Reducing Campus Electricity Consumption through Cooperation and Fun

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Purpose - Approximately 700 colleges and universities have committed to climate neutrality, which will require significant reductions in energy consumption. This study explores the effectiveness of an Annual Energy Challenge in curtailting electricity use by changing consumption behaviors at one liberal arts college.

Design/Methodology/Approach - From 2010-2014 Allegheny College (Meadville, PA) ran four-week long energy challenges. Electricity consumption was measured compared to a baseline year of 2008. An alternate baseline, more granular data for 20 sub-metered buildings, and historic utility bill consumption trends were further analyzed to identify any persisting change and understand the impact of behavior change separate from efficiency retrofits, changes in population, and normal seasonal shifts.

Findings - Electricity consumption during the challenge period dropped an average of 9% compared to the 2008 baseline and 6% compared to the baseline of the 4 weeks preceding each challenge. Consumption trends changed in the years during challenge implementation compared to the years before engaging the campus community. All analyses reinforce that the challenge reduces electricity consumption. However, results must be analyzed in multiple ways to isolate for behavior change.

Introduction: Allegheny’s Climate Action Plan calls for achieving climate neutrality by the year 2020 using a multipronged approach to reducing greenhouse gas emissions. Allegheny’s strategies include maximizing operational efficiency, responsible purchasing, investing in renewable energy, encouraging behavioral change to reduce impacts, and finally using carbon offsets and trades to balance any remaining negative impacts of campus operations and purchases. Over years of simultaneous efforts to reduce energy consumption via retrofitting existing structures and modifying behaviors throughout campus, the aims of this study is to identify how significant reductions in electricity are occurring as the result of the challenge and if there are lasting reductions across campus after the challenge has concluded.

Beginning in 2010, for four weeks per year (in October and November), Allegheny College has challenged the collective campus community to reduce its consumption of electricity by 10 percent from the baseline established in the same time frame in 2008. Throughout the challenge, weekly usage was tracked through the use of sub-meter data for 24 buildings as well as manual meter readings for 5 other buildings and 5 campus-owned apartments. All together the challenge monitored energy use for 81 percent of the residential population of the campus and 87 percent of Allegheny’s total square footage, excluding buildings only when data was inaccessible due to the lack of either a sub-meter or campus utility meter for each building.

A multifaceted approach was used to promote energy conservation. The college Sustainability Coordinator, in collaboration with student organizations and leaders, promoted the challenge and energy conservation behaviors beginning a few days before the four-week challenge. In addition, in every year, students in two sections of introduction to Environmental Science (“B” students only) were assigned group projects to promote energy conservation. The Sustainability Coordinator, student organizers, and students in the introduction to Environmental Science class worked on the principle that the more education one gets to be encouraged against engaging in and positive reinforcement rather than guilt, lecturing, and competing, exploring the theory that building up a positive culture of collective campus change is more encouraging more responsible behaviors that will persist after the challenge concludes. Typical Energy Challenge events emphasizing fun and engagement in low-energy activities are highlighted in the 2015 Schedule of Events (Figure 1).

After each annual four week long Energy Challenge, final results in total percent and kilowatt hours reduced as well as dollars saved compared to the baseline year of 2008, were posted and widely announced. The money saved was invested in additional energy saving measures like photovoltaic solar panels, a method popular with students who are skeptical of “saving the college money” without a tangible reward or result.

Results: Annual results were calculated as the total percent and kilowatt hours reduced and dollars saved compared to the same period in the baseline year of 2008 (Table 1). This measurement indicates that each year energy is reduced by at least 7% and more than $32,000 in total has been saved and invested in sustainability projects of interest to students.

Table 1: Annual Allegheny College Energy Challenge results summary - 2008 baseline

<table>
<thead>
<tr>
<th>Year</th>
<th>Percent Reduction</th>
<th>Energy Use Reduction (kWh)</th>
<th>Energy Cost Reduction ($)</th>
<th>Method of Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>10.0%</td>
<td>95,654</td>
<td>5,739</td>
<td>combined with 2011 savings</td>
</tr>
<tr>
<td>2011</td>
<td>9.8%</td>
<td>100,863</td>
<td>7,060</td>
<td>1.68 kW solar array</td>
</tr>
<tr>
<td>2012</td>
<td>7.8%</td>
<td>84,791</td>
<td>7,143</td>
<td>2.24 kW solar array</td>
</tr>
<tr>
<td>2013</td>
<td>7.2%</td>
<td>78,040</td>
<td>6,574</td>
<td>3 kW solar array</td>
</tr>
<tr>
<td>2014</td>
<td>10.6%</td>
<td>101,870</td>
<td>8,745</td>
<td>filtered water reflow stations</td>
</tr>
</tbody>
</table>

In addition to comparing data with the 2008 baseline, this study tested a baseline method using weekly data directly preceding the challenge as the baseline in order to isolate results due to changes in the behavior of the current population from building modifications, such as efficiency retrofits. Additionally, the annual results are recalculated using the alternate baseline of four weeks preceding the challenge, there is a reduction in energy use both during the challenge and continuing afterward (Figure 2). During 2013, 2014, and 2015, the amount of energy used by the college continues to decrease as the challenge. In 2010 and 2012, although energy usage does not continue to decline, daily average kWh consumption remains less than the four weeks prior to the challenge.

Discussion: All three analyses of the data, using the 2008 baseline, using the baseline of the four weeks preceding each challenge, and comparing seasonal consumption trends in the years before challenge implementation with the years during the challenges, suggest that the Energy Challenge reduces electricity consumption by influencing behavior on campus. However, this study also revealed that campus competitors and challenges, including Allegheny College’s, need to analyze data within multiple contexts to truly understand the impact of behavior change separate from efficiency retrofits, changes in population and weather, and normal seasonal shifts in consumption.

This study found shifting the baseline from a previous year to the weeks directly preceding each challenge moderates the impact of energy saving behavior within the context of a particular population and level of building operational efficiency each year. However, this alternate baseline introduces impacts of seasonal shifts on consumption which may similarly obscure results due solely to behavior change.

The Energy Challenge consists of fun events, engaging education, collective action, and all students making an impact on campus. The fact that this research observed a decrease in electricity use due to behavioral change makes an impressive is made on students which may influence their actions as they move from college into society.

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Yo! Lights out! Steal This Sign

![Image of a light switch with the words "Yo! Lights out!"]

![Steal This Sign image]

By Boulton, Choate, Wilson, Carbone

![Signature of authors]