy saving and carbon reduction recommendations based on LCA findings

* LCA software and databases: SimaPro (Educational License), OpenLCA (Open-Source), ecoinvent (Free Access for Educational Use), US LCI Database, Construction Industry Database

4b. Scope: Benefit Statement

Expected Outcomes and benefits of this project include:

+Identification of energy efficiency opportunities in the selected campus building will serve as a model, with recommendations that can be scaled and applied across the entire campus

+Comprehensive LCA report detailing environmental impacts and potential carbon reductions

+Recommendations for retrofitting and operational changes that align with established MTSU's sustainability goals

This project will provide valuable insights into building energy efficiency and environmental impacts at MTSU, supporting the university's commitment to sustainability and net-zero carbon emissions. By integrating energy audits with life cycle assessment, the university can make informed decisions about future building practices, enhancing its role as a leader in sustainability.

4. Project Description (continued)

4c. Location of Project (Building, etc.)

Two key locations, the Science Building and the Rec Center, have been selected for this project. The Science Building, with its diverse functions—including faculty offices, research labs, an auditorium, and common areas—provides a comprehensive view of varied energy demands and efficiency potential, making it an ideal site for evaluation. The Rec Center was chosen due to the constant need for HVAC systems to maintain comfortable conditions, as well as the energy demands of its pools and fitness facilities. These continuous operational requirements create a high potential for energy inefficiencies, making the Rec Center a critical focus for improving overall performance and reducing energy consumption.

4d. Participants and Roles

Dr. Mina Mohebbi: Project supervisor. planning and implementing the project, directing students in data collection and analysis

One graduate research assistant: Collects and analyzes data, performs life cycle assessment, develops reports on net-zero carbon strategies

Undergraduate research assistant(s) (not funded via this project): helping with energy audit data collection

4e. Student participation and/or student benefit

Student Participation: Undergraduate and graduate assistants will play important roles in the project by engaging in various tasks such as conducting energy audits, gathering data for the Life Cycle Assessment (LCA), and assisting in the analysis and reporting of findings. They will also have opportunities to participate in fieldwork, utilize specialized tools, and collaborate with faculty throughout the research process.

Student Benefits: Participating in this project will provide students with hands-on experience in sustainability practices and energy efficiency assessments, enhancing their practical skills and knowledge in the field. They will gain valuable insights into real-world applications of their studies, improve their research and analytical abilities, and strengthen their resumes, positioning themselves for future career opportunities in environmental engineering and sustainability.

4f. Future Operating and/or Maintenance Requirements

If purchased, the energy audit tools and equipment will be maintained for ongoing assessments of other campus infrastructures. They will also support course projects and future externally funded research initiatives, ensuring long-term utility and contribution to MTSU's sustainability goals.

4g. Additional Comments or Information Pertinent to the Proposed Project

Examples of energy audit tools:

- Seek Thermal RevealPRO (https://a.co/d/26kD9s9)
- HOBO UX120 4-Channel Data Logger (https://microdaq.com/onset-hobo-ux120-4-analog-input-data-logger.php?srsltid=AfmBOoqEtFI_QSsuaNdEuFBdfUgGC-4Bum4Mx1OIoT5v7bouO-VexC76)
- Extech LT300 Light Meter (https://a.co/d/czk8wyD)
- HOBO MX1101 Temperature/Humidity Logger: (https://www.onsetcomp.com/products/data-loggers/mx1101?srsltid=AfmBOooXtPkxu3gVbd-fa4D4XfGw0ASu0fuH2mzXow_grGSF-uTWxQrF)

5. Project Performance Information

Provide information if applicable.

a. Provide information on estimated annual energy savings stated in units such as kW, kWh, Btu, gallons, etc.
b. Provide information on estimated annual energy cost savings in monetary terms.
c. Provide information on any annual operating or other cost savings in monetary terms. Be specific.
d. Provide information about any matching or supplementary funding opportunities that are available. Identify all sources and explain.

5a. Estimated Annual Energy Savings (Estimated in kW, kWh, Btu, etc.)

Energy Audit:

After conducting the energy audit, we may find specific inefficiencies, which need HVAC upgrades, lighting retrofits, or insulation improvements. Savings can be quantified as a percentage of the building's current energy consumption:

HVAC Improvements: Upgrading HVAC systems can yield energy savings of 20-30% of current consumption.
Lighting Retrofits: Switching to LED lighting typically results in energy savings of 50-70%.
Insulation and Sealing: Enhancements can lead to energy savings of 10-20%.

5b. Annual Energy COST Savings ($)

We need to check the most recent utility bills to find the average cost per kWh. Using the estimated annual energy savings (kWh) from part 5a, we will be able to calculate cost savings ($).

5c. Annual Operating or Other Cost Savings. Specify. ($)

Exact savings will depend on the specific energy consumption patterns and improvements identified through the energy audit. However, based on the findings in the literature, a minimum annual operating cost saving of $10k is estimated for both buildings.

5d.Matching or Supplementary Funding (Identify and Explain)

Project supervisor will support undergraduate students involved in this project.