

## **IRB Protocol Abstract**

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9/20/2010 Version

### **Principal investigators**

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### **Project title**

Starin Hall Electricity Monitoring and Behavior Study

### **Abstract**

The purpose of this pilot study is to explore a variety of casual factors that may contribute to electricity usage and potential reduction by residences of Starin Hall, the new residence hall at UW-Whitewater. Starin Hall, with individual real-time electricity meters in each suite, makes an ideal “living laboratory” in which to conduct such a study. Multiple factors such demographics and values/beliefs of residents will be used to assess their response to an experimental treatment – providing access to real-time information about their electricity usage (on the in-suite meters and through a web interface). The specific hypothesis to be tested is whether access to real-time information about electricity usage leads to behavior changes and energy usage reduction based upon some underlying value system of the residents. Baseline electricity usage will be collected in Fall 2010 without any treatment or resident access to the meters. In Spring 2011, the residences will be divided into a control and treatment group and both will be surveyed for background values and beliefs. The treatment group will receive training on electricity use reduction and have access to meter data. A post-treatment survey will assess resident views of the metering system.

# **IRB Protocol Summary**

9/20/2010 Version

## **Principal investigators**

Eric Compas, compase@uww.edu; Lance Weinhardt, lsw@mcw.edu; Jennifer Flad, fladj@uww.edu

## **Project title**

Starin Hall Electricity Monitoring and Behavior Study

## **Rationale**

Concerns about climate change and the environmental impacts of energy usage have raised many questions about how our society can reduce our CO2 emissions. Multiple studies (Sonderegger 1978, Dietz et al. 2009) have shown the potential for significant energy savings in residential energy usage through relatively simple behavior changes. The advent of low-cost tools providing real-time feedback of energy usage have increased the potential for household to monitor and reduce their energy usage (McCalley and Midden 2002). The basic theory holds that residents will reduce their electricity usage when provided more detailed and real-time information on their electricity usage. Multiple universities with on-campus real-time energy monitoring systems have effectively demonstrated energy reduction within dormitories using such systems (Petersen et al. 2007, Haeffner and Casalegno 2009) and others are proposing such studies (Brewer 2009). For multiple reasons -- consistent room designs, high degree of experimental control, and student interests -- residence halls are ideal locations to conduct such studies.

The new LEED-certified residence hall on the UW-Whitewater campus was built with an electricity monitoring system with a relatively unique degree of resolution. Each of the 109 suite-style residences (four people per suite) has its own electricity monitoring and reporting system which is capable of recording and reporting electricity usage at a specified time interval (up to once per second) both through a wall-mounted display and through a web-based monitoring tool. Studies conducted at other universities have utilized whole-building meters or, at best, meters for each floor. Given this resolution, Whitewater's new residence hall presents a novel opportunity to study residential energy usage in detail with a high degree of experimental control.

The purpose of this pilot study is to explore a variety of casual factors that may contribute to electricity usage and potential reduction by residences. These factors will include background characteristics of residents -- basic demographics, attitudes and beliefs, and exposure to training programs -- and an experimental treatment -- access to real-time information about their electricity usage (on the in-suite meters and through a web interface). The specific hypothesis to be tested is whether access to real-time information about electricity usage leads to behavior changes and energy usage reduction based upon some underlying value system of the residents. Future iterations of the study may test additional treatments such as incentives (contests and financial rewards) and various methods of delivering electricity information (web

vs. digital meter vs. social media). In terms of practical implications, determining which factors lead to a greater reduction in electricity usage by residence will allow for a thorough assessment of the effectiveness and limitations of new monitoring technologies in altering behavior.

## **Methodology**

**Summary.** This study will be conducted using a treatment and control group of hall residents. After an initial period in which baseline electricity use will be measured, all residents will be surveyed for various demographic, behavior, and attitude characteristics. Then, residents will be divided into two groups:

1. a control group which will not receive real-time electricity usage information or energy reduction training, and
2. a treatment group which receive both real-time electricity usage information and training about energy reduction.

Differences will be examined both pre- and post-treatment and between treatment and control groups to ascertain which factors are the best predictors of electricity use reduction. Data on daylight duration and daily weather, e.g. cloud cover, will also be used to control for variations in ambient light which may influence electricity usage (data is currently recorded hourly by the UW-Whitewater weather station and Dr. David Travis has granted permission for its use). After the treatment phase, residents in the treatment groups will be surveyed again to gauge responses to the electricity monitoring system and their assessment of changes to electrical usage. Open-ended, qualitative interviews of a select set of residents will also be part of the post-treatment data collection.

**Participants, groups, and training.** Students will be selected to participate based on their residency within Starin Hall. In the current 2010-2011 academic year, no Starin Hall residents are minors. Dr. Compas and Dr. Flad, both faculty at UW-Whitewater will be conducting the interviews, training program, and any person-to-person contact with students. Dr. Weinhardt, a faculty at the Medical College of Wisconsin, will only be assisting with the design of the study, analysis of data, and writing up the results.

Since Starin Hall is composed of two wings, each wing will be assigned to one group<sup>1</sup>. The training program, which will be provided only to the treatment group, will consist of a 30-minute presentation on how electricity is metered, the benefits of energy use reduction, and techniques for reducing energy use. The training will be given by Dr. Compas and/or Dr. Flad.

**Pre-survey.** The pre-survey will collect data on basic demographics, environmental attitudes, and suite usage information from each resident. The basic demographics will be compiled both from questions on the survey and from drawing from each students' university record. Environmental attitudes will be measured using Dunlap et al's revised New Environmental Paradigm survey (2000), a set of 15 Likert-scale questions which has been thoroughly reviewed and used within the literature (e.g. Hawcroft et al. 2010). The pre-survey will be advertised through each floor's weekly meeting. Students will have an initial opportunity to complete the

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<sup>1</sup>Random assignments are not reasonable in this scenario since some residents on a given floor wouldn't have access and would wonder why. By splitting groups by each wing, the wing without access can be told that the system in their wing isn't functional yet.

survey on-line. Non-respondents will be followed up with through email or phone and either asked to complete the on-line survey or given the option of completing it face-to-face. Face-to-face surveys will be conducted by Dr. Compas and/or Dr. Flad.

**Post-survey/interviews.** The post-survey will collect data on how students utilized the meters and data provided on the web, understood and used the electricity training, and thought about the metering. Data for the post-surveys will be collected using the same procedure as the pre-surveys. After the data has been analyzed, a smaller subset of residents will be interviewed (open-ended, semi-structured) to better determine the causal factors for decrease in electricity usage (or lack thereof). Interviewees will be chosen based on the results and will not be random. We will be interested in exploring the causal relationships in unique or interesting findings. These interviews will be arranged through phone or email with specific students or suite-mates and conducted by one or more of the PIs.

**Confidentiality.** Since detailed personal data will be collected that is not anonymous (student IDs will be linked to electricity usage, the values and attitudes survey, and student records), so the raw data will only be stored and used on the researchers' office computers. The data from this study will be used to analyze the difference between treatment and control groups. Future use of the data may include comparing results with future studies using different treatments (such as charging for electricity). Data will be shared amongst researchers only via email using password-protected "zip" archive files. Data will be archived on DVD and stored in Dr. Compas's office in Upham Hall for five years and then destroyed. Any reporting of the study's data will only include aggregate data -- no individual student's or individual suite's data will be used in any publication or report from the study.

**Risks.** There are potential risks to the interviewee which include:

- Perception by resident that their privacy is being invaded by electricity data collection.
- Potential conflicts between residents over electricity usage within the suite.
- Fear of repercussions from high electricity usage.
- Hazardous tinkering or altering electronic devices to alter or circumvent metering.

These risks are being minimized through a thorough consent form and a training program which emphasizes the voluntary nature of the research program and the lack of any penalties for using relatively large amounts of electricity. In addition, residential assistants within the hall will be aware of the study and will be asked to contact the PIs if they see or hear anything that concerns them.

## **Schedule**

- Fall 2010
  - Baseline monitoring of electricity data - no data reported to residents
  - Pre-survey of attitudes and values late in semester (early November)
  - Weather station ambient light meter monitoring device used to control for length of day and weather conditions
- Spring 2011
  - Begin reporting electricity data to 1/2 of residence hall suites through in-suite meters and web site, training by TAs and researchers about system and how to use it, data reporting on-line

- In-depth training for 1/2 of residence about electricity usage and the need to conserve (will be provided [Kill-A-Watt devices](#) to measure electricity draw of specific appliances)
- Post-survey and in-depth interviews in late April/early May to gauge resident response to the exercise
- Summer 2011
  - Publish result of initial study
  - Consider future phases of the study and additional factors to test

### **Expected results/outcomes**

The expected outcomes from this study are a better understanding of how electricity metering and monitoring can lead to behavior change and potential energy usage reductions. This study will also identify the potential causal factors for this behavior change. The results of this study will be submitted for publication and used for future research projects within this residence hall.

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# **Consent Agreement to participate in research project**

**Project title: Residence Hall Electricity Monitoring and Behavior Study**

**Researchers: Dr. Eric Compas, Dr. Lance Weinhardt, and Dr. Jennifer Flad, University of Wisconsin Whitewater**

This document outlines research being conducted on energy usage and reduction within the new LEED-certified residence hall on the UW-Whitewater campus. We ask that you read this document and ask any questions you may have before giving your consent to participate in this study.

## **Background Information**

The purpose of this study is to explore a variety of factors that may contribute to energy reduction by residences. More specifically, this research will look at the effect of basic demographics, attitudes and beliefs, electricity monitoring, and exposure to training programs on energy reduction.

This study will lead to a greater understanding of the determining factors in creating a greater reduction in energy usage by residents and this will allow for a thorough assessment of the effectiveness and limitations of new monitoring technologies within the buildings.

## **Risks and benefits of being in the study**

The study has the following risks:

- Residents may fear their responses will affect their standing within the residence hall
- Residents may encounter roommate tension over issues of electricity usage

The study has the following potential benefits:

- Increased understanding of factors needed for a reduction in energy usage
- Improved awareness for residences about energy use through training programs
- Improved understanding of the effects of delivering electricity information in various ways
- A generalizable theory of energy reduction behavior that can be applied to other campuses and other locales.

## **Survey procedure**

1. Review consent forms, ask any questions about consent, indicate the agreed level of confidentiality, and provide your signature
2. Answer a close-ended set of questions on the survey.

3. After reviewing the surveys, the researchers may contact you for an interview if you consent to do so.

All responses will be kept confidential and any quotes or summaries used in publications will not include names or specifics that could be traced back to individuals.

## **Confidentiality**

All information from survey respondents will be kept confidential. All identifying information will be kept separate from the surveys themselves. No names or identifying information will be used within future publications. No information will be seen by members of UW-Whitewater faculty outside of the principal investigators for this research project. No information given will be used to determine where you can live on campus; all information is strictly for research purposes.

## **Voluntary nature of the study**

Your decision whether or not to participate will not affect your current or future relations with the researchers or institution. If you decide to participate, you may withdraw your participation without penalty.

## **Contacts and questions**

The researchers conducting this study are:

Dr. Eric Compas  
Department of Geography and Geology  
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Director, Center for AIDS Intervention Research  
Medical College of Wisconsin  
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Email: [lsw@mcw.edu](mailto:lsw@mcw.edu)

Additional questions or concerns about the research can be directed to:

Denise Ehlen  
Director, Office of Research and Sponsored Programs  
800 West Main Street  
Whitewater, WI 53190  
Phone: 262-472-5212  
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### **Statement of consent**

I have read the above information. I have asked questions and have received answers. I consent to participate in the study.

(on-line version will have text boxes and check box for participant's name, email, and consent)

Name  
(Print) \_\_\_\_\_

Signature \_\_\_\_\_ Date \_\_\_\_\_

Signature of  
Investigator \_\_\_\_\_ Date \_\_\_\_\_

You will be given or emailed a copy of this form for your records.

# Residence Hall Electricity Behavior study - Pre-treatment survey

The goal of this survey is to gauge residents environmental views and energy habits and behavior within the new Starin Residence Hall. The survey is part of a broader study examining electricity usage within the residence hall. The survey should take approximately 20 minutes to complete and all published results from the survey will be completely anonymous. No individual or suite data will be made available or published to roommates, residential assistance, or university personnel besides the faculty members conducting the study. If you have any questions or concerns about this survey, please contact Dr. Eric Compas ([compase@uww.edu](mailto:compase@uww.edu), 262-472-5126).

## General information

1. Name \_\_\_\_\_
2. Student ID \_\_\_\_\_
3. Suite # \_\_\_\_\_
4. On average, how many hours per week are you working at a job while school is in session?
  1. None
  2. 1-10 hour per week
  3. 11-20 hours per week
  4. 21-30 hours per week
  5. More than 30 hours per week
5. How much money did you take out in student loans for the 2010-2011 school year?
  1. None
  2. Less than \$2,000
  3. \$2,001 - \$5,000
  4. \$5,001 - \$10,000
  5. More than \$10,000
6. What is your parents' approximate annual income?
  1. 0 - \$20,000
  2. \$20,001 - \$50,000
  3. \$50,001 - \$100,000
  4. \$100,001 - \$200,000
  5. More than \$200,000
7. Political party to which your beliefs are most closely aligned:
  1. Republicans
  2. Democrats
  3. Libertarians
  4. Greens
  5. Other

## Individual knowledge, values, and beliefs

Please check the your level of agreement with the following statements.

Statement	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
I believe that my personal actions can make a difference					
I would call myself environmentally conscious					
Global climate change is occurring					
Global climate change is predominately caused by humans					
Conservation saves money					
Taking care of nature is part of our duty to God					
I try to recycle everything that the University collects					
My parents were conscientious about electricity usage at home					
The university should make all efforts to reduce electricity use within the residence halls					
We are approaching the limit of the number of people that the earth can support					
Humans have the right to modify the natural environment to suit their needs					
When humans interfere with nature it often produces disastrous consequences					
Human ingenuity will insure that we do NOT make the earth unlivable					
Humans are severely abusing the environment					
The earth has plenty of natural resources if we just learn how to develop them					
Plants and animals have as much right as humans to exist					
The balance of nature is strong enough to cope with the impacts of modern industrial nations					
Despite our special abilities humans					

are still subject to the laws of nature					
The so-called "ecological crisis" facing humankind has been greatly exaggerated					
The earth is like a spaceship with very limited room and resources					
Humans were meant to rule over the rest of nature					
The balance of nature is very delicate and easily upset					
Humans will eventually learn enough about how nature works to be able to control it					
If things continue on their present course, we will soon experience a major ecological catastrophe					
I care about how my roommates view me					
I don't want to be viewed as controlling by my roommates					
I don't like some of my roommates behavior					
I am good friends with my roommates					
I am able to discuss problems or concerns with my roommates					
I know most of the other students on my floor					
I know most of the other students in Starin Hall					
I participate in most of my floor's activities					
I socialize very little with my floor mates					
My residential assistant (RA) does a good job at bringing the floor's residents together					
I know how electricity is measured for an electrical bill					
I know what a kilowatt-hour is					
I am aware of how much electricity I use in a month					
I am not concerned about my electricity usage since I don't directly					

pay for it					
I would be more concerned about my electricity usage if I had to pay for it					

## Individual habits and behavior

Please indicate how often you do the following

Statement	Always	Mostly	Sometimes	Rarely	Almost never
I turn off the lights when leaving an empty room					
I turn off or suspend my computer when I am finished with it					
I have energy-saving settings turned on in my computer					
I unplug my chargers (cell phone, music player) when not in use					
My parents made me turn off the lights in my room when I lived at home					
I have or would purchase a fuel-efficient vehicle					
I turn off the water when I brush my teeth					
I make sure the windows are closed when the air conditioning is on					
I buy organic, Fair Trade, or other environmentally-friendly products when they are available					
I measure how many miles per gallon my vehicle gets					
I walk or ride a bike instead of driving when the weather permits					
I will spend more to purchase a health or environmentally-friendly product					
I take shorter showers to conserve water					
I will ask my roommates to turn off their electronic devices					
My roommate will ask me to turn off my electronic devices					

# Residence Hall Electricity Behavior study - Post-treatment survey

The goal of this survey is to gather information about electricity usage and knowledge within Starin Residence Hall. The survey is part of a broader study examining electricity usage within the residence hall. The survey should take approximately 20 minutes to complete and all published results from the survey will be completely anonymous. No individual or suite data will be made available or published to roommates, residential assistance, or university personnel besides the faculty members conducting the study. If you have any questions or concerns about this survey, please contact Dr. Eric Compas ([compase@uww.edu](mailto:compase@uww.edu), 262-472-5126).

## General information

1. Name \_\_\_\_\_
2. Student ID \_\_\_\_\_
3. Suite # \_\_\_\_\_

## Questions for residents within treatment group

1. How often, on average, did you look at the electricity meter on the wall in your suite?
  1. Never
  2. Once a month
  3. A few times a week
  4. Once a day
  5. Several times a day
2. Which statement best characterizes how useful you found the information from this meter:
  1. I understood the meter's readings, and it helped me manage our electricity usage in the suite
  2. I understood the meter's readings, but it didn't help me manage our electricity usage in the suite.
  3. I partially understood the meter's readings, and it helped me manage our electricity usage in the suite.
  4. I partially understood the meter's readings, but it didn't help me manage our electricity usage in the suite.
  5. I did not understand the information that the meter provided.
3. Any additional comments about what you liked or didn't like about the in-suite meters?  
\_\_\_\_\_
4. How often, on average, did you look at the electricity usage website?
  1. Never
  2. Once a month
  3. A few times a week
  4. Once a day
  5. Several times a day
5. Which statement best characterizes how useful you found the information from this meter:  
\_\_\_\_\_

1. I understood the website's data and graphs, and it helped me manage our electricity usage in the suite
  2. I understood the website's data and graphs, but it didn't help me manage our electricity usage in the suite.
  3. I partially understood the website's data and graphs, and it helped me manage our electricity usage in the suite.
  4. I partially understood the website's data and graphs, but it didn't help me manage our electricity usage in the suite.
  5. I did not understand the information that the website's data and graphs provided
6. Any additional comments about what you liked or didn't like about the electricity usage website?
- 
7. Having access to my electricity usage information led me to (check all that apply)?
1. Reduce my electricity usage
  2. Increase my electricity usage
  3. Do nothing differently
  4. Talk to my suite mates about our electricity usage
  - 5.
8. How often did you talk with your suite mates about electricity usage?
1. Never
  2. Once a month
  3. A few times a week
  4. Once a day
  5. Several times a day
9. Did you influence your suite mates to use less electricity?
1. All of them
  2. Some of them
  3. Didn't need to influence them - they use less energy than I do
  4. Didn't need to influence them - they tried to convince me
  5. Didn't try to influence them
10. If you influenced your suite mates to use less energy, how did you do it?
1. By talking with them
  2. Leading by example
  3. Turning off their stuff
  4. Additional comments: \_\_\_\_\_
11. If you attempted to reduce your electricity usage during the past semester, how did you do it (check all that apply)?
1. I turned off lights when leaving a room
  2. I turned off the power strip for my computer when not in use
  3. I shut down or put on standby my computer when not in use
  4. I used my electric appliances less
  5. I spent less time in my suite and more time in library or other locations
  6. Other: \_\_\_\_\_
12. Did you check out and use the Kill-a-Watt to measure electricity usage of some of my appliances?
1. Yes
  2. No
13. What did you like or dislike about the Kill-a-Watt?
- 
14. Did you decreased the amount of time you used particular appliances after using the Kill-a-Watt?

1. Yes
  2. No
15. Which appliances?
- 

## Training program

The following questions are about the electricity training program in Starin Hall and access to the Kill-a-Watt tool. Please check the most appropriate box.

Statement	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
I found the electricity training program useful					
I learned something new about electricity in the training program					
The training helped me better understand the data that my suite meter is providing					
The training helped me better understand the data that the energy website is providing					
I learned how to use a Kill-a-watt to measure the electricity usage of an appliance					
The professor giving the training was knowledgeable about this subject					

What did you like best about this training?

What did you like least about this training?

General comments about the training:

## Individual habits and behavior

Please indicate how often you do the following

Statement	Always	Mostly	Sometimes	Rarely	Almost never
I turn off the lights when leaving an empty room					

I turn off or suspend my computer when I am finished with it					
I have energy-saving settings turned on in my computer					
I unplug my chargers (cell phone, music player) when not in use					
I make sure the windows are closed when the air conditioning is on					
I will ask my roommates to turn off their electronic devices					
My roommate will ask me to turn off my electronic devices					

## Individual knowledge, values, and beliefs

Please check the your level of agreement with the following statements.

Statement	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
I believe that my personal actions can make a difference					
I would call myself environmentally conscious					
Global climate change is occurring					
Global climate change is predominately caused by humans					
Conservation saves money					
Taking care of nature is part of our duty to God					
I try to recycle everything that the University collects					
My parents were conscientious about electricity usage at home					
The university should make all efforts to reduce electricity use within the residence halls					
We are approaching the limit of the number of people that the earth can support					
Humans have the right to modify the natural environment to suit their needs					
When humans interfere with nature it often produces disastrous consequences					
Human ingenuity will insure that we do					

<del>NOT make the earth unlivable</del>					
Humans are severely abusing the environment					
The earth has plenty of natural resources if we just learn how to develop them					
Plants and animals have as much right as humans to exist					
The balance of nature is strong enough to cope with the impacts of modern industrial nations					
Despite our special abilities humans are still subject to the laws of nature					
The so-called "ecological crisis" facing humankind has been greatly exaggerated					
The earth is like a spaceship with very limited room and resources					
Humans were meant to rule over the rest of nature					
The balance of nature is very delicate and easily upset					
Humans will eventually learn enough about how nature works to be able to control it					
If things continue on their present course, we will soon experience a major ecological catastrophe					
I know how electricity is measured for an electrical bill					
I know what a kilowatt-hour is					
I am aware of how much electricity I use in a month					
I am not concerned about my electricity usage since I don't directly pay for it					
I would be more concerned about my electricity usage if I had to pay for it					