STUDENT ORGANIZATION SUSTAINABILITY INITIATIVE PROPOSAL FORM

Part I- General Information:

Name of Student Organization	**Office of Sustainability Water Intern Team**
Contact/Responsible Person	**Maia Dupes**
Contact Office Held/Title	**Team Leader**
Contact Email Address	**mdupes55@vt.edu**
Contact Telephone Number	**717-433-2757**

Part II- Project Cost Information

Estimated Cost of this Proposal	$150,000	See III.C. below
Estimated Savings -	TBD, but likely to be phenomenal	See III.D. below
Net Cost of this Proposal =	TBD	

Part III- Supporting Information

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

In periods of low occupancy, especially during the summer months, water demand on campus residence halls decreases significantly. As a result, the hot water in these buildings tempers down, and occupants must run cold water for an extended period of time before hot water is available at the faucet again. In buildings such as Vawter and Lee, the only hot water recirculation that occurs is under the building. Because the hot water is only recirculated below ground, it takes a significant amount of time to push out the tempered water in the pipelines at the upper stories before hot water can reach those parts of the building. Faucets are often run continuously throughout the summer months to move water, and water is also wasted down the drain by students, who must wait for the water in their showers and sinks to heat up. This process is extremely water inefficient.

To mitigate this problem, we suggest a hot water recirculation system for residence halls, as detailed in Appendix A. Hot water recirculation is a plumbing system that utilizes a pump and a pipe system to recirculate tempered water through a return pipeline for reheating. Since hot water would be present in the system, the recirculation system would eliminate the need to continuously run faucets to push out the tempered water and release thousands of gallons of water down the drain. Our proposed changes to the residence halls plumbing system include adding a recirculation pump and piping to the current water distribution system. Check valves and balancing valves are also needed in the piping system to control water flow. A contractor may install electrical wiring, panel breakers, and motor starter switches to operate the system. An adjustable aquastat can be installed on the return line near the pump to turn the pump off once the water has reached a set temperature. A schematic of the recirculation is attached.

Our initiative will reduce the amount of cold water wasted on campus. This process can also reduce utility costs, as well as energy and sewer expenses. Hot water heating is the second largest energy end use in U.S. buildings, after space conditioning [1]. The Department of Energy estimates

that 800 to 1600 kilowatt-hours per year are used to treat and pump water to households that will be wasted as the occupant waits for the water to heat up [2]. Because the water in our proposed system is recirculated, less wastewater is produced and sent down the drain to wastewater treatment, therefore saving energy necessary to treat it.

Resources:
[1]http://login.ezproxy.lib.vt.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=edsstc&AN=edsstc.1358069&site=eds-live&scope=site
[2] https://www.nachi.org/hot-water-recirculation-systems.htm

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

- *Point 1 of the CAC states that sustainability is important to the economic stability and affordability of the university.* The hot water return systems will contribute to this by significantly reducing the amount of money spent on water during low occupancy periods. In correspondence with economic stability, the return system allows for the pursuit of environmental stewardship by the significant reduction of water waste.

- *Part III of The Virginia Tech Sustainability Plan outlines the use of the Sustainability Tracking, Assessment, and Rating System (STARS) to track campus sustainability.* The most recent STARS submission from December 19, 2017 reported that Virginia Tech has achieved only 0.85/4 points within the Water Use category (OP-22). Scoring for this category is calculated using 1) the potable water use per weighted campus user and 2) the potable water use per gross square foot/metre of floor area. The proposed hot water return system will help Virginia Tech achieve a significant reduction in potable water use and allow the University to earn more points in the OP-22 category and reach the STARS goals outlined in the Sustainability Plan.

- *Point 7 of the CACR requires that Virginia Tech will "improve the heating efficiency of campus facilities and their operations"*. The current method of hot water delivery in the buildings is antiquated and can be drastically improved to be more efficient via installation of a hot water recirculation system.
- *Point 7.3 of the Sustainability plan species that VT will improve water-use efficiency of new and existing buildings.* Installing hot water recirculation infrastructure in the residential halls will greatly reduce the need for excessive water consumption in order to obtain hot water.
- *Point 10 of the CACR says that Virginia Tech will "engage students, faculty and staff through education and involvement to reduce consumption of energy, water, and materials in academic and research buildings, dining and residence halls, and other facilities".* Our proposal will achieve both a reduction in the consumption of energy and the consumption of water.

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

We met with Todd Pignataro, William Barnett, and Mark Prescott to develop a cost estimate and gather more information about the recirculation system. Mr. Pignataro's estimate for the installation of the system was $150,000. Specifically, the estimate per 3-4 story residence hall was $8,000-10,000. Installation in Pritchard, a larger dorm, is estimated to cost $22,000-25,000. Additional costs include

verifying that the work areas are free of friable asbestos, which requires sample testing and any necessary abatement. The specific manufacturer and model of the pumps and valves are left to the contractor's discretion. Contractor quotes will be available in the future from Housing and Residence Life. Calculations are attached in Appendix A.

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.

A hot water-recirculation system will produce enormous cost savings for the University. The system has the potential to save money on energy, and is guaranteed to save money on water utilities. Town water utility rates were used to calculate savings - $6.90/1000 gallons of water and $5.80/1000 gallons of wastewater. Savings were calculated for two specific situations: on-campus residents' daily showers and laundry sinks running over breaks. Residents were assumed to live on campus 208 days out of the academic year, during fall and spring semester, not including breaks. The wait time for hot water in the showers was estimated to be 5 minutes based on anecdotal information. The laundry sinks were estimated to run continuously over Thanksgiving, Winter, and Spring Breaks. Total savings were estimated to be approximately $250,000 per year, considering laundry and showers. Calculations are displayed in Appendix B.

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

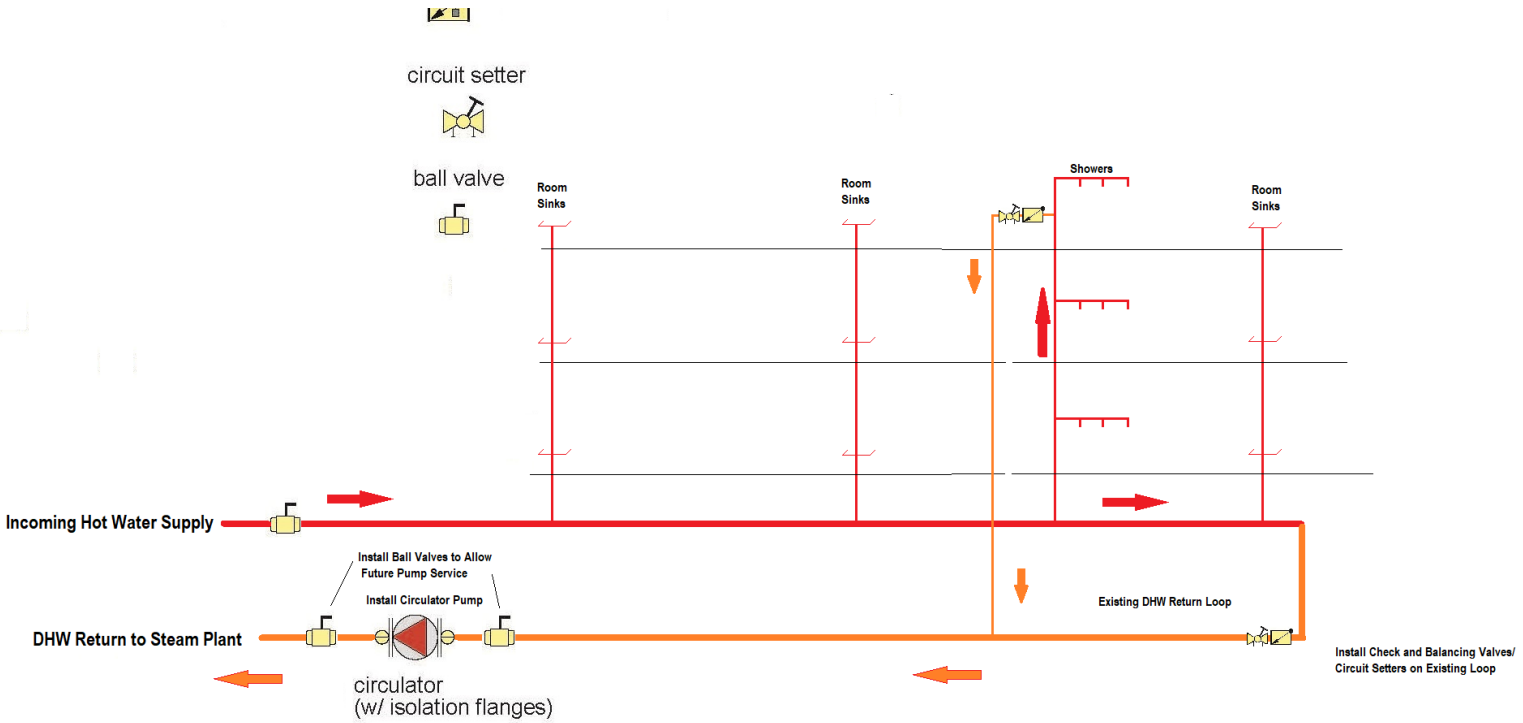
■ **One-time** ☐ **Ongoing**

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

Funding may be available through Housing and Residence Life. The re-circulation system is being considered as a future project, funded by the department.

STUDENT ORGANIZATION SUSTAINABILITY INITIATIVE PROPOSAL FORM (Continued)

Part IV- Requestors/Reviewers	
Maia Dupes Prepared By (Name of Contact for Student Organization)	11/16/2018 Date
Todd Pignataro Reviewed By (Name of Appropriate University Official)	10/24/2018 Date
Karlee Siepierski Reviewed By (Name of Office of Energy and Sustainability Representative)	11/14/2018 Date


circuit setter
ball valve
Room Sinks
Room Sinks
Showers
Room Sinks
Incoming Hot Water Supply
Install Ball Valves to Allow Future Pump Service
Install Circulator Pump
DHW Return to Steam Plant
circulator (w/ isolation flanges)
Existing DHW Return Loop
Install Check and Balancing Valves/ Circuit Setters on Existing Loop

APPENDIX A:

Residence Halls	Cost per Hall
Barringer	$8-10K
West Eggleston	$8-10K
East Campbell	$8-10K
Main Campbell	$8-10K
East Eggleston	$8-10K
Main Eggleston	$8-10K
Johnson	$8-10K
Newman	$8-10K
Pritchard	$22-25K
Vawter	$8-10K
Total Installation	$94-115K
Total Estimate	$150 K

APPENDIX B:

Days of On-Campus Residence (August 22 - Dec 13)				(January 22 - May 15)	
August	12			January	10
September	30			February	28
October	31			March	31
November	30			April	30
December	13			May	15
Breaks	-13			Breaks	-9
Total	103			Total	105
Thanksgiving, Winter, and Spring Break					
Thanksgiving	9				
Winter	38				
Spring	9				
Total	56				

Utility	Rate ($/1000 gal)	Laundry Sink Run Time (min)	Flow (gpm)	Volume (gal)	Savings Per Sink Per Year
Water	$ 6.90	80640	5	403200	$ 2,782.08
Sewer	$ 5.80	80640	5	403200	$ 2,338.56
					$ 5,120.64
assumption: 56 days of break per year					

On-Campus Students	9398			
https://vt.edu/about/facts-about-virginia-tech/factbook/student-overview.html				

Utility	Rate ($/1000 gal)	Time (min)	Flow (gpm)	Volume (gal)	Savings per Shower	Savings per Day	Savings per Year
Water	$ 6.90	5	2	10	$ 0.07	$ 648.46	$ 134,880.10
Sewer	$ 5.80	5	2	10	$ 0.06	$ 545.08	$ 113,377.47
						$ 1,193.55	$ 248,257.57
http://www.blacksburg.gov/departments/departments-a-k/financial-services/utility-service							
assumption: all on-campus undergraduate students take one shower per day							
assumption: 208 days of residence per year							

Total Savings:	$ 253,378.21