

AN EXAMINATION OF THE VALUE, FEASIBILITY AND LOGISTICS OF A NATIONAL ELECTRICITY AND WATER USE REDUCTION COMPETITION AMONG RESIDENTIAL STUDENT HOUSES

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ABSTRACT: Prior research has shown that resource reduction competitions in residential housing provide an important means of engaging, educating, motivating and empowering students to conserve environmental resources. Here we explore the value, feasibility and logistics of an annually recurring, nation-wide water and energy use reduction competition within and among residential housing units (residence halls, dormitories and houses) on college and university campuses. In addition to positively affecting attitude and consumptive behavior, the competition could potentially serve as a mechanism for building community within and across campuses around issues of resource conservation and personal and group responsibility. The competition would also provide opportunities for students on multiple campuses to develop leadership and community organizing skills that can then be applied to local, regional and national political processes.

The proposed endeavor would necessarily entail a close collaboration among: national and local environmental organizations; a technology provider; and student activists, staff and faculty at individual institutions. Environmental and academic organizations would take principle responsibility for organizing and promoting the event, developing educational materials and assisting student activists in organizing and participating in the competition. With respect to the technology, the company Lucid Design Group, the developers of Building Dashboard®, has already implemented real-time feedback display systems for over 30 schools that allows for internal competitions. As collaborators in organizing the national competition, Lucid would develop new software to allow residence halls at these institutions to compete among as well as within institutions. A key prerequisite for the national competition is that Lucid would develop a freely available web-based software that will allow students or facilities personnel at any institution to upload and view manually collected utility data on electricity and water consumption in residence halls, and to participate in competitions within their own institution and among groups at other institutions. We propose a trial regional competition (for example among schools in the State of Ohio) taking place for 2-4 weeks in spring of '10 followed by a full blown national competition taking place during the '10-'11 academic year.

Keywords: electricity, energy, water, conservation, competition

Background

North Americans residents of the United States spend more than 90 percent of their lives in buildings (Evans and McCoy, 1998). Residential and commercial buildings account for two-thirds of the electricity used in the US, 36 percent of US greenhouse gasses, 9 percent of world greenhouse emissions, and 12 percent of US fresh water consumption (Wilson and Yost, 2001). On residential college and university campuses, activities that take place in buildings typically account for the vast majority of energy use, water use and total greenhouse gas emissions associated with the institutions ecological footprint (e.g. >90% for all three at Oberlin College, Heede and Swisher 2009). While most schools recognize the value of upgrading infrastructure as a mechanism for increasing resource use efficiency, changing the behavior of building occupants is increasingly recognized as a critical component of conservation, one that offers valuable educational opportunities in addition to the environmental and economic benefits. An emphasis on motivating behavioral change recognizes that undergraduate education is a seminal and transformative period during which future decision makers gain

knowledge, skills and experiences that inform the personal, political and professional choices that they make throughout the rest of their lives. The premise of the proposed national competition is that residential housing on college and university campuses can function not just as places in which learning occurs but as fundamental components of a curriculum that teaches environmental stewardship.

A number of factors can work in combination to engage, educate, motivate and empower students to conserve resources in residential housing. Research indicates that people are highly motivated to engage in behavior that is in accord with norms and goals associated with peer groups (Cialdini 1993). Most of us would like to perform at least as well as our peers and would like to exhibit behavior that is deemed socially desirable by members of groups with which we identify. Structured competitions provide an excellent tool for leveraging positive environmental behavior. Socially and environmentally contextualized feedback on resource use, competition and education can be combined to maximize impact. For example up to 56% reductions in electricity use have been documented in residential houses in response to resource reduction competitions that include education and real-time feedback (Petersen et al. 2007). It seems reasonable to conclude that competitions among institutions that students already consider peers or rivals may be particularly effective (e.g. competitions among: schools that share athletic conferences, small liberal arts colleges, ivy league schools, state institutions, etc.).

Prior resource reduction competitions have varied in a number of important respects including: resources considered (e.g. material waste, water, electricity and total energy); type of buildings included (e.g. dormitories vs. academic buildings), degree of aggregation and scale (e.g. competitions among individual buildings on one campus vs. competitions among campuses that include all buildings); and the way in which performance is quantified and provided as feedback to participants (e.g. automated real-time feedback on websites or kiosks vs. manually collected data posted on bulletin boards at the close of a competition). An excellent resource exists regarding best practices for organizing campus-wide resource reduction competitions. In 2008 Colin Hagan, in association with the Association for the Advancement of Sustainability in Higher Education (AASHE), completed a guide, "Organizing residence hall conservation competitions, a guide for students." The guide provides a brief summary of the variety of within-campus resource reduction competitions that have flourished since the early 1990s and offers useful suggestions to students regarding how to organize successful competition events.

Case Studies of National Competitions:

In addition to within-campus competitions, there have been a number of efforts to host competitions among different campuses. Here we report on three of the most relevant efforts and the lessons that they provide.

1) "RecycleMania" may provide the best existing model for a recurring national resource use reduction competition (www.recyclemaniacs.org). RecycleMania is an annual 10-week long contest in which schools compete to achieve the largest amount of recyclables per capita, the largest amount of total recyclables and the least amount of trash per capita. First initiated in 2001 as a competition between Ohio University and Miami University of Ohio, participation has grown exponentially with 297 schools registered to compete in 2009. Coordinators on each campus fill in an online form each week and updates are then posted online so that schools can compare their performance. The RecycleMania website provides a variety of tools to assist student organizers. Organizers report that "80% of participating schools experienced a noticeable increase in recycling collection during the competition". Staff administration for RecycleMania is provided by the National Recycling Coalition, a non-profit advocacy group. Coca Cola provides financial and logistical support.

2) In the last two years there have been noteworthy efforts to organize energy and greenhouse gas emission reduction competitions between campuses. For example, in 2007, 16 Minnesota colleges and universities organized and participated in "Campus Energy Wars". In 2008 several of the organizers of this event subsequently initiated an effort to organize a "National Campus Energy Competition" (www.climatechallenge.org/ncec). Schools competed to achieve the greatest percent reduction in total campus energy use during the month of February (relative to baseline data from February of 2006). A detailed user manual and a web site were developed describing the mechanism for participating. To our knowledge, no similar competition has been organized in subsequent years. Communication with the organizers suggests several reasons why this competition may not have been more successful, and provide useful lessons for future efforts. First, the focus was on total energy reduction and the bulk of the energy load on most campuses is not directly controlled by short-term behavior or advocacy efforts of students. Second, the competition involved an intensive reporting structure that required schools to supply data from several prior years and included variables that are not

readily available or comparable such as total campus BTU. Third, there was no centralized feedback or easy way of assessing the relative performance of different campuses during the competition; performance data were submitted to the national organizers and winners were then announced some time later. Finally, although sponsored by a coalition of environmental groups (www.climatechallenge.org), the effort was entirely managed by student volunteers and had no professional staffing or support, either for outreach, data acquisition, processing or reporting. Publicity efforts were relatively modest, and environmental groups on many (perhaps most) campuses may have been unaware that the event was taking place.

3) “American’s Greenest Campus” (americasgreenestcampus.com) is an ongoing national campus greenhouse gas reduction competition initiated in spring of 2009. Their initial competition will end in October, 2009. The project serves as a counterpoint to the National Campus Energy Competition in that campuses participating in America’s Greenest Campus compete based on self-reporting commitments of individual students on each campus to change their behavior rather than on direct measures of campus resource consumption. Individual students register on the web site and are asked to choose among a series of commitments to reducing their carbon footprint. A campus’ standing in the competition is based on the number of students participating and on the aggregate (and perhaps per capita) carbon reductions.

More broadly “Climate Culture”, the commercial organization sponsoring American’s Greenest Campus, seeks to create an online community focused on encouraging greenhouse gas reductions through personal commitments to change behavior. The organization has developed a highly sophisticated web interface that allow individuals to calculate their carbon footprint, express savings in different units, and to explore the GHG reduction implications of different personal choices through role playing. The site automatically integrates with Facebook. The group is offering a prize of \$20,000 for the winning campus and has enlisted “Obama Girl” to help promote the contest. Climate Culture was founded by a group of recent graduates from Yale, Harvard and New York universities. The U.S. DOE and at least one private company are backing the effort of the group. It is still too early to assess the success of the organization’s efforts to stimulate change in attitude and behavior or cumulative resource use reduction.

The three examples of national competitions described above highlight a number of opportunities and challenges for such efforts. The success that RecycleMania has enjoyed indicates that recurring national competitions that engage and empower students in campus organizing and genuine data collection are feasible. The national competition that we envision would build on, contrast with and complement RecycleMania. Whereas RecycleMania focuses on solid waste and recyclables, the competition we envision would focus on the use of water and electricity in residential housing. Opportunities for collaboration between these efforts should be explored. Efforts need to be made to construct the new competition in a way that minimizes the potential for “competition burnout”. For example, it may (or may not) be advantageous to conduct the water and energy competition at the same time, immediately before or immediately after RecycleMania.

The initial work of America’s Greenest Campus suggests that a national competition can be constructed in a way that takes full advantage of web and social networking technology. The experience of the National Campus Energy Competition suggests that total campus emissions may be challenging to use as a competition metric and that a long-term commitment from one or more national organizations, with dedicated staffing, may be necessary in order to create a successful recurring competition.

We believe that the time is ripe for organizing a national campus competition focused on electricity and water use reductions in residential housing. An exclusive focus on residential housing makes sense for a number of reasons. First, such a focus is likely to achieve the goals of engaging, educating, motivating and empowering students in conservation; the buildings in which students live are the locations in which they exert the greatest control over resource flows. Although heating, ventilation and air conditioning (HVAC) are generally very important contributors to total campus greenhouse emissions there are several reasons why electricity and water are more desirable targets. Students generally have little direct control over HVAC, consumption in individual dorms is often difficult or impossible to measure, and the magnitude and timing of energy used for HVAC varies considerably over geographic region.

Based on the examples above, we believe that execution of a successful national dorm competition is contingent on two developments. First a sophisticated web portal must be implemented that allows students and/or facilities personnel at any institution to easily upload manually collected data and to display and track changes in this data in a fashion that takes full advantage of web 2.0 technology such as social networking. Second, an organization or group of organizations with the capacity to promote the contest nationwide needs to

commit to the necessary effort. Lucid Design Group was founded with the goal of using real-time feedback to engage, educate and motivate and empower building occupants to reduce energy use. With installations at over 30 campuses, Lucid is already a leader in developing real-time monitoring and display systems and competitions for campuses and is enthusiastic about developing the freely available software interface. National and regional environmental organizations and perhaps business sponsors, together with on-campus organizers are necessary to support this development and more importantly to collaborate in orchestrating and promoting a national competition.

Approach to Implementation:

There are a range of interesting and exciting opportunities for using competitions among different groupings of students within and among campuses to motivate conservation. As an initial suggestion, we propose that a national dormitory energy and water use conservation competition would take place at the same time for all participating schools. Based on prior experience, we think a competition lasting between 2 and 4 weeks, with weekly meter reading updates, would provide a duration that is short enough to be manageable and long enough to allow students to teach themselves conservation strategies and develop meaningful savings in resources. Online instructions for accurately reading a range of different types of utility meters would be developed. Regional data, readily available, would be used to convert electricity and water conservation into greenhouse gas emissions reductions, dollar savings, etc. Reductions in consumption of electricity and water at each school would be measured relative to a baseline. The simplest approach to acquiring suitable and comparable baseline data will be to have students on each campus collect data in the weeks immediately prior to the competition.

Students will be motivated to compete against groups that they most closely identify with. We therefore envision a contest in which students simultaneously compete at multiple scales and among multiple groups. For example, at a fine scale, individual residential housing units on a given campus (i.e. dorms, dorm floors, houses, fraternities, etc.) would compete against each other to achieve the highest percent reductions in water and electricity use. At a broad scale, average percent reductions on each campus will be compared among all institutions to identify a national winner. At intermediate scales, individual residential housing units and whole campuses would have the opportunity to choose to join together and compete against self-identified groups within or across campuses (see group categorizations below). Housing units and campuses could choose to participate in multiple categories. Examples of groups that might choose to compete against each other (and/or against other groups) include the following:

- Schools within a state (e.g. schools within Ohio compete against each other and collectively against schools in other states)
- State Universities nationally
- Athletic conference division (e.g. between “big ten” athletic conference schools)
- Large geographic regions (e.g. NE, SE, Midwest, SW, NW)
- Bioregions (e.g. Great Lakes drainage basin, Mississippi Drainage Basin, etc)
- Institutions of similar size and focus (e.g. small residential liberal arts colleges)
- Demographically distinct institutions (e.g. historically black colleges, religiously affiliated schools, women’s colleges, etc.)
- Schools that consider themselves peers (e.g. Ivy leagues, “Sweet 16” schools, Great Lakes College Association schools, etc.)
- National fraternities

The finest scale of the competition possible for a given school will depend on the existing metering infrastructure on the campus. Students within any residential housing unit served by a utility meter or other device that monitors electricity or water use will be able to participate. On many campuses dormitories, and occasionally even floors or wings, are individually metered. On other campuses residential units are grouped together into quads or other combinations of housing. As long as consumption within residential housing is in some way metered such that it can be isolated from non-residential consumption, a school will be able to participate in the overall national competition. It may be necessary to create separate categories for residential units that include and exclude dining facilities. As a component of the project, we hope that campuses that

currently aggregate resource consumption among buildings will be motivated to add sub-metering so that residential houses, floors of houses or even individual rooms can be isolated and can then participate in the competition. Campuses that have Lucid Design Group's "Building Dashboard" installed will automatically be able to participate (no meter reading necessary) and will be able to view their resource consumption in real-time. Figure 1. above provides an example of how what the competition page might look like for a dormitory that has real time feedback (display at top of page), and is competing against a variety of dormitories at the same and at different institutions.

Research

A research program would be integrated with the competition that is designed to quantify factors that maximize resource reductions and the educational value of the competition so that lessons learned can be applied to improving the competition and improving our understanding of the factors that motivate conservation. Faculty and students and participating campuses would be invited to participate in this research. Principle means of quantification will include measured resource use reduction during the competition, surveys of students in participating dorms before and after the competition, and hits to the web site.

Potential Collaborative Partners:

The strategy and timing for most effectively organizing the competition will depend on collaborative opportunities that become apparent and the commitments made to participate during the fall of '09 as this idea is vetted among environmental groups and campus organizers. Ideally, we would like to see prototype web software developed during the Fall of '09. We propose a trial regional competition (for example among schools in the State of Ohio) taking place for 2-4 weeks in spring of '10 followed by a full blown national competition taking place during the '10-'11 academic year. Below we provide examples of potential collaborators grouped by various categories (apologies for organizations not included in this incomplete list):

Environmental Organizations

- Energy Action Coalition (together with AASHE sponsored the "Organizing residence hall conservation competitions, a guide for students" and hosted the "National Campus Energy Competition.")
- Power Shift
- World Wildlife Fund
- National Wildlife Federation
- National Resource Defense Council
- U.S. Green Building Council
- Rocky Mountain Institute
- Sierra student coalition
- Recycle Mania
- Focus the Nation
- National Teach In
- ACUPCC
- Step it Up

Corporate Sponsors

- EnerNOC
- Ben and Jerry's
- Sterling Planet
- Bon Appetit

Government

- Environmental Protection Agency
- Department of Energy

- National Science Foundation

Higher Education Organizations

- Association for the Advancement of Sustainability in Higher Education (AASHE)

Educational Organizations

- Society for College and University Planning (SCUP)
- National Association for College and University Business Officers (NACUBO)
- Great Lakes College Association

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