SUSTAINABILITY INITIATIVES BY STUDENT ORGANIZATIONS FUNDING PROPOSAL

Part I - General Information

Name of Student Organization	Virginia Tech Facilities Engineering - Office of Energy Management
Contact/Responsible Person	Kevin Byrnes
Contact Office Held/Title	Energy Analyst
Contact Email Address	kevinb1@vt.edu
Contact Telephone Number	(516) 650-7497

Part II - Project Cost Information

Estimate Cost of this Proposal	$8,500	See Part III.C
Estimated Savings –	$15,000	See Part III.D
Net Cost of this Proposal	**-$6,500 in year one**	

Part III - Supporting Information

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

My sustainability initiative seeks to decrease the amount of energy wasted on select heating, ventilation, and air-conditioning (HVAC) equipment serving Moss Arts Center. The current supply air temperature (SAT) control in place on various air handling unit (AHU) systems in the building are considered “non-integrated”; meaning, the various sensors within the AHU system act independently often to different sensors in different locations. From the time air is pulled from the ambient environment, to when it is expelled to the space in question, the air must pass through several heating and cooling control loops. Between each of these components, the temperature of the air is measured by a sensor, and since none of the sensors are integrated with one another, set point “overshoot”/”undershoot” is rampant. Some over-/under-shoot is normal but with non-integrated loops, the slightest deviation from setpoint may result in unnecessary mechanical heating and cooling. Also this may lead airflow to be heated, only to be cooled, only to be heated again. This practice is extraordinarily wasteful.

This proposal aims to increase the intelligence of this system by allowing integration and coordination between various temperature sensors and control loops. More specifically, if the system knows at the start what the final temperature of the air must be, it will be able to perform the following functions:

1. Is the outside air at an appropriately high temperature (Mixed Air Setpoint) to allow through without recirc air?
    a. Yes: Open economizer completely, allowing purely outside air to flow through system.
    b. No: Modulate the economizer, allowing the warm air from inside the building to mix with the fresh outside air before heating and cooling.
2. Does the humidity of the air need to be lowered?
    a. Yes: Cool air down rapidly to wring out moisture, reheat to desired temperature.
    b. No: No function is necessary.
3. Is the fan heat significant enough for consideration?
    a. Yes: decrease Supply Air Setpoint by “x” amount of degrees.
    b. No: No function is necessary
4. After air has/hasn’t been mixed, does it need to be heated or cooled to a certain temperature?
    a. Yes: heat OR cool air to desired temperature, ensure that both sensors are functioning such that air will not be overheated, and thus need excess cooling, or vice versa.
    b. No: Allow air to flow into space.

Other aspects of this project will be to correct excessive overheating due to “binding” preheat coil face and bypass dampers and/or leaking valves, inaccurate sensors, etc. AHU-8 was indicating an air temperature rise over 20 deg F in the indicated full bypass position. The attached Excel workbook includes as-found programming, notes regarding scope, trends indicating and validating the control issues, and baseline and ECM energy calculations

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

The Virginia Tech Climate Action Committee Resolution and Sustainability Plan aims to achieve fourteen major goals that will improve the university’s impact on the environment around it. This proposal will assist in completing three of these goals: Establish a target for the reduction of campus greenhouse gas (GHG) emissions to 80% below the 1990 emission level by 2050, with interim targets for 2012 and 2025, to improve energy efficiency and the reduction of energy waste, and to Be a Leader in Campus Sustainability.

1. Carbon emissions are released in the generation of electricity. HVAC systems are one of the biggest electrical consumers of a buildings infrastructure, eating up far more energy than lighting or plumbing. Therefore, it logically follows that in order to decrease the overall electrical consumption of a building would be to improve the efficiency of the HVAC systems. Since increasing efficiency of a system will decrease the amount of energy required, less electricity will be consumed, and thus, less carbon emissions will need to be released.
2. The way that this system is currently being run is outrageously wasteful. What is the point of heating air, only to cool it, to then promptly heat it again? It doesn't make sense and it is wasting the university's money. My proposal will decrease the amount of energy needed to heat or cool a specific load, thus, generating less waste.
3. Smart buildings are an integral step in furthering ourselves as a green society, and if Virginia Tech aims to be a "Leader in Campus Sustainability", they cannot ignore such simple improvements. The decision to not overheat or overcool our air seems to be a glaringly obvious sustainable choice, and if Virginia Tech wishes to accredit itself as a sustainable leader, it must recognize this importance.

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 **$8,500** based on estimates from Kim Briele. This is estimated to not exceed budget and is based on hourly labor charges for similar past work at VT. To accomplish the work, it is presumed that the Moss Arts Center Facility Manager can initiates work orders through the current HVAC controls service contract, or preferably a competitive bid process from other vendors as allowed. The estimated labor is 34 hours at $125 per hour. Only a controls technician is needed to make these changes. The Office of Energy Management can write more detailed instruction and work with the contractor to ensure changes accomplish said objectives and programming labor and costs are minimized.

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 reduce energy costs for the University, particularly Moss Arts Center. Energy usage calculations using hourly VT outdoor air data and other design and operations data/trends resulted in estimated energy costs savings in steam and chilled water of approximately **$15,000 per year**. Based on the estimated costs, this equates to a simple payback of **three and one-half months**.

Steam energy usage is reduced by approximately 680 MMBTU (million Btu) per year or roughly 740,000 lbs of steam. Electrical energy usage to produce and distribute chilled water is reduced by 100,600 kWh. Savings result primarily with the elimination or reduction in simultaneous heating and cooling as well as unnecessary mechanical cooling and heating resulting from the non-integrated supply air temperature control as well as a few maintenance tasks such as binding/leaking dampers, etc.

E. Is this funding request an Ongoing or One-Time change **(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

SUSTAINABILITY INITIATIVES BY STUDENT ORGANIZATIONS FUNDING PROPOSAL

Part IV- Requestors/Reviewers

Kevin Byrnes, Mechanical Engineering, Energy Analyst	11-21-19
Prepared By (Name of Contact for Student Organization)	Date
Lowell Jessee, Energy Engineer, VT Facilities Department of Energy Management	11-21-19
Reviewed By (Name of Appropriate University Official)	Date
Reviewed By (Name of Office of Sustainability Representative) Denny Cochrane	Date 1-21-20