Keycard Based Energy Saving Pilot Program

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Summary

The goal of this project is to implement a key card activated energy conservation system at the Crosby Suites that promotes energy use awareness and decreases instances of wasted energy. These card switches will be activated by Rutgers University student IDs which provide students with the ability to manage their own energy usage. Considering how essential RUIDs are to everyday life, when students leave their rooms, they'll be required to remove their IDs from the switches, turning off the energy flow to the room; this will decrease the amount of energy used when no one is present. The principle steps in implementing this energy saving plan are to first contact Entergize, the primary manufacturer of key card switches, and establish an agreement for purchasing the switches. In conjunction with Rutgers maintenance departments, the switches will be installed with limited effect to the current living conditions. The model chosen to represent a successful proposal is the Westin Convention Center Pittsburgh. Factoring in each unit and self-installation, the total cost of the project would be $10,800 with an annual savings of $8,486.65 leading to a payback period of 11 months.

Opportunity

Electricity is a necessity for Rutgers University dormitories; however with the continuous disregard by the residential students in turning off their electronic equipment, there is an opportunity to reduce the wasted energy. Students are constantly entering and exiting the dormitories and they forget to perform simple tasks such as turning off light switches, computers, televisions, and various other electronic devices. The proposed solution is to use the Rutgers ID as a keycard that controls the use of electricity to certain rooms in the suites. Lights, televisions, and computers would only be active when an RU ID is placed in the key card slot. Because Rutgers student rely their ID card for many situations outside of the dorm, it is convenient to use the RU ID as the foundation. This proposal would be implemented in the Crosby Suites on Busch Campus as a pilot program to more completely evaluate the benefits of this program.

By effectively introducing an energy saving structure, Rutgers will be able to cut energy expenditures and introduce new opportunities for further energy management strategies throughout each campus. This program also benefits the University in the promotion of program an eco-conscious environment.

The key card system will function as a switch. One switch will be installed per dormitory within the Crosby suites. The switch will be activated when a Rutgers University Identification card (RUID) is inserted and electricity will be supplied to the room. When students exit the dormitories, they will remove their RUID from the key card switch, thus deactivating the switch and cutting power from the room. In addition to this, the switches can be programmed to have preset settings for the air conditioning and heating systems. When the room is vacated, the presets will either raise or lower the room temperature depending on the time of year and to

optimize savings. The RUID was selected as the functional part of this project because each university student already has one and uses it multiple times throughout the day. For example, a student needs their RUID to swipe into the Crosby suites, which means they cannot leave the cards in the slots throughout the day.

Research

For the purpose of this project, all energy based management strategies will be installed at the Crosby Suites on Busch campus. All of the data used for the calculations is taken from the 2008 energy usage acquired from Rutgers Facilities, as shown in Table 1 and Figure 1 in the Appendix. The average monthly output of energy in the Crosby Suites was 21,800 kWh and the daily usage was around 716 kWh[1]. Assuming a monthly a cost of $0.13/kWh, the monthly expense for energy output is $2,834 per month. This building contains four floors comprising of a total of 30 suites[2]. In order to compute a realistic estimate of energy usage, the following assumptions were taken into account per suite: 8 desk lamps, 3 televisions, 3 overhead lights, and 6 laptops. The microfridge and heating/cooling units would return to a predetermined output when the room was unoccupied. For example, during breaks from school and during seasonal changes, the presets would vary to minimize the energy consumption. The suite would have a key card unit in each room and have each of the 9 outlets replaced with the radio frequency controlled outlets. These 9 replaced outlets do not include the 3 outlets in each suite dedicated to the microfridge. When first walking in, there would be a normal light switch to turn on and off the light above the sinks. This is due to the fact that a key card needs to be placed in each room and can't be both at the front door and the room at the same time. The bathroom will also be on a normal switch and not be controlled by individual occupied rooms. Any time a key card was

inserted into an individual room, the communal lounge would be switched to an occupied status. Using the stated assumptions, the energy savings data for each day, month, and academic year (8 months) is calculated and displayed in the Appendix. The total saving for an academic year at Crosby Suites would be on the order of $8486.65.

Model

The Starwood hotel chain has had recent success installing a keycard system in the Westin Convention Center Pittsburgh with the focus on maximizing energy conservation when guests are not present in their rooms. In 2004, Starwood invested $120,000 to retrofit the 616-room hotel and recovered this investment in only 11 months[4]. For this project, the Westin hotel installed a wireless radio frequency (RF) keycard system produced by Entergize. This particular system uses an RF signal to trigger the outlets installed with the Wireless Wall Electrical Outlet. Once the card is inserted, the outlets move into an occupied status, thereby allowing the use of that outlet. Each keycard activated switch and subsequent electrical outlets simply replace the current unit with only basic rewiring necessary. This is an important concept in terms of installation time and costs. A schematic of the wall unit and the outlet unit are shown in Figure 2 and Figure 3 in the Appendix. The total cost for installation relies on the unit cost for the keycard, electrical outlet and wall switch, which is calculated in the Appendix.

Plan

The plan is to establish a key card based energy management system in the Crosby Suites on Busch campus at Rutgers University to enhance awareness and reduce wasted energy usage.

Phase I – 2 weeks

The planning and approval phase will be the most time consuming. In this stage, Rutgers facilities approval will be required to retrofit the existing dorm in addition to scheduling Rutgers facilities maintenance to install the devices. The 90 key card units and 270 outlet units for each of the 30 suites will be purchased from Entergize. Any other electrical supplies needed for simply replacement of the outlet will be secured and purchased if necessary.

Phase II – 1 week

The installation will finished in one week's time because of the simple outlet replacement involved in project. Each suite will have a keycards unit in each of the three rooms and 12 outlets replaced. Entergize indicates the typical room is completed in a half hour. There is no need to take out any contents of the room because the retrofit only deals with the electrical outlets and light switches.

The immediate benefits of this project should be seen after one month following the installation. To determine the success of this project the energy consumption in the month prior to and following installation will be compared. After a period of one semester, these values will be compared to the Suites' monthly output from the previous semester. It is important to determine how effective the key card system is over variable levels of demand. If the pilot program has been deemed a success, future retrofitting can be accomplished at lower costs by taking advantage New Jersey SmartStart Buildings Incentive worth up to $500,000.

References

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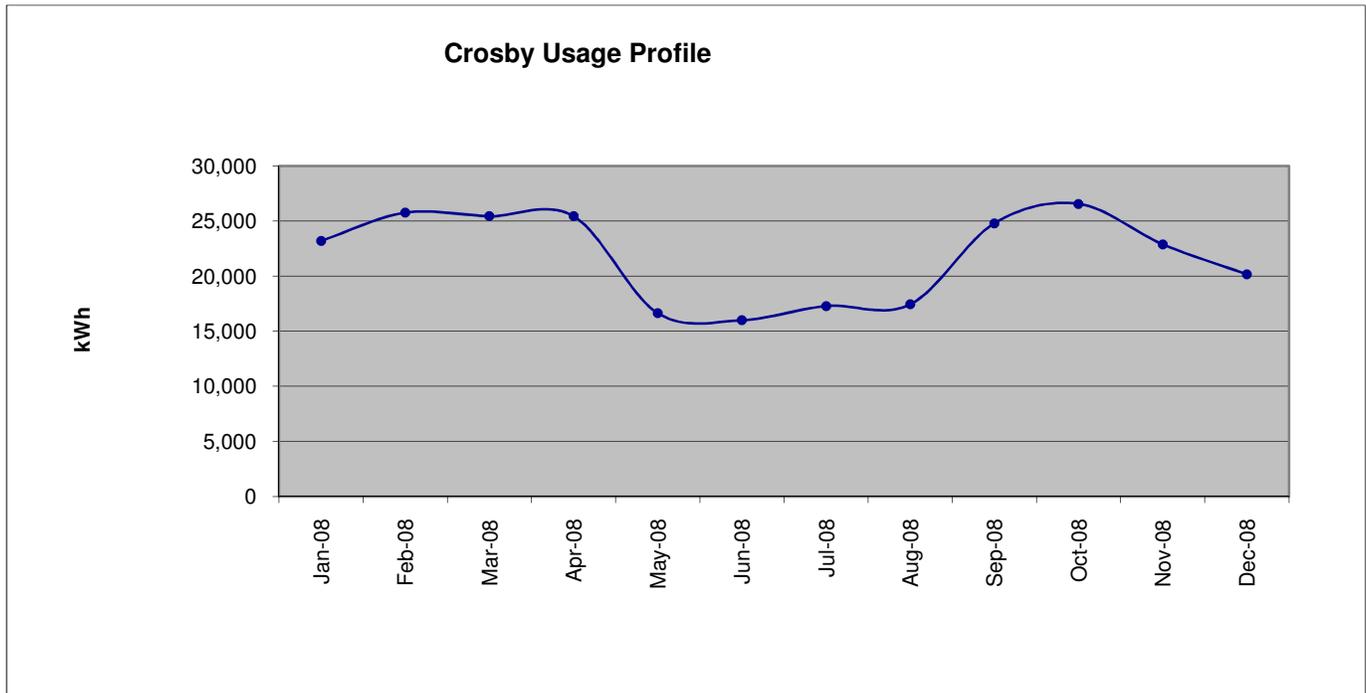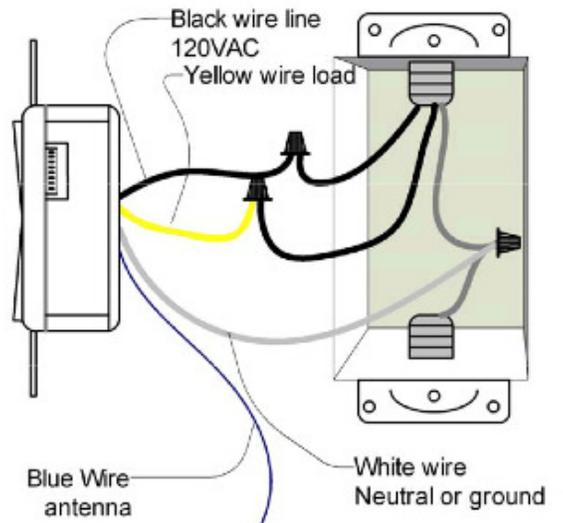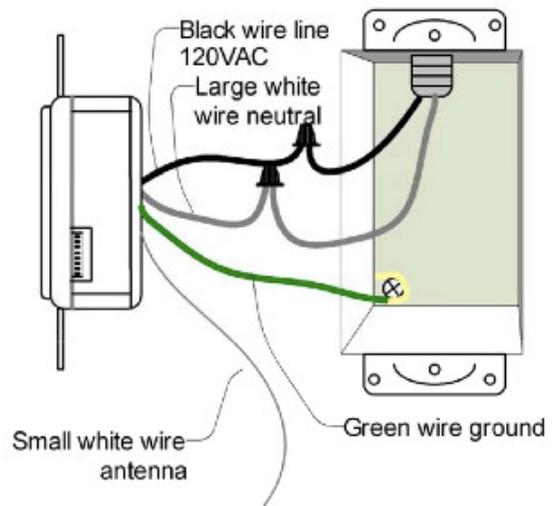   <http://www.entergize.com/?site_id=922&page_id=17889&id_sub=17889>.

Appendix

Figure 1. Energy usage in Crosby Suites throughout the year in 2008.

Table 1. Energy usage of Crosby Suites in 2008			
	# of days	kWh	kWh/day
Jan-08	31	23,200	748
Feb-08	29	25,760	888
Mar-08	31	25,440	821
Apr-08	30	25,440	848
May-08	31	16,640	537
Jun-08	30	16,000	533
Jul-08	31	17,280	557
Aug-08	31	17,440	563
Sep-08	30	24,800	827
Oct-08	31	26,560	857
Nov-08	30	22,880	763
Dec-08	31	20,160	650

KEY CARD MASTER ACTIVATION SWITCH[5]

Black wire line 120VAC
Yellow wire load

Blue Wire antenna

White wire Neutral or ground

WIRELESS WALL ELECTRICAL OUTLET[5]

Black wire line 120VAC
Large white wire neutral

Small white wire antenna

Green wire ground

WIRELESS WALL ELECTRICAL SWITCH[5]

Black wire line 120VAC
Yellow wire load

Blue Wire antenna

White wire Neutral or ground
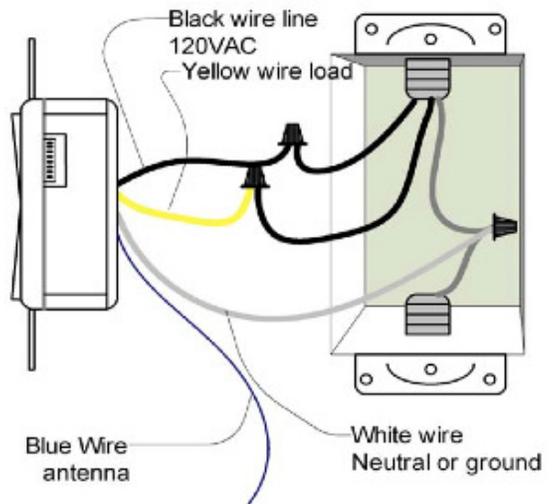
Energy Savings Calculations

Appliances (Dorm)	Number of Appliances in Single Suite	Hours of Wasted Energy	Total Wasted Hours	Wattages of each appliance per hour (Watts*hr)	Total Watts Wasted in a single day by each appliance (Watts)
Clock Radio	3	3	9	10	90
Laptop	3	8	24	50	1200
19" TV	3	3	9	85	765
Light Bulb	8	4	32	60	1920
Long Flourescent Bulbs	4	3	12	40	480
Air Conditioning & Heating	1	6	6	750	4500

Total Wasted (Watts/Day)	8955

Energy Savings Evaluation

Total Amount Saved in a Week (per Suite)	Total Amount Saved in 6 Month (per Suite)	Total Amount Saved in an Academic Year (Per Suite)
$8.15	$211.88	$282.89

Total Energy Savings in Academic Year per Building	$8486.65

<u>*Cost Evaluations*</u>

Suites	*Key Card Switches (per Suite)*	*Outlets (per Suite)*	*Total Number of Key Card Switches (per Building)*	*Total Number of Outlet Units (per Building)*	*Cost of a Key Card Switch (Dollars)*	*Cost of Outlet Units (Dollars)*
30	3	9	90	270	45	25

Total Cost of Key Card Switches (Dollars)	*Total Cost of Outlet Units (Dollars)*	*Total Hardware Cost for Building (Dollars)*
4050	6750	**10,800**

<u>*Returns on Investment Evaluations*</u>

Energy Savings for the Building per day (Dollars/day)	*Total Hardware Cost for Building (Dollars)*	*Number of Days required for Return on Investment*	*Number of Months for Return on Investments*
34.9245	10800	309.24	**10.31**

ROI: With energy savings of $34.93 per day for the entire building, it will take **11 months** for a complete return on investment.

<u>*Assumptions and Relevant Numerical Values*</u>

The number of suites per building was approximated at 30.

An academic year is set at 8 months or of the approximated value of 243 days.

Calculations done under the assumption that Rutgers maintenance department would exercise the option of installing the units instead of contracting an outside electrician for services.