BEHAVIOR CHANGE: RESIDENCE HALLS

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7.1 Introduction

Chapman University is undergoing another on-campus population boom. The previous boom, from Fall 2008 to Spring 2011, resulted in a population increase of 28% (***Fig 7.1.***). It is unclear how much our campus will grow this time around, but what is clear is that the energy demand at Chapman's residence halls is growing. Add to that, a rising demand for on-campus housing and Chapman University is left at a crucial moment. Chapman needs to ensure its housing accommodations are cost-efficient and at the same time, accommodating a student's expectations for a hospitable environment. Fortunately, there is no need for radical solutions that might scare off the average student. A simple, well thought, behavior change program can build community, foster student-involvement, create fun incentives, and save an additional 4-12% a year on energy bills (Bin, 2012).

The main goals of this audit are as follows:

- Prepare data to create a model behavior change program at Chapman
- Find ways to improve on-going energy behavior change campaigns.
- Establish a residential baseline kWh/student to track change.
- Access Eco-Olympics 2014's impact

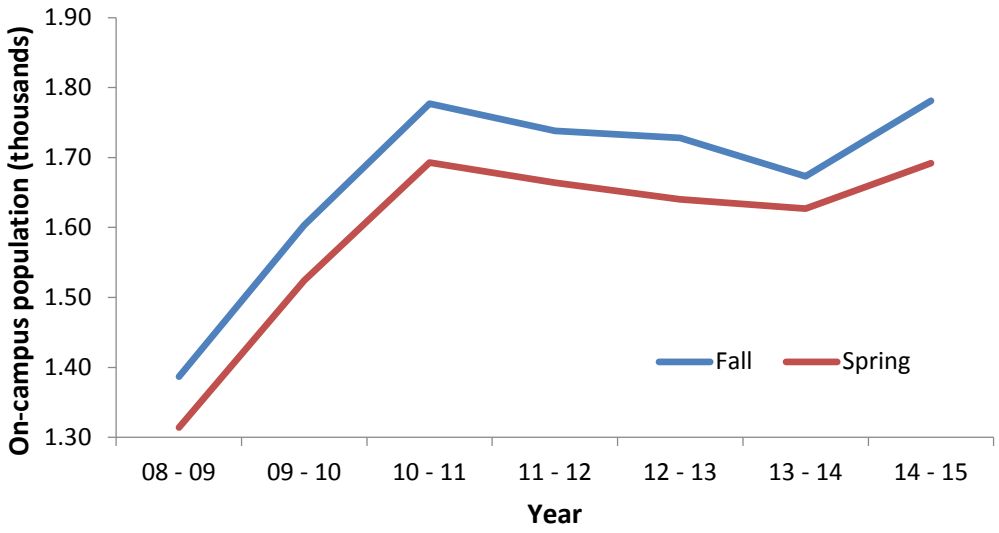

Fig. 7.1 *The rising on-campus student population.*

7.2 What is a Behavior Change Program?

Energy efficiency is strictly defined as a method of reducing the amount of energy required to run an institution. Outside of Chapman, the majority of energy efficiency projects—from major institutional retrofitting to changing light bulbs at home—stem from a traditional methodology known as the physical-technical-economic-model (PTEM). Participants of such projects are largely driven by the cost-saving nature of energy efficiency—it saves money on energy bills.

Unfortunately PTEM solutions ignore the very foundation of energy demand: it is a consumer that consumes energy. Getting students interested in energy conservation does not mean investing in PTEMs. As of this audit, Chapman University does not inform their on-campus students about the residential energy costs. And so, we have an insight as to why students have been largely uninterested in conserving energy—Chapman's Facilities Management may view its residence halls as a mess of Kwh/hour consumption and work orders fit for economic solutions, but students living on-campus simply see them as "home" (Ingle, Moezzi, Lutzenhiser, & Diamond, 2012). This chapter will focus on ways of getting on-campus students interested in energy conservation, not with technology-based methodologies, but with a human-centric approach known in the industry as an energy behavior change program.

The energy efficiency industry defines a behavior program as a stand-alone, one-time, campaign. These campaigns have been shown to reduce energy use by roughly 5% in a year (Bin, 2012). The goal of this audit is not to create such a behavior change campaign. Research has shown that a comprehensive approach to energy-efficiency, one that employs a behavior change campaign, retrofits, digital control of lighting, plug loads, tenant demand control, improved windows, etc. can reduce energy use by 31% (Bin, 2012). Therefore, the main goal of this audit will be to create a model, in which future behavior change campaigns can better function as a component in the greater effort to save energy at Chapman University.

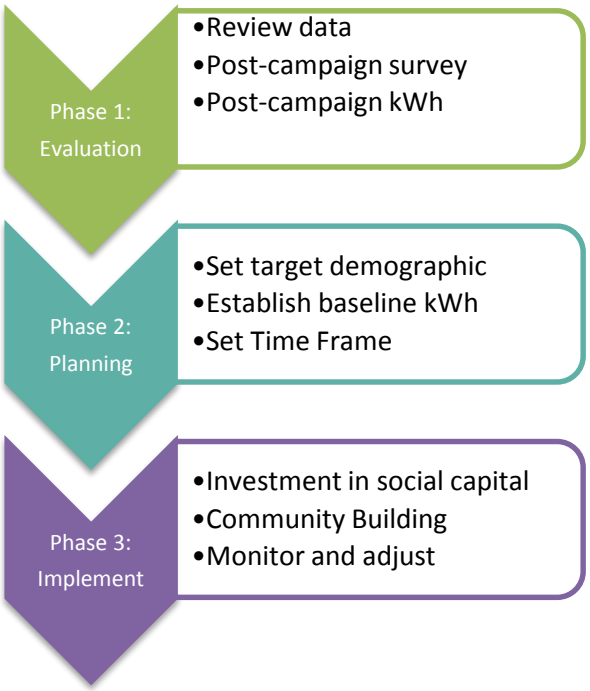

Fig 7.2. *While behavior programs may seem complicated, they can be approaches through a simplified adaptive management process.*

Preparation for a behavior change program is key. Energy behavior change programs should be approached through the *adaptive management* process. Behavior Program pilots need to be able to incorporate existing data, monitor changes, adjust strategies, and contribute to the overall growth of knowledge through post-pilot evaluation (Lutzenhiser, et al., 2009). Not every pilot will end up a major success, yet failures should be taken as an opportunity to improve with future behavior programs.

This audit provides a simplified adaptive management approach for any future behavior program at Chapman University. The cycle is divided into three phases: (1) Evaluation, (2) Planning, and (3) Implement (***Fig 7.2.***). Although the steps within each phase are not in any particular order, effort should be made to accomplish them all.

7.3. PHASE ONE: ANALYSIS

7.3.1 Evaluating Eco-Olympics 2014

Eco-Olympics 2014 was a collaborative effort between Facilities Management, The Office of Housing and Residence Life, and the on-campus students themselves. It was also Chapman University's first major attempt in implementing a behavior program to promote energy efficiency. For one month, residence halls competed to see which hall could reduce the greatest consumption of water and power.

Six on-campus residence halls where chosen to participate. Panther Village and off-campus housing were not included. The following were strategies used to market the Eco-Olympics:

1. Educational events gave easy-to-follow tips on how to win
2. Weekly raffles incentivized constant participation
3. Resident Advisors helped raise awareness and enthusiasm

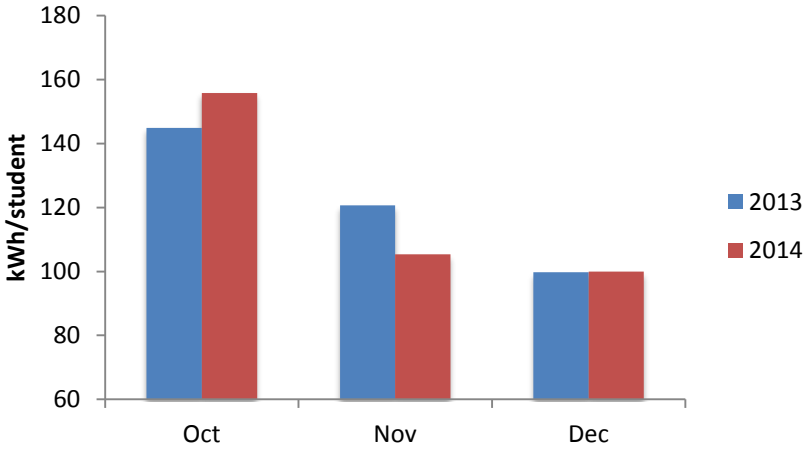

Fig 7.3. *Pralle-Sodaro Hall Kwh/student usage from Oct. 2013-Dec. 2013 and Oct 2014 (Eco-Olympics)-Dec. 2014*

Data from the competition reported a median of 17% reduction of energy usage from baseline. Pralle-Sodaro Hall was determined the winner of Eco-Olympics 2014 with an average 24% reduction throughout the course of 4 weeks.

Relative analysis of monthly metering for 2013 and 2014 (***Fig 7.3.***) show that Eco-Olympics was a relative success in reducing energy consumption by 4% at Pralle-Sodaro Hall. Long-term analysis on the effect Eco-Olympics 2014 had on student energy consumption cannot be completed with a building's monthly kWh data alone. This type of metering cannot measure the impact on individual student behavior. And as of this audit, Chapman University does not have energy meter data for building room, floor, or subgroup.

7.3.2 Student Demographics

Recent studies have proposed demographic and psychological variables are important contributors to energy conservation behaviors. Researchers in one study found that homeownership was the strongest predictor of efficiency behavior (Karlin, Davis, Sanguinetti, Gamble, Kirkby, & Stokols, 2014). One study found that the most active participants in their behavior change program participants were most likely to be relatively young, female, non-white parents living in a multi-resident home (Opinion Dynamics Corporation, 2011). Chapman University Student Headcount shows that there is a strong majority of undergraduates that are white female students. If research has shown that non-whites are more likely to be active in a behavior change program, then Chapman is in a good position. The total non-white student population has increased by 33% in five years.

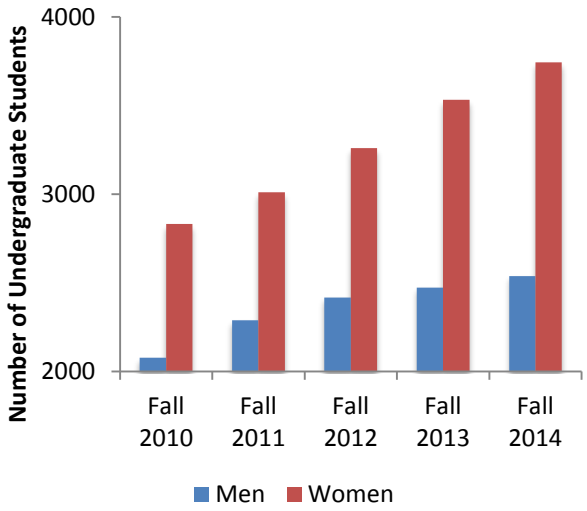

Fig. 7.4 *Historically women have been the majority of students at Chapman University.*

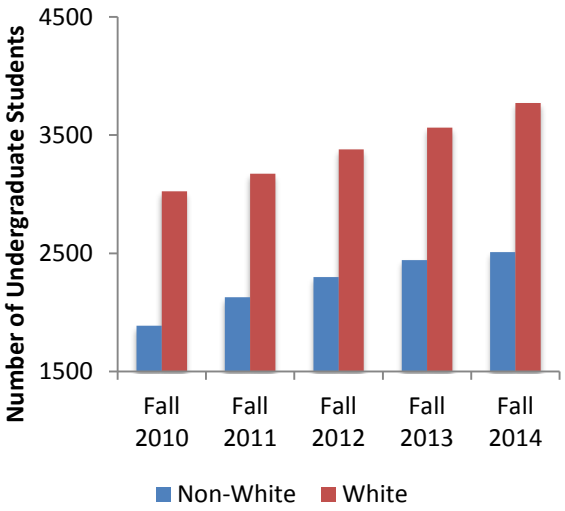

Fig. 7.5 *Non-white student populations have increased significantly since Fall 2010.*

7.3.3 2015 Environmental Audit Survey

Part of any behavior program focused on energy efficiency relies on a community that is conscious of their personal energy usage. It has been suggested that the primary motive for conserving energy was an environmental concern and bill consciousness (Karlin, Davis, Sanguinetti, Gamble, Kirkby, & Stokols, 2014). During Eco-Olympics, on-campus students were invited to attend weekly community events to learn of ways to reduce their energy consumption during the competition. The events are considered an incentivized driver, as there was a monetary raffle at every event On-campus students were surveyed to gauge what type of environmental residential program they were interested in. Results show that there was an overwhelming support for any type of program (***Table 7.1***). Yet, when asked about their attendance to such programs 82% of respondents felt they sometimes-to-never attend (***Fig 7.6***). Therefore traditional residential programs, or asking students to physically attend meetings, will not be the right approach to a behavior change program. Instead, efforts should focus on online methods such as, social media or email.

Table 7.1 *2015 Environmental Survey responses concerning residential programs*

Are you interested in residential programs concerning:	Average Answer	Mean
How to save money when moving off-campus?	Very Interested	3.76
Recent sustainable improvements on campus?	Interested	3.18
How to live an energy-efficient lifestyle?"	Interested	3.27
How to live a sustainable lifestyle in the residential halls?	Interested	3.04

7.4 PHASE TWO: PLANNING

7.4.1 Setting Freshmen as Target Demographic

Any well-made behavior program begins with a well-thought out target demographic. The vast range of individual perceptions (psychological, geo-spatial background, and political) poses a problem when importing existing programs into an outside institution. If Chapman University is to implement a new program it must be fine-tuned for the Chapman community.

Incoming freshmen are automatically placed in the Fenestra Program. The program is designed to integrate any new student into the greater campus community through events and roommate assigning. Students are assigned living accommodations based on major and roommate preferences. The Fenestra Learning Communities span 5 residence halls, Henley Hall, Pralle-Sodaro Hall, Glass Hall, and Morlan Hall.

Incoming freshmen make up the majority of students living on campus. What incoming students bring with them on move-in day affects not only their immediate energy consumption, but can also establish undesired habits in the long run.

The Office of Housing and Residence Life has posted a PDF entitled *Everything You Need to Know About Moving into the Residential Communities of Chapman University* on the university website. Items, such as large appliances, are already listed under "What Not To Bring". Furthermore, there is already strong encouragement for shared items, such as television sets, stereos, and coffee makers.

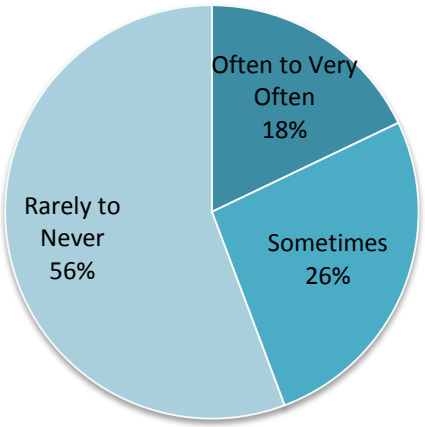

Fig 7.6. *Survey responses to: "How often do you attend residence hall programs?"(n=201).*

Today, students have any number of tech gadgets where they can play games, access the Internet, stream movies and access social media. The Pew Internet Project surveyed 246 undergrads and found that 96% owned a cellphone, 88% owned a laptop computer, 58% owned a gaming console, and 84% owned an additional mp3 player (Smith, Rainie, & Zickuhr, 2011). Gadgets with rechargeable batteries are known as always-on appliances, as they are almost always plugged into an outlet, drawing electricity, and charging. And it's not just tech gadgets that are always plugged in. ***Table 7.2*** lists just a few always-on appliances that may be intentionally, or unintentionally drawing power inefficiently right now. The OHRL's PDF gives us an opportunity to foster desired conservation practices early and maybe even promote a counter-consumerism movement.

Table 7.2 *Common lifestyle electronic devices*

Lifestyle Electronic Devices	
Laptop	Hairdryer
Desktop	Curling Irons
Tablet	Flat Irons
Phone	Coffee Pot
Handheld Console	Digital Photo Frames
Videogame Console	Television
Record Player	Digital Camera
Electronic Toothbrush	Electric Instrument

7.4.2. Establishing a Baseline kWh/Student

The question: "Did the behavioral program work?" can be answered with an established baseline kWh/student. Deviation from this baseline can provide feedback of the relative change in energy-use over a given time frame. Refer to ***Table 7.3*** for the calculated baseline of 4 freshmen residence halls and apartment buildings. Since there are an insufficient number of students living on campus during the summer, these months are not included.

7.4.3. Setting a Time Frame

Yearly comparisons should be avoided, as there are significant differences in the number of on-campus students from semester to semester. It would be more beneficial to restrict programs that are no shorter than a single day and no longer than one semester long.

Table 7.3. *Calculated as a monthly average of 2013 and 2014.*
** No energy sub-metering exists to separate the energy demand of Randall Dining Commons and Sandhu's residential halls.*
***Insufficient energy metering data for the months of January through May.*

	Baseline kWh/Student				
	Henley	Pralle	Sandhu*	Glass**	Apts.
Jan	146	110	894	-	168
Feb	139	113	820	-	155
Mar	154	121	893	-	169
Apr	132	74	766	-	181
May	159	107	909	-	215
Jun *Jul* *Aug*					
Sep	147	131	1038	211	271
Oct	202	151	955	184	209
Nov	145	113	794	138	138
Dec	98	100	590	81	126

7.5. PHASE THREE: IMPLEMENTATION

7.5.1. Investing in Social Capital

Students consider their dormitory as home and it is up to Chapman University to maintain a sense of hospitality. Investing in social capital means an investment in a student's comfort in all areas, including any behavior change program. Programs should not be difficult to participate in, needs to stay fun, and more importantly, benefit the student. A comfortable student is more likely to help out in conservation efforts. A happier student is someone who is willing to stick around and live on-campus for another semester. Chapman University provides their on-campus students with a variety of conveniences and perks. Students can participate in Zipcar (2010), refillable water bottle stations (2010), OHRL shuttles to nearby markets (2013), a residence hall community garden, and a university shuttle service (2014). These programs are ongoing and are inline with the concept of energy efficiency. A behavior change program should be another piece of the puzzle.

7.5.2. Community Building

Finding the right behavior program could provide a great opportunity for undergraduate research. Major utility companies are beginning to look into unconventional approaches to conserve energy; it is no longer about finding new PTEM innovations. As of this audit, there have been virtually no on-going studies in energy efficiency behavior change programs within a college dormitory. Finding ways to promote energy conservation within a community is not only issue of

environmental science. Much like the 2015 U.S. Solar Decathlon, it is an opportunity for undergraduate and professional research in psychology, sociology, computational sciences, communications, leadership studies, economics, and environmental science.

Research in this growing field can support the mission of the Office of Undergraduate research and the all-encompassing mission statement of Chapman University. Engaging in this field would mean, "promoting and facilitating student-faculty collaborative research" and will, "provide personalized education".

7.6 Monitor and Adjust

In 2014 UCLA created an opt-in behavior change program known as ENGAGE. Subsequent UCLA research calculated showed 19% in energy reduction. Their program used a variety of nonprice incentives including a "consumer-friendly" website and an emailing list to provide information to participants (Asensio & Delmas, 2014). Information could be accessed 24/7 via computer or portable devices.

UCLA's ENGAGE uses a utility dashboard system, essentially sub-metering for individual residential homes, which was funded by the California Air Resource Board. This system allows for real-time tracking and direct-to-consumer electronic message. The messages provide customized information to individuals to maximize physiological impact. The ENGAGE Team at UCLA describes

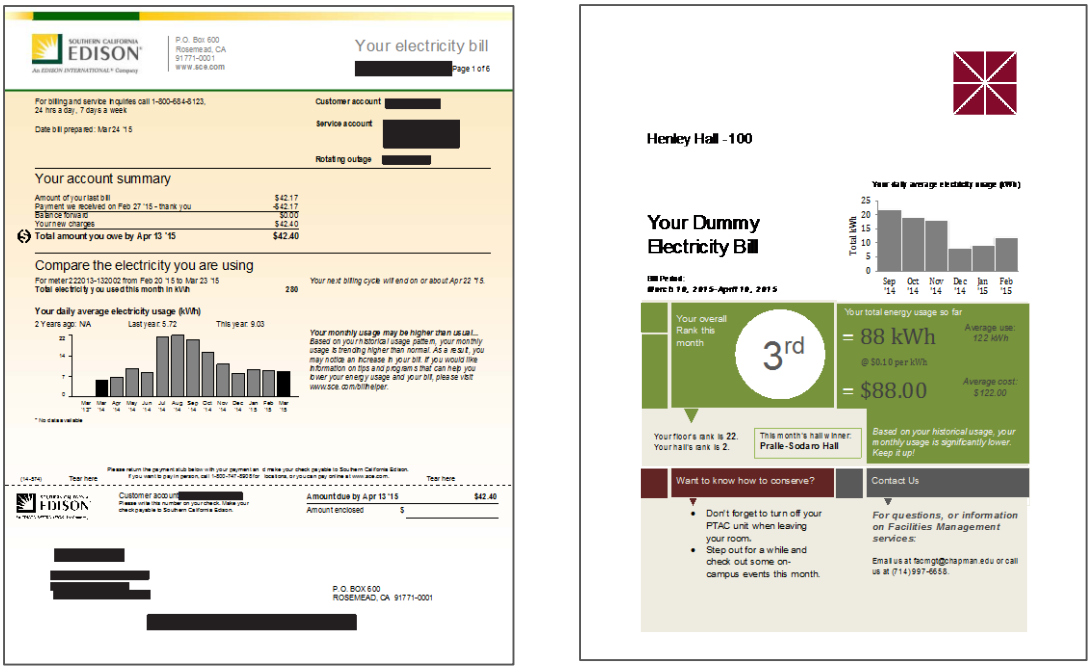

Fig 7.10. *Pictured Left: Southern California Edison monthly electricity bill. Pictured Right: A simplified electricity "dummy bill" can be a great tool to use within a behavior program.*

it as, "the largest real-time, appliance level feedback experiments in the United States" (ENGAGE Team). direct-to-consumer With a similar dashboard system in place, Chapman can begin to create the foundational community needed to strengthen a behavior program. Utility dashboards can help provided targeted, information to students in order to motivate them towards conservation action. Major energy providers provide their customers with monthly electric bills. In the same way, "dummy bills" can provide students with monthly targeted information. Products such as ENERNOC, Lucid by Building OS, or Sterling Analytics LLC promise a comprehensive platform in which to track energy usage and deliver appropriate online messaging. Additionally, a dashboard system can establish a more accurate kWh/student baseline.

Educating our students on conserving energy will not only benefit them economically in the long run, but continue to support the university's mission statement to lead to "ethical and productive lives as global citizens". Accessing data through the course of a program can provide feedback to where improvements can be made. Whether a program's timeframe is one week or one month, appropriate energy metering should be taken. Campaign surveys should also be given on a regular basis to get a feel for the opinions of the stakeholders.

7.7 Recommendations

7.7.1 Low Cost Effort Recommendations

- Re-invest in Eco-Olympics for Fall 2015. Merge the efforts with the Fenestra Residential Program, and set incoming freshmen as the target demographic.
- Edit the OHRL's *Moving In PDF* to include lifestyle appliances and promote energy conservation.

7.7.2 Moderate Cost Effort Recommendations

- Push bi-monthly or monthly information pertaining to energy efficiency through an on-campus, student-emailing list. (Refer to **7.4.2.1** and ***Fig 7.10***.)

7.7.3 High Cost Effort Recommendations

- Install a utility dashboard for an accurate metering of energy use within residential halls.
- Begin a collaborative effort in energy behavior change research to support the Office of Undergrad Research's mission to, "promote and facilitate student-faculty collaborative research"

7.8 Future Areas of Research

Baseline kWh/student was not calculated for both North and South Morlan and Panther Village. This audit concerned on-campus students who own little to no major electric appliances. Research can be done on the energy consumption of apartment living, or whether steps can be taken to make laundry rooms more efficient.

7.9 Contacts

1. Beth Karlin, Director, Transformational Media Lab (bkarlin@uci.edu)
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7. Timothy Eng, P.E., CIE, Project Manager, Kaiser Permanente (timothy.c.eng@kp.org, 626-405-5152)

7.10 References

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