

The Energy Contest Cover Page

Rutgers New Brunswick Undergraduate Students

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Proposal Title: Submetering Rutgers Housing and Nudging Positive Behavior

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Summary of the proposal: A coalition of student and faculty members will be formed to bring awareness to energy reduction methods. Competitions with rewards between residence halls, apartments, and campuses can bring additional motivation for energy reduction to people who do not currently pay for electricity. This requires data that is currently unknown but can be solved through an installation of more extensive submetering of buildings and analysis software and will provide a fast return on investment through cost savings.

Introduction

Rutgers University and their students at large need to make significant changes in order to reduce student energy consumption on campus as well as promote awareness about smarter, eco-friendlier practices. This program “nudges” students to participate, where mindfulness is not forced but encouraged, using honey instead of vinegar to elicit change. “Nudges attempt to subtly change the environment in which people make decisions to help them make better choices — better for themselves and for society” (Ferraro).

Students living on-campus need to understand that they also consume electricity, despite not receiving a monthly bill. Currently, their consumption is externalized, where they do not account for the environmental impact of their decisions because they are not personally affected. Displaying the on-campus students’ energy consumption online will help bring an awareness to the impacts on the planet and that they could individually make a difference. Consumption performance will be ranked and tips showed online for lowering their consumption to give strong ideas on improving.

Program Plan for Rutgers University

Similar programs have been successfully accomplished in other schools. The Alliance to Save Energy – a coalition of industrial, technological, and energy corporations - worked with Howard University for the “goal of reducing campus housing energy use through education and behavior change” by metering their residence halls and made a very reproducible plan that could be used at Rutgers University.

Keeping in mind that more environmentally conscious students already live on Cook Campus, the Newell and Starkey Apartments as well as Voorhees and Perry Hall will be chosen as a trial for a larger scale operation. Core teams of students will be set up, including resident assistants, sustainability interns, campus organization members, and those interested in

sustainability. A faculty team will be comprised of members of the sustainability council, facilities, residence life, and the university energy manager.

From September to October, training sessions and resources will be given to the teams including topics of sustainability, energy efficiency, and best practices for dorm competitions. Preliminary surveys will be performed to evaluate levels of student energy awareness before starting the competition. Examples of energy savings are turning off lights in rooms when not in use, efficient lightbulbs, taking shorter showers, unplugging appliances, and using washers and dryers in off-peak hours. Marketing materials will be distributed through educational fliers, weekly emails, and competitions posted on campus websites. Articles will also be written in the campus newsletter and announcements sent to faculty, campus departments and student organizations.

Beginning in November, the school will launch the first annual residence hall energy competition. Students will continue to outreach and campaign to motivate dorm residents to save energy. The energy manager and other campus staff will obtain and analyze metered data for participating residence halls and show residents their progress. Periodically through the month, an activity will be arranged to remind students of ways to reduce their energy use and keep them interested in the competition.

In December, the competition will finish and a winning hall, dorm, apartment, and campus will be determined. The winners could receive a gift card or reduced housing costs. Media will be invited to participate and report on the event, bringing in extra attention to the cause. Finally, a post-competition survey will be conducted for the residents to measure whether behavior was changed during the completion and whether the behavior changes would continue

on an extended basis after the competition is over. This process will be repeated the following semester based on results.

Savings

At Howard University, much of this plan has already succeeded. The students at Howard University reduced their overall energy use by 14% in the participating dorms. Between the three campuses in the competition, massive savings were made. “By reducing energy use in their residence halls through education and outreach to fellow students, they saved over 168,000 kWh of electricity in just four weeks – an average reduction of 7% compared to a year earlier” (Mann). As reported by the University of Notre Dame, they too had their own energy competition in 2012 where more than half of the dorms had over a 20% reduction. Overall, the 29 residence halls saved 43,547 kilowatt hours and prevented 60,965 pounds of CO2 emissions (Novick).

With data provided by Milton Potosky, the senior energy analyst for Rutgers University, it shows that the four residence facilities during the period of January 2014 to December 2015 consumed roughly 11 million kWh for a total cost of roughly \$1.3 million. It is anticipated that during the first challenge period, there would be a decrease between 5-10% for energy and cost. Subsequent periods could result in greater than 20% reductions which would save hundreds of thousands of dollars in those 4 buildings alone with significantly greater savings across the rest of Rutgers University (See image below).

Submetering

Extensive submetering will have to be installed in individual apartments and dorm halls, but the savings will pay dividends in a short amount of time. In an Energy Star study on behalf of the U.S. Environmental Protection Agency, it is estimated that colleges and universities spend

close to \$2 billion each year on energy costs. Submetering measures the energy use of buildings from electricity, natural gas, or steam. It can be used to compare energy use between individual buildings, isolate outliers that would be needed for repair or replacement, and to guide energy efficiency projects by tracking progress over time and recognizing achievements in individual buildings (Kiechel 6-9).

Installation takes about three hours, requires no major interior changes to buildings, and can be part of standard maintenance work. The cost for a submeter installation on a college campus for six submeters in three separate locations is a total of \$40,960, or roughly \$7,000 per submeter, including labor, software, and additional equipment. In order to minimize costs, monthly submetering services exist where the company owns, operates, and maintains the submeters for a flat monthly fee of \$150-\$400 per month (Kiechel 23). Another savings program where a university wanted to reduce overall expenses used greater awareness techniques, retrofit projects, and utility renegotiations. Over a ten-year period, the school estimated that they saved about \$1 million each year (Energy Star).

Conclusion

Behavioral modification of the individuals at Rutgers University is key. Despite the great data provided by submetering, it is important to keep in mind that submetering alone will not save energy or money. "Submetering by itself does not reduce energy use, greenhouse gases, or costs... However, thoughtfully designed submetering programs generate data that can guide management strategies, operational and investment decisions, and tenant interaction that ultimately results in significant energy-reduction benefits" (GSA). This continual upkeep will be achieved by this proposed plan in an efficient and cost effective manner.

Ferraro, Paul “The Road to Sustainability: More Nudging, Less Shoving” Science for Nature and People Partnership, Available online at <http://snappartnership.net/magazine/paul-ferraro-sustainability-nudges-conservation>

Howard University “Residence Hall Energy Competitions” Alliance to Save Energy, Available online at <https://www.howard.edu/residencelife/green/Howard%20University%20-%20Dorm%20E%20Competition.pdf>

Novick, Rachel “Dorms Kill Watts By The Millions” University of Notre Dame, October 2012, Available online at <http://green.nd.edu/news/34024-kill-a-watt-results/>

Mann, Rachel “Howard University Wins Big Energy In DC Campus Competition” Howard University New Room, May 2013, Available online at <http://www.howard.edu/newsroom/releases/2012/20120308HowardUniversityWinsBigEnergy.html>

Kichel, Victoria “Sub-Metering for Higher Education Campuses with ENERGY STAR” AASHE 2011 National Conference, Available online at <http://www.aashe.org/files/aashe2011-materials/p515311.pdf>

“Submetering Business Case: How to calculate cost-effective solutions in the building context” General Services Administration, Available online at

[http://www.gsa.gov/portal/mediaId/181031/fileName/Submetering Business Case How to calculate cost-effective solutions in the building context](http://www.gsa.gov/portal/mediaId/181031/fileName/Submetering_Business_Case_How_to_calculate_cost-effective_solutions_in_the_building_context)

Rutgers University Cook Residences Energy Consumption and Costs						
	Monthly Unit Cost	Newell Apts	Voorhees Apts	Starkey Apts	Perry Apts	
Date	\$/kWh	kWh	kWh	kWh	kWh	
Jan-2014	0.2069	288,954	25,778	141,614	23,294	
Feb-2014	0.1508	269,729	43,852	132,191	39,627	
Mar-2014	0.152	282,840	13,300	138,616	12,019	
Apr-2014	0.1220	270,385	18,329	132,511	16,564	
May-2014	0.1179	254,119	25,001	124,539	22,596	
Jun-2014	0.1111	262,568	28,274	128,680	25,559	
Jul-2014	0.1136	291,609	33,128	142,912	29,947	
Aug-2014	0.1128	292,861	30,604	143,526	27,665	
Sep-2014	0.1080	305,010	36,101	149,480	32,631	
Oct-2014	0.1014	299,971	31,318	147,010	28,306	
Nov-2014	0.1123	255,369	24,471	125,152	22,113	
Dec-2014	0.1031	232,852	23,525	114,118	21,259	
Jan-2015	0.1356	249,558	25,072	122,305	22,657	
Feb-2015	0.1658	277,758	22,530	136,124	20,360	
Mar-2015	0.1423	266,772	22,964	130,741	20,752	
Apr-2015	0.1066	144,455	25,281	70,796	22,847	
May-2015	0.0931	585,318	24,791	286,849	22,409	
Jun-2015	0.1050	101,249	27,600	49,622	24,951	
Jul-2015	0.1050	246,767	30,966	120,936	27,993	
Aug-2015	0.1000	299,498	33,085	146,777	29,910	
Sep-2015	0.1000	291,712	29,593	142,961	26,749	
Oct-2015	0.0864	277,426	32,824	135,962	29,668	
Nov-2015	0.0959	246,931	24,902	121,018	22,504	
Dec-2015	0.0825	207,970	22,334	101,923	20,183	