

STUDENT ORGANIZATION SUSTAINABILITY INITIATIVE PROPOSAL FORM

Part I- General Information:

Name of Student Organization	Math Emporium Energy Improvement Initiative
Contact/Responsible Person	Daniel Webb
Contact Office Held/Title	Energy Analyst
Contact Email Address	dwebb20@vt.edu
Contact Telephone Number	540-293-3107

Part II- Project Cost Information

Estimated Cost of this Proposal See III.C. below

Estimated Savings - See III.D. below

Net Cost of this Proposal =

Part III- Supporting Information

A. Please describe your sustainability initiative and attach supporting documentation.

My sustainability initiative is to add a system of controls to the existing HVAC system at the Math Emporium. The Math Emporium used to be a 24-hour facility. Now, it is open 16 hours a day when classes are in session. Before, the space did not really need HVAC controls since it was open all the time. Now, with hours of the day where the space is unoccupied, there is less demand for heating and cooling. Adding additional controls will enhance the energy efficiency of the AHUs. This system of controls includes 8 programmable thermostats that are wired from each unit to the space they serve.

The controls I am proposing will add "Time of Day" scheduling capabilities for all units. This will allow scheduling the HVAC on a 7-day weekly calendar. The facility managers will be able to schedule times where it is not open and can reduce the amount of heating and cooling to the space. This will be valuable for the facility in terms of overnight hours when the facility is closed, in addition to the various breaks the University has where the space is not open.

In addition, I propose to rebalance the existing units to save even more energy. These units supply air to the space, but with the large heating load produced by the lights and computers, it may make sense to reduce the amount of supply air. Doing this will optimize all of the units for the space they serve, without any additional controls.

B. How does this initiative help to achieve the goals of the Virginia Tech Climate Action Commitment Resolution and Sustainability Plan?

The Virginia Tech Climate Action Commitment and Sustainability Plan (VTCAC&SP) states that "Virginia Tech will be a leader in Campus Sustainability" and that sustainability is an important part of the university as "it pursues enhanced economic stability" and "environmental stewardship". This initiative demonstrates on a large scale that Virginia Tech is a leader in campus sustainability. It demonstrates that Virginia Tech

does so for its students and its surrounding community. This project will demonstrate to others that Virginia Tech is willing to make an investment if it means campus can operate in a more sustainable way.

In addition, the VTCAC&SP says that Virginia Tech has a target of reducing campus GHG emissions to 295,000 tons by 2025. This project, annually, saves 12.8 equivalent tons of CO₂. This was determined from a direct conversion of kWh of electricity and CCF of natural gas saved to equivalent tons of CO₂ saved using established conversion factors. The electricity saved corresponds with 12.1 equivalent tons of CO₂ saved and 0.697 equivalent tons of CO₂ saved for natural gas. The plan also says that Virginia Tech will work toward their emission reduction targets through improved energy efficiency, which is exactly what this project does.

The VTCAC&SP says that "Virginia Tech will improve electricity and heating efficiency of campus facilities and their operations by improving the heating and cooling infrastructure and operation...and metering and control of its existing buildings". This project improves the heating and cooling efficiency of the Math Emporium through energy savings. The control system being proposed directly relates to the point about improving the metering and control of existing buildings. This control system will account for less HVAC demand during non-operational hours.

Another point of the VTCAC&SP says that Virginia Tech will engage students through involvement to develop and implement innovative strategies for efficient and sustainable use of energy in facilities. This project demonstrates a proposed student initiative that will make a facility have a more responsible use of energy. This will meet Virginia Tech's goal of engaging and educating students with sustainability initiatives on campus.

C. What is the cost of your proposal? Please describe in adequate detail the basis for your cost estimate.

The approximate cost of this proposal is **\$8,000**. This was found using various estimating tools and adding overhead to the cost of equipment and installation. I estimate **\$5,600** for the programmable thermostats and **\$2,400** for the rebalancing of the units.

I am proposing adding 8 programmable thermostats, one for each of the AHUs. A high estimate for installing one typical programmable thermostat (equipment plus labor) using online estimating tools is in the range of \$400-\$700. I went with the highest estimate of \$700 per programmable thermostat, with the assumption that the final project cost will be less than my calculated values in this proposal. For 8 thermostats, the total cost of this part of the project would be **\$5600**.

The rebalancing of the AHUs would likely take two people working for a day. I calculated the cost of rebalancing, which requires no additional equipment, to be around **\$2400** (2 people x 8 hours x \$150/hour).

D. Will your proposal produce cost savings for the University? If so, how much? Please describe in adequate detail the basis for your savings estimate.

This proposal does produce cost savings for the University. This addition of controls is expected to reduce the current HVAC cost by **15%** due to scheduling and rebalancing. This reduction can then be compared to current annual cost to determine cost savings.

In FY2017, the Math Emporium HVAC system used an approximate **103,314 kWh, or \$8,840.89**. In addition, the system used **2294.89 CCF of natural gas, or \$1,869.96**. Combined, this is **\$10,710.85** spent annually in HVAC related costs. I am assuming there will be a 10% reduction in energy consumption due to the programmable thermostats. This proposed 10% reduction would save **10,331.4 kWh, or \$884.09** annually, from the fan of the AHUs. In addition, there will be about a 5% reduction in energy consumption from rebalancing the units, applied to both the fan and compressor. This saves **5,165.70 kWh and 114.75 CCF, or \$535.50 annually**.

From the savings calculations above, we find that the total annual savings for this project is **15,492.10 kWh and 114.75 CCF, or \$1,419.59**.

By taking the projected cost of the entire project and dividing it by the annual savings, we determine the simple payback period. This is (\$8,000/\$1,419.59) **5.64 years**.

E. Is this funding request for a One-Time need or an Ongoing need (please check one)?

One-time

Ongoing

F. Is funding available for this request from another source? If yes, describe the funding (source, amount, etc.)

No

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(Continued)

Part IV- Requestors/Reviewers



Daniel Webb, Electrical Engineering, Energy Analyst

Prepared By (Name of Contact for Student Organization)

Date: 11/15/2018

Ruben Avagyan, Campus Energy Manager, Energy Management

Reviewed By (Name of Appropriate University Official)

Date: 11/15/2018

Denny Cochrane, Sustainability Program Manager, Office of Sustainability

Reviewed By (Name of Office of Energy and Sustainability Representative)

Date: 11/15/2018