STUDENT SUSTAINABILITY COMMITTEE

Semesterly Report

Thank you for your commitment to green initiatives at the University of Illinois. One of the ongoing requirements listed in the terms of the funding agreement for your project is the submission of semesterly reports with key information about your project. In addition to this form, please provide additional financial documentation and/or progress photos if available.

Please be as accurate as possible in describing the project (including possible setbacks or challenges in meeting the initial goals of the project). Not fully meeting your project's goals will not disqualify you from making future funding requests as long as your reports are as complete and accurate as possible. If you have any questions, please contact the Student Sustainability Committee, at sustainability-committee@illinois.edu.

Project Name: Temple Hoyne Buell Hall (TBH) as an Energy Learning Laboratory

Date of Report Submission: 9/30/2020

Project Purpose:
To explore how energy use, comfort, and indoor air quality are impacted by upgrading controls in a portion of TBH. The goals are to determine the savings and benefits of upgrading the controls to modern direct digital controls (DDC); to justify converting the rest of the building and other buildings on campus that still are lagging behind; and to involve students in an applied energy education opportunities. This has included measuring room conditions through long term data logging of temperatures, energy use, and HVAC system operations before and after installing the new DDC. Previously, the system used pneumatic controls which is an old inefficient method that uses air pressure for control. DDC enables energy efficiency and other improvements through tighter control and scheduling, particularly overnight, during weekends/holidays, and mild weather when the full capacity is not needed.

Detailed Accounting of Expenditures to Date:
Project expenses are summarized below. For a detailed account, please refer to Appendix A.

TOTAL EXPENSES:	**$ 24,271.37**
TOTAL AWARD:	$ 38,000.00
REMAINING AWARD:	$ 13,728.63

Project Progress to Date:
The project focuses on a pilot implementation of a modern digital control system, in 3 large rooms of the building, TBH rooms 315, 319, and 327. The rooms were selected with consultation from departmental and F&S personnel.

During summer/fall 2019 we installed sensors and collected a complete set of HVAC baseline data that represents outdoor seasonal conditions and academic year operating conditions. We continued data collection and analysis through January/February 2020. From the analysis, we found that overall in the original baseline condition with the old pneumatic control system, there was significant energy waste due to excessive outdoor air ventilation, excessive HVAC air flow rates, long system operating hours compared to actual occupancy, and inconsistent temperature control. We also noticed cases of energy waste where baseboard heaters were trying to heat a room while at the same time, the ventilation in the same room was trying to cool the room. This was because the radiators were controlled by one thermostat, the ventilation air was controlled by a different thermostat, and each thermostat was set to a different temperature.

In February 2020, F&S began the work to remove the old controls and associated system hardware, install the new equipment, and install a new building automation system (a digital interface for system control and monitoring). Originally the installation was planned to start sooner, but it was delayed due to F&S availability and need to complete other projects. The installation substantially completed over the spring/summer of 2020. Figure 1 shows two of the old thermostats from Room 327, Figure 2 shows the new thermostat, and Figure 3 shows the new digital interface for the building automation system.

Figure 1: TBH Room 327, old pneumatic thermostat

Figure 2: TBH Room 327, new digital thermostat and sensors.

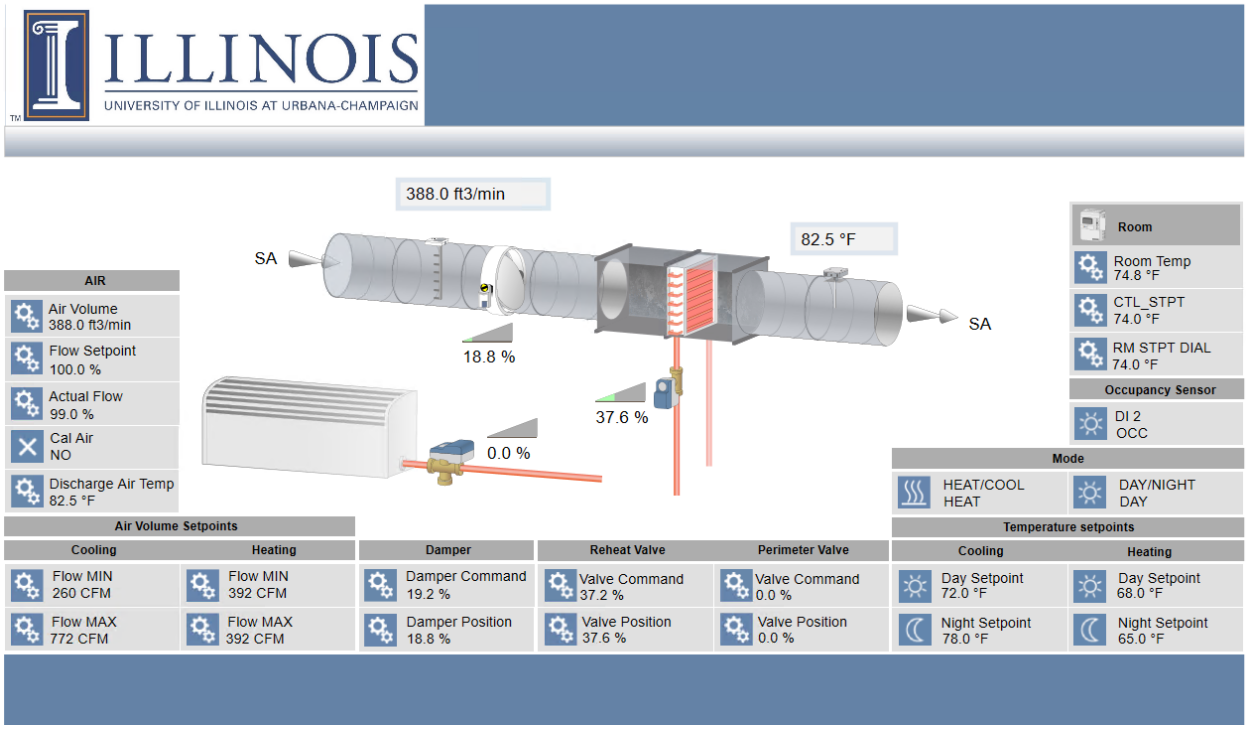

Figure 3: Example screenshot of detailed room-level information on the new building automation system digital interface.

Due to facility access restrictions and other cautions related to COVID-19 pandemic response, SEDAC was unable to enter the building until late July and lost data from the summer post installation monitoring period. As of mid-August our sensors and loggers have been collecting a

full set of data in each of the 3 rooms so that we can compare system operation before and after the controls upgrade. Our preliminary review of the data shows that HVAC energy use and total building energy use have decreased, and that comfort control has improved. We would like to extend the data collection period for comparison across both warm and cold weather.

Student Involvement and Outreach to Date:
Three graduate students have been involved in installing and maintaining the data collection equipment and performing project data analysis. Our graduate students have also discussed the project with other students and informally surveyed students in the rooms to ask about their perceptions of energy use and comfort in the rooms, before and after. This project has been featured as a classroom discussion in two classes with 15-20 students each (Spring 2019 LA 390/590 The Landscape of Energy Efficiency and Spring 2020 LA 466/UP 466 Energy & The Built Environment).

Marketing and Promotion Efforts to Date:
Project promotion to date has been through direct student interactions and in classes as described above.

Additional Comments:
This project has been a great first step for major improvements in energy and comfort in the building, as well as a positive example of a collaborative effort between SEDAC, students, administrative staff of the College of Fine & Applied Arts, and Facilities and Services. We hope to extend this project to regain time lost due to COVID-19 facility access restrictions.

APPENDIX A: DETAILED EXPENSE REPORT

TBH Energy Retrofit					
1-303692-569000-569148					
Todd Rusk					
Expense Period:					
TOTAL EXPENSES:		**$ 24,271.37**			
TOTAL AWARD:		$ 38,000.00			
REMAINING AWARD:		$ 13,728.63			
Vendor	**Document #**	**Date**	**Amount**	**Pending**	**Description**
Monoprice, Inc.	PCA32854	12/5/2018	$ 22.92		Cables: 5, 10', 3 15', 3, 25' and 1 30'
Amazon mktp	PCA3290L	12/6/2018	$ 9.78		USB Cable 25' black - 1
Amazon mktp	PCA3290N	12/7/2018	$ 29.34		USB Cable 25' black - 3
Facilities Operation/Main Services	AM004C50	10/31/2018	$ 424.66		
Facilities Operation/Main Services	AM004CFC	11/30/2018	$ 77.21		
		TOTAL:	**$ 563.91**		
Wages + Fringe					
Name	Document #	**BW/MN**	**Amount**		
Rusk, Todd		MN9 2019	$ 790.60		
Rusk, Todd		MN9 2019	$ 790.60		
Rusk, Todd		MN12 2019	$ 1,581.20		
Rusk, Todd		MN1 2020	$ 5,502.61		
Rusk, Todd		MN2 2020	$ 425.48		
Day		BW18 2019	$ 1,338.75		
Day & Santarelli		BW19 2019	$ 2,650.84		
Day & Santarelli		BW20 2019	$ 2,788.66		
Day & Santarelli		BW21 2019	$ 2,526.02		
Rusk, Todd		MN7 2020	$ 316.24		
Siegel, Ryan		MN7 2020	$ 539.58		
Rusk, Todd		MN8 2020	$ 632.48		
Siegel, Ryan		MN8 2020	$ 1,079.17		
Rusk, Todd		MN9 2020	$ 632.48		
Siegel, Ryan		MN9 2020	$ 1,079.17		
Fringe Benefits			$ 1,033.58		
		TOTAL:	**$ 23,707.46**		