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Tale of Two Green Communities: Energy Informatics and Social Competition on Energy Conservation Behavior

Dobin Yim

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ABSTRACT

This study explores whether providing information on energy consumption is effective in changing energy consumption behavior. More specifically, in groups with collectivist culture, energy informatics have a significant role in inducing active participation and engagement in energy conservation efforts. Using data collected from energy monitoring competitions conducted in student residence halls of a university, I find that energy competition has positive influence in reducing energy consumption for cohesive dorms, whereas it has adverse effect for less cohesive ones . The findings of the study indicate suggest that the role of information on the energy saving is conditional on existing culture in communities. I discuss the managerial implications of the findings.

Keywords

Sustainability, Green IS, Energy Informatics, Social Competition, Intergroup Competition.

INTRODUCTION

While the concerns towards environmental sustainability are growing, the progress in inducing sustainable practices across individuals, firms, and nations is seen as a vital challenge. Lack of appropriate information is becoming a constraint to educate and instill the energy conservation behavior. Policy makers are exploring plans for mounting national level awareness drives, and business leaders are looking at opportunities to instill Green behaviors in their firms. For example, several companies have transitioned into using eco-efficient laptops across the organization. Similarly, government has initiated programs such as tax credits for adopting Green technology such as Energystar-compliant appliances.

Prior studies suggest that energy informatics (Watson et al. 2010) can play a vital role in building awareness and instilling green behavior. Existing studies focus on creating incentives at individual level, and adopting strategies for dissemination of information on energy savings across the organization can help in coordinating sustainable practices. Other studies suggest that instead of monetary incentives, creating social norms through information-based programs might lead to positive results. For instance, empowering recycling through community awareness leads to effective changes in energy consumption behavior (Schultz 1999; Cialdini 2004). A few pilot programs for utilities have included a neighborhood use information in the monthly energy bill for consumers as reducing energy use through social comparison (e.g. OPOWER company provide software platform to utilities to generate such monthly statement, Allcot 2010).

Against the role of instilling energy saving behavior through incentives, prior studies suggest that rewarding individual behavior may not lead to any reduction in energy consumption (McCalley 2003). Further, it is argued that people fail to adopt such straightforward measures, even though doing so could lead to positive results in reducing energy consumption (Granade et al. 2009). Although there may be multiple reasons (Jaffe and Stavins 1994), it is clear that monetary incentives alone are not sufficient to sustain consumer participation. Therefore, empirical evidence on results of using energy informatics is a gap in the existing literature. Further, incorporating the socio-technical systems approach (Dwyer, 2010) using feedback loops to large-scale groups towards sustainable practices remains an unexplored area of research.

This study explores the role of energy informatics on engaging social groups to conserve energy through social competition. I used the context of dorm level competitions for energy conservation conducted during 2008 – 2010. I collected data on daily energy consumption, and studied the configurations of the dorms that were participating in the competition. I divided data samples into two groups, based on their configurations: i.e. Greek houses with high level of cohesion among members, and generic student residence halls where social norm on collectivist culture is relatively weak. I find that competition is positively associated with 6.5% reduction in energy use when the underlying social norm is strong. Further, in the resident halls where social norm is weak, there is an *increase* of 14.2 % in energy use. The findings indicate the interplay of energy informatics and social norms toward energy consumption behavior. The findings provide the managerial implications that designing appropriate energy informatics plan in an organization has to keep in mind the social configuration of the organization. I conclude with contributions of this study and future research agenda.

THEORETICAL FRAMEWORK

The theoretical framework of this study is based on the discussions around prosocial behavior and feedback interventions theory (FIT). I argue that prosocial behavior can be instilled through a competitive framework, where free-riding for energy consumption can be mitigated through availability of information on others' behaviors. Further, by using feedback interventions, the means to achieve the prosocial behavior will be improved to form a sufficient mass of participants to enable social change to save the environment.

Energy Conservation Behaviors and Social Competition

Sustainable behaviors in energy conservation context are analogous to *prosocial* behaviors, where individuals engage in costly activities to benefit others or society, such as voting, volunteering, and making charitable contributions (Trivers 1971; Batson 1998; Fehr & Fischbacher 2003). However, major challenge in inducing prosocial behavior is how to align incentives while mitigating free riding behaviors, especially in a group or communities where member size is large. In the context of green initiatives, individuals might not find any value in exerting costly effort towards energy conservation practices when they can free ride at the expense of others. Despite clear incentives to free-ride, many individuals continue to engage in prosocial behaviors; however, lab experiments have shown that with repeated interactions, such behaviors dissipate quickly (Isaac et al. 1984; Ledyard 1995). Without the ability to monitor member behavior or punish those who free-ride (Fehr and Gachter 2000), acquiring and engaging participants may be inherently a lost cause. Therefore, a necessary condition to foster energy conservation behavior is to minimize free-riding by shifting the decision framework of consumers from "self-regarding" to "other-regarding" behaviors (Benabout and Tirole 2006).

Extensive literature on group-based competition or tournaments has shown to increase total effort level by aligning incentives with group outcome. For instance, evidences from experimental and field studies on intergroup competition has shown to reduce free riding in social dilemma and raise total effort levels (Erev, Bornstein and Galil 1993). Compared to piece-rates or incentives to reward individual performance, relative performance evaluation has shown to raise total effort levels of agents compared to general form of contracts (Lazear and Rosen 1981; Green and Stokey 1983; Nalebuff and Stiglitz 1983; Glazer and Hassin 1988; Gradstein and Konrad 1999; Moldovanu and Sela 2001). Prior studies have demonstrated that performance evaluations in the intergroup competitions have provided mixed results depending on the group size and number of prizes (Harbring and Irlenbusch 2003). Tournaments with more contestants and prizes may increase free-riding when others' efforts are known (Fu and Lu, 2009). Finally, the composition of the group has effect on performance; for instance, presence of high-effort individuals reduces total effort level of participants (Brown 2008).

Feedback Interventions and Social Competition

The feedback interventions theory (FIT) posits that information resulting after exerting effort can be used to gauge future effort level (Kluger & DeNisi 1996). For instance, incentives to reward individual behavior may improve productivity of only those whose utility level exceeds that of winning likelihood. Consequently, goal setting, locus of information such as task, individual, or group, can refine the quality of feedback and thus affect the effectiveness of incentives and subsequent performance (Pritchard et al. 1988).

Normative feedback interventions provide useful information about what others do by informing existing social norm (Schultz 1999). By comparing what others do, individuals can raise the effort level to match that of a norm. For instance, using surveys and messaging to a group of households in San Diego, Nolan et al. (2008) have shown that "descriptive norm" message works best compared to other types of feedback in participants to adopt green behavior. A rationale for observing this behavior is that if sufficient members have engaged in energy saving behavior, average person is more likely to adopt energy saving behavior. However, while informing what others do can have positive effect on bringing members close to social norm, peripheral or atypical members may defect just as easily (Popielarz and McPherson 1995).

In the energy context, the positive effect of normative feedback interventions and competition has studied in the dorm-level energy competition in a university setting. Whereas traditional tournament studies find research setting in organization context or laboratories with monetary prizes, "social" competition with "bragging rights" or social status as the only rewards offers more cost-efficient alternative to individual incentives. For instance, Oberlin

College's energy competition displayed real-time energy use for each dorm on websites to reduce electricity use (Petersen et al. 2005). In addition, the value of energy informatics in competition setting may mitigate the free-riding behavior inherent in energy conservation efforts. Lastly, increasing communication among members could establish social norm (Sutter and Strassmair 2009).

RESEARCH CONTEXT

Two Resident Communities: Greek Houses vs. Resident Halls

Energy saving under climate change initiatives has become the priority for many organizations to achieve the vision of a greener planet. Specifically, universities have a greater role in creating awareness, educating and training next generation of students to become green leaders in society. Previous studies have estimated that occupant behavior can control up to 50 percent of residential energy use, while the rest depends on energy demand of the buildings based on physical characteristics and infrastructure efficiency. Preparing students through practice based norms towards energy consumption will go a long way in shaping the green leadership initiatives in the future.

Instilling green behavior among students requires active participation and engagement. To understand how social competitions motivate students to learn and save energy, I compare and contrast two independent dorm competitions conducted at the University of Maryland, College Park. First, the Office of Fraternity and Sorority Life (OFSL) and the Office of Sustainability at the University of Maryland, College Park, partnered to run Green Greek Challenge, an annual competition among Greek houses in the Fraternity Row. The competition was conducted in 2009 and 2010. In its first year, a winning dorm received monetary prizes, whereas in the second year, social recognition and non-monetary prizes (e.g.: tickets to Basketball games) were used to elicit student participation. In both years, financial budget to support the competition remained the same. The automated electronic monitoring systems captured daily energy use, and each dorm received a weekly report summarizing the amount of energy used and their current rank in the competition. At the end of the 9-week period, the top ranked dorm wins prizes as well as bragging rights.

Second, a student-initiated dorm competition was run in 2010 involving 11 North Campus student residence halls, as part of a national competition called Campus Conservation National (CCN) involving 39 colleges. Although the competition lasted much shorter (i.e.: 3-weeks) during the first three weeks in November, both competitions used similar designs to increase student awareness and induce energy conservation behavior. Because these two competitions differ in duration as well as having a wider involvement of other campuses for CCN, I cannot directly compare the results but rather contrast the differences and highlight the key insights for future consideration in designing social competitions to motivate students. Lastly, both competitions used multiple channels of communication to display weekly results using email, Facebook, website, and off-line print materials posted on the dorm bullet boards.

The key findings are based on analyzing the energy use before and after each year's competition. The unit of analysis on the dependent variable is the daily energy consumption for dorms in each student community from September to November in each year. By using a statistical model that predicts daily energy demand for each dorm based on changes in the daily average temperature and the occupancy level, I am able to quantify the effect that the social competition had on energy conservation behavior. I also compare the changes in energy level of participating dorms (Greek houses and North Campus student residence halls) against 18 dorms in the South Campus during same time periods as control.

DATA COLLECTION AND ANALYSIS

I obtained data on total daily energy consumption (*ENERGY-kWh*) via ITRON, an automated metering system installed at each dorm to take various energy measurements such as electricity and water records at fifteen minute and hour interval, respectively. My approach in data analysis is two-fold: first, I identify the main factors that accurately capture daily energy use level for each dorm. Next, based on the predicted values of energy use, I can quantify the effectiveness of the program by comparing the energy use before and after the competition.

First, I identify *daily average temperature* and *occupancy level* (i.e.: number of occupants in a house on a given day) as two main factors to predict total daily energy use for each dorm on the Fraternity Row. In other words, I can accurately estimate the daily energy demand by capturing daily average temperature and occupancy level. For instance, it is reasonable to assume that higher average temperature on a given day would influence occupants to use more air conditioning or fan, thereby increasing energy demand, whereas lower occupancy on weekends would reduce energy consumption level due to many students going out to party. I obtained the recorded average daily temperature from the weather database and used the day of the week (e.g.: Sunday) as dummy variables to explain most of the variances (77%) in the actual data. This simple model enables us to capture quantitatively the effectiveness of the GGC, by comparing the daily energy use before and after the competition.

The accuracy of this model depends on whether the *change* in each house's daily energy demand due to the main predictors is consistent over time. In simple terms, I need to make sure that the temperature changes and occupancy level across time has a linear trend. As Figure 1 shows, daily temperature between September and November declines in a linear fashion. To adjust daily fluctuation of energy consumption due to the day of the week (i.e.: weekends) as well as due to holidays (e.g.: Thanksgiving), I use dummy variables. The result of our model thus fits most of the observed data. Figure 2 compares the predicted and actual daily average energy use.

Next, I quantify the effect of the competition by comparing the energy use before and after the competition. If I use pre-competition period (September) in 2008 as baseline, I can compare the relative change in energy reduction level during competition period for 2009-2010. By comparing the differences, I can quantify the effect of the competition on the energy consumption behavior. For instance, a house in the Fraternity Row consumed 454 kWh per day before the competition in 2008. During the competition period in 2009 and 2010, there was 2.9% and 9.6% reduction in energy consumption level, respectively.

However, my interpretation of this result may be biased because the differences in average temperature during this time period or the change in composition of the student cohorts was responsible for the reduced level of energy consumption. For instance, Figure 3 shows that during 2009-2010, average daily energy use pre-competition was much lower in 2008, perhaps indicating that the reduction may not be solely due to competition. In order to accurately assess the positive impact of the competition, I need a "control" or expected energy use had there been no competition.

To estimate the expected energy consumption without the influence of the competition, I choose a group of "control" dorms in the South Campus. Because these dorms are located in the near vicinity of the houses in the Fraternity Row, each dorm is subject to the same temperature changes as well as having the same change in day of the week. There are total of 18 dorms in South Campus, and I used the same procedure and analysis for the comparison. Using this control, I have a more robust estimate of the competition effect on the reduction in the energy consumption level (Figure 4).

More formally, the estimation model is as follows (1):

$$ln(ENERGY)_{it} = a + \mathbf{b_1 COMP(y)_t + b_2 LOC^* COMP(y)_t} + b_3 TAVG_t + b_{4j} DOW + b_5 YEAR + e, (1)$$

where COMP=competition type (GGC, CCN); LOC=South Campus; TAVG=daily average temperature; DOW=day of the week; YEAR=year dummy (See Table 1).

I used fixed effects model to estimate the key parameter of interest. The fixed effects estimation is useful in panel data because only time-variant factors affect the change in energy use. This assumption may be reasonable given that energy demand is primarily affected by temperature change and occupancy level (Cartalis 2001). Alternatively, a random effects model may be used to estimate the effect of competition on energy use incorporating dorm capacity and other factors that vary in cross-section. A Hasuman test to choose between the fixed effects and random effects supported my decision. However, the results do not change.

The Table 2 shows the results contrasting the effect of social competition on energy use. In 2010, a house in the Fraternity Row reduced 26.7% in energy use compared to a non-participating South dorm, whereas in 2009, this figure is 26.4%. If I relax the differences in student cohorts over each year, I can directly attribute the competition effect in 2009 and 2010 to be 6.5% and 6.2%, respectively, to 2008 figure. In other words, if I were to implement a GGC-like competition across campus, a typical dorm would expect on average 6% reduction in energy use above and beyond temperature decline and change in occupancy over the course of the semester.

However, the effect of CCN on North Campus has opposite result. In 2010, a resident hall in the North Campus increased energy use by 8.9% during 3-week competition than a South Campus dorm. Comparing the energy use in same time period during 2009, a North Campus experienced 5.3% decrease in energy use. These two figures represent 14.2% swing in year-over-year in energy use in the *opposite* direction of expected change due to social competition.

Lastly, this model incorporating control dorms is not without its limitations. I assume that a typical South Campus is affected by temperature and day of the week in the same manner as a house in the Fraternity Row. Although our model has a reasonable fit predicting the daily energy use (63%), a reduced fit indicates that a South Campus may not be a good enough control. For instance, a South Campus dorm varies in size more so than a Fraternity Row house. In addition, a typical resident in a South Campus dorm may not be as close to others as in the Fraternity Row house. Together, these differences may change the size of the effect in either positive or negative direction; although it is reasonable assume that the bias is likely to be downwards.

In summary, key findings are as follows:

GGC Competition

- In 2010, a Fraternity Row house consumed 26.7% less energy during competition than a South Campus resident hall, compared to 20.2% in 2008, representing 6.5% Year-over-Year reduction
- In 2009, a Fraternity Row house consumed 26.4% less energy during competition than a South Campus resident hall, compared to 20.2% in 2008, representing 6.2% Year-over-Year reduction

CCN Competition

- In 2010, a North Campus resident hall consumed 8.9% more energy during competition than a South Campus dorm, compared to 5.4% less energy consumed in 2009, representing 14.3% upswing Year-over-Year energy use

DISCUSSION

I set out to study the impact of energy informatics on energy conservation behavior using social competition to increase effort level of students in saving energy in dorms. The role of energy use information may drive behavioral change by increasing learning and motivation to participate. In addition, displaying observable performance of other groups engages the power of social comparison to further raise the total effort level of participants. However, revealing group performance information may have adverse effect on increasing free riding behavior if a member in a losing group realizes that the likelihood of winning a competition is small, thereby decreasing the margin of return for effort exerted. Counterbalancing this free riding behavior may be mitigated through social monitoring of member behaviors or use communication to increase solidarity within communities (Sutter and Strassmair 2009).

The choice of what information to disclose to engage consumers towards sustainable practices must consider the underlying relationships among members in the existing community. If there is strong ties among members in a community, feedback interventions on group performance may enhance total effort level, whereas providing energy informatics in a less cohesive community may unintentionally increase energy use. For instance, an average member may falsely assume that the community is exerting sufficient effort, or that she may discover that the cost of effort outweighs the potential benefit received.

The main contribution of this paper is that effectiveness of energy informatics on reducing energy conservation behavior depends on existing social norm. In communities where strong collectivist culture exists, members of communities can be re-directed to align their behaviors with desired pro-community outcome. I find that in Greek whose members exhibit stronger affinity towards other members within their community, the social competition has positive influence in reducing energy consumption, whereas in North Campus resident halls, energy consumption increased.

Second, I use an estimation model using expected daily energy demand of each dorm using the occupancy level and temperature change as two main predictors of change in energy use. By sampling a temporal period in which the temperature decline is uniform, I was able to use a linear model to estimate and predict the outcome with strong fit. The fixed effects model eliminates the time-invariant factors and enables testing the effect of key variables. The usefulness of this model to evaluate the effectiveness of sustainable programs may be generalized in other contexts.

Before we discuss the implications of this finding and future research agenda, there are several limitations of this study. First, the social competition "treatment" is not same across two communities, thereby making direct comparisons of the result not valid. An ideal field experiment should have the same exogenous shock applied in the two contrasting environment; however, due to constraints in the design, I can only infer the effect of social competition as two separate illustrative cases. In addition, the difference in competition design such as duration may affect the findings in that beyond 3-week period of the CCN, the community members might have increased learning and achieve similar types of energy conservation as the members in the Greek community. In addition, Greek community members have two years of competition that could bias the result. While social learning difference could certainly exist, energy saving behavior is strongest at the beginning of the contest, which indicates that members' effort spirals downward to minimum level with repeated exposure to competition. In either case, this study's findings for potential energy reduction is likely to be more conservative. However, I cannot completely rule out this alternative biasing the findings.

Second, the unit of analysis is at the group level, so generalizing the findings to the individual level may not be feasible. Although, the effect of social competition on average member may be positive, the increase dispersion of individual behaviors commonly observed in tournaments could be the main driver of increase in energy use, especially in a large community, where incentive to free ride is high. To control for the existing relationships in the community, a measure of community cohesiveness such as network density may strengthen the findings. Alternatively, a future research design can incorporate individual behavior as dependent variable.

CONCLUSION

The emerging technologies in energy informatics such as smart grids, monitoring devices, and other Web 2.0 technology such as online social networks make it easy to reach and organize masses of individuals through peer-to-peer network. However, a care must be taken on the potential benefit as well as the adverse effects of using information to induce behavioral change. Just as easily as technology can recruit members and establish Green norm, it can disintegrate existing communities rapidly as well.

Based on the results obtained in this study, social competition can be an effective strategy to reduce energy consumption behavior of students in the dorms each year. However, where social norm is weak, energy informatics may contribute to increase in energy consumption. Lastly, employing “social” incentives is more effective than monetary prizes in engaging students. The findings provide first order evidence that monitoring and incentive based competitions are successful towards energy reduction behavior. Second, contrasting two different communities highlights the importance of keeping a community close as a necessary requirement. A future improvement of the competition could leverage information technology such as social network to reach more people while keeping the community close.

REFERENCES

1. Allcott, H. (2010) Social Norms and Energy Conservation, *Working paper, Massachusetts Institute of Technology (MIT), Cambridge, MA*, http://web.mit.edu/allcott/www/papers.html.
2. Batson, D. (1998), Altruism and Prosocial Behavior, In D. Gilbert, S. Fiske, & G. Lindzey (Eds.), *The handbook of social psychology, (4th edition) vol. 2*, New York: McGraw-Hill, Chapter 23.
3. Benabou, Roland and Jean Tirole, (2006) Incentives and Prosocial behavior, *American Economic Review*, 96, 5, 1652–1678.
4. Brown, J. (2008) Quitters Never Win: The (Adverse) Incentive E¤ects of Competing with Superstars, *Job Talk Paper,* http://home.business.utah.edu/finmh/Brown_Quitters_Never_Win.pdf
5. Dwyer, C. (2010). "Socio-technical Systems Theory and Environmental Sustainability," *Proceedings of SIG Green Workshop*, ICIS 2010
6. Cartalis, C., Synodinou, A., Proedrou, M., Tsangrassoulis, A., and Santamouris, M. (2001) Modifications in energy demand in urban areas as a result of climate changes: an assessment for the southeast Mediterranean region, *Energy Conservation Management*, 41, 1647-1656.
7. Cialdini, R. B., & Goldstein, N. J. (2004) Social influence: Compliance and conformity, *Annual Review of Psychology*, 55, 591-621.
8. Erev, I., Bornstein, G., and Galili, R. (1993) Constructive intergroup competition as a solution to the free rider problem: A field experiment, *Journal of Experimental Social Psychology*, 29, 463–478.
9. Fehr, E., and Gachter, S. (2000) Fairness and Retaliation: The Economics of Reciprocity, *Journal of Economic Perspectives*, 14, 3, 159-181
10. Fu, Q., and Lu, J., (2009) The beauty of "bigness": On optimal design of multi-winner contests, *Games and Economic Behavior*, 66,146–161
11. Glazer, D., Hassin, R., (1988) Optimal contests, *Econ. Inquiry* 26, 133–143.
12. Gradstein, M., Konrad, K.A., (1999) Orchestrating rent seeking contests. *Econ. J.* 109, 536–545.
13. Granade, H.C., Creyts, J., Derkach, A., Farese P., Nyquist, S., and Ostrowski, K. (2009) Unlocking Energy Efficiency in the U.S. Economy, *McKinsey & Co., New York*, http://www.mckinsey.com/clientservice/electricpowernaturalgas/US_energy_efficiency/
14. Green, J., and Stokey, N. (1983) A comparison of tournaments and contracts, *Journal of Political Economy*, 91, 349–364.
15. Harbring, C., Irlenbusch, B. (2003) An experimental study on tournament design, *Labour Economics,* 10, 443–464
16. Isaac, R. M., and Walker, J. M. (1988) Group-size effects in public-goods provision—the voluntary contributions mechanism, *Quarterly Journal of Economics*, 103, 179–199.
17. Jaffe, A., and Stavins, R.(1994) The energy paradox and the diffusion of conservation technology, *Resource and Energy Economics*, 16, 2, 91-122.
18. Kluger, A., and DeNisi, A. (1996) The Effects of Feedback Interventions on Performance: A Historical Review, a Meta-Analysis, and a Preliminary Feedback Intervention Theory, *Psychological Bulletin*, 119, 2, 254-284
19. Lazear, E., and Rosen, S., (1981) Rank order tournaments as optimal labor contracts, *J. Polit. Economy* 89, 841–864.
20. Ledyard, J. (1995), in *Handbook of Experimental Economics*, eds Kagel, J. & Roth, A, Princeton Univ. Press., 111-194.
21. McCalley, L. T., (2003) From motivation and cognition theories to everyday applications and back again: the case of product-integrated information and feedback, *Conference Proceedings from ECEEE 2003 Summer Study, Dynamics of Consumption*, 1151-1157.
22. Moldovanu, B., Sela, A., (2001) The optimal allocation of prizes in contests. *Amer. Econ. Rev.* 91, 542–558.

23. Nalebuff, B.J., Stiglitz, J.E., (1983) Prizes and incentives: towards a general theory of compensation and competition, *Bell J. Econ*. 14, 21–43.

24. Nolan, J., Schultz, P., Cialdini, R., Goldstein, N., and Griskevicius, V. (2008) Normative Social Influence is Underdetected, *Personality and Social Psychology Bulletin*, 34, 913-923.

25. Petersen, J. E., Shunturov, V., Janda, K., Platt, G., and Weinberger, K., (2007) Dormitory residents reduce electricity consumption when exposed to real-time visual feedback and incentives, *International Journal of Sustainability in Higher Education*, 8, 1, 16-33.

26. Popielarz, P., and McPherson, J. (1995) On the Edge or In Between: Niche Position, Niche Overlap, and the Duration of Voluntary Association Memberships, *The American Journal of Sociology*, 101, 3, 698-720

27. Pritchard, R., Jones, S., Roth, P., Stuebing, K., and Ekeberg, S. (1988) Effects of Group Feedback, Goal Setting, and Incentives on Organizational Productivity, *Journal of Applied Psychology Monograph*, 73, 2, 337-358.

28. Schultz, P. W. (1999) Changing behavior with normative feedback interventions: A field experiment on curbside recycling. *Basic and Applied Social Psychology*, 21, 25-36.

29. Sutter, M., and Strassmair, C. (2009) Communication, cooperation and collusion in team tournaments – An experimental study, *Games and Economic Behavior*, 66, 506–525

30. Trivers, R. (1971), The Evolution of Reciprocal Altruism, *The Quarterly Review of Biology*, 46, 35-57.

31. Watson, R. T., Boudreau, M-C., and Chen, A. J. W. (2010) Information Systems and Environmentally Sustainable Development: Energy Informatics and New Directions for the IS Community, *MIS Quarterly* 34, 1, 23-38.

APPENDIX

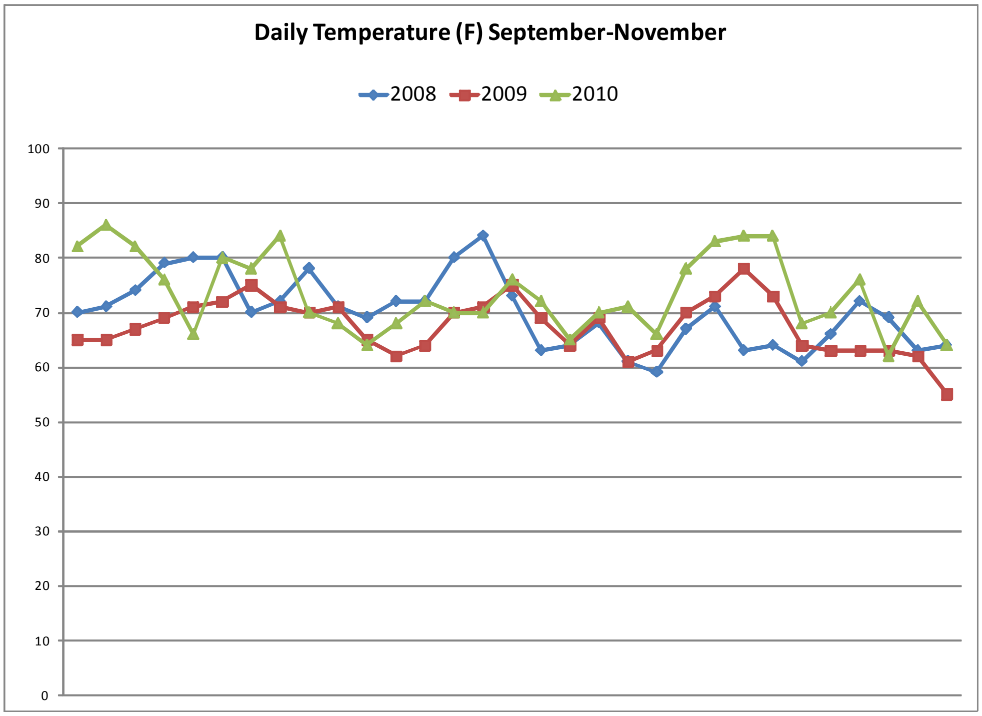

Figure 1: Daily Average Temperature (F) – September-November

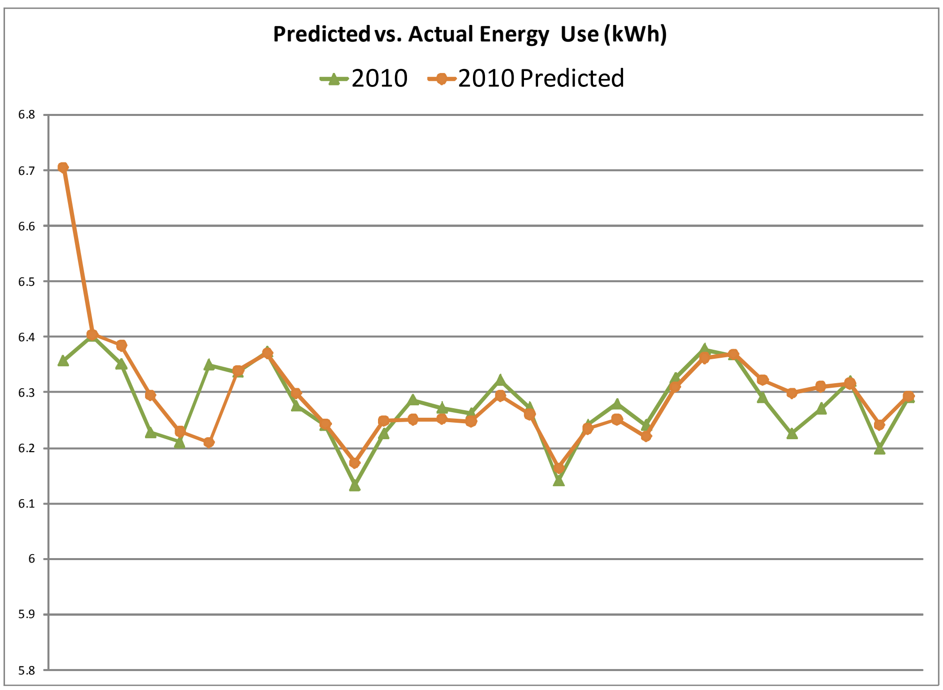

Figure 2: Daily Average Electricity Use (kWh)

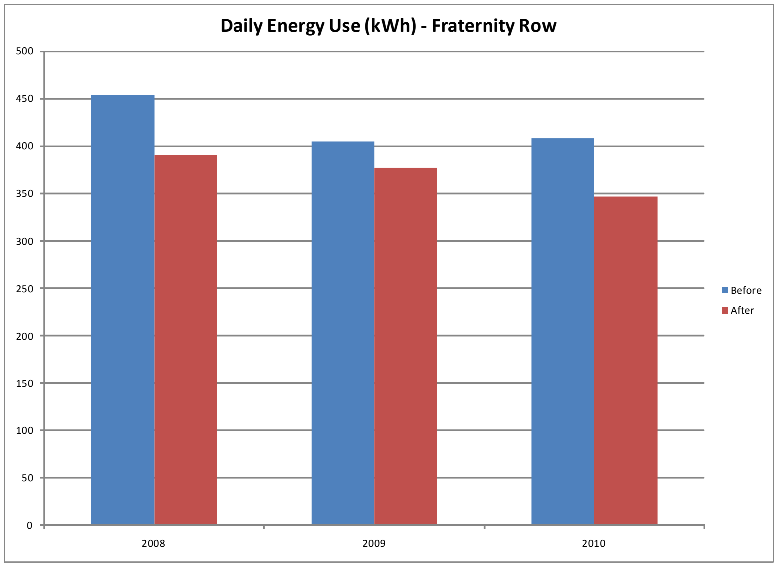

Figure 3: Daily Energy Use (kWh) - Before/After

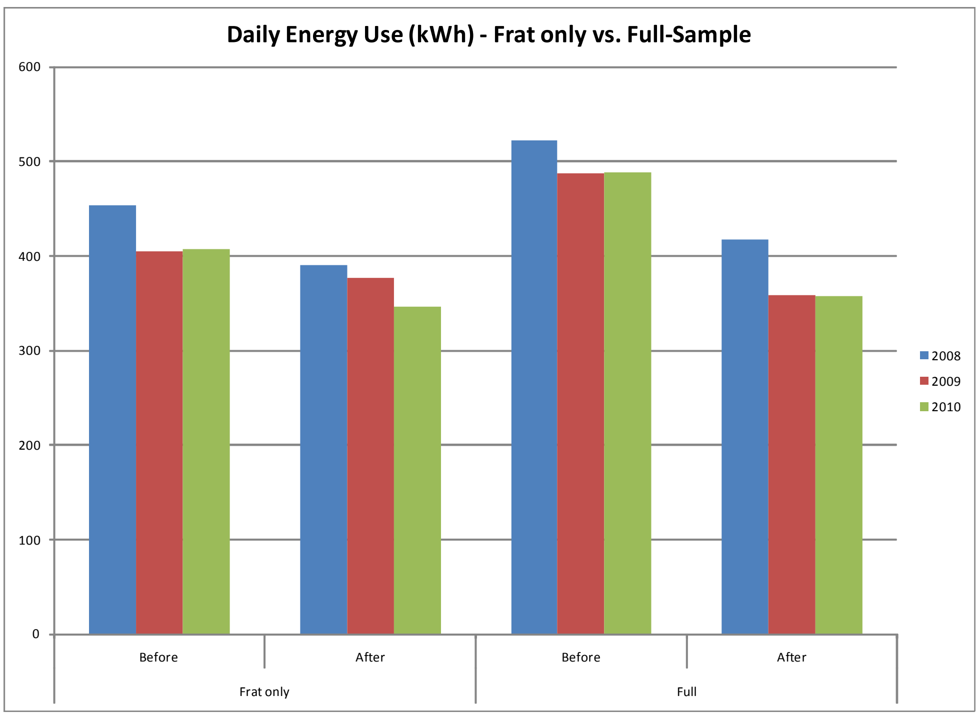

Figure 4: Daily Energy Use (kWh) - Before/After – Frat only vs. Full

Variables List	
TREAT	Whether a dorm experienced competition (1=Greek/North Campus, 0=South Campus)
COMP	Competition period
TAVG	Daily Average Temperature (F)
DOW	Day of the Week (Sunday-Monday)
YEAR	Academic Calendar Year
HOLIDAY	Thanksgiving period

Table 1: List of Variables

Fixed Effects Regression		
	Frat b/se	North Campus b/se
TREAT*COMP		
2010	-0.267***	0.089***
	(0.008)	(0.018)
2009	-0.264***	-0.054***
	(0.008)	(0.018)
2008	-0.202***	
	(0.008)	
COMP		
2010	-0.043***	0.055***
	(0.007)	(0.013)
2009	0.031***	0.087***
	(0.006)	(0.012)
2008	0.022***	
	(0.007)	
TAVG	0.008***	0.011***
	(0.000)	(0.000)
DOW		
Monday	0.029***	0.022**
	(0.005)	(0.011)
Tuesday	0.031***	0.007
	(0.005)	(0.011)
Wednesday	0.020***	-0.003
	(0.005)	(0.011)
Thursday	0.033***	0.018
	(0.005)	(0.011)
Friday	0.015***	0.008
	(0.005)	(0.011)
Saturday	-0.062***	-0.079***
	(0.005)	(0.010)
_cons	5.752***	6.000***
	(0.013)	(0.020)
R2-within	0.63	0.35
N	8,668	5,197

*Other Control Variables – Year and Holidays are not shown for formatting purposes

Table 2: Fixed Effects Regression