

# GreenLite: Unplug, or the Polar Bear Gets It!

## Information Visualization System to Encourage Behaviors That Conserve Resources

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### Purpose

Climate change is an issue everyone needs to understand and work to mitigate. While innovations in renewable energy are critical, research shows that changing energy-use behavior has become increasingly important in the fight against global warming. We believe that if people feel both an intellectual and emotional connection between daily actions and their adverse effects on the environment, they will make better choices around resource use. We combine computer graphics, art, engineering, sociology, environmental science, systems-thinking and behavioral psychology to turn real-time energy use data into an interactive display.

### The System: How it Works

**Data Retrieval:** We collect data from meters (ie. power, water, heat, printer usage). We poll data over modbus tcp or through xml web services. The poller stores its meter readings in a MySQL database.

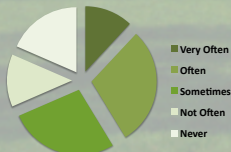
**Data Aggregation:** We compute aggregates on various time lengths for power consumption data and store these for analysis and graph generation. In addition, we aggregate data from several meters together to compute power consumption at building and campus-wide levels

**Data Analysis:** We crunch the numbers to analyze short and long term behavior, measure trends, and identify areas for improvement. We compute a "mood score" based on a weighting algorithm that looks at historical data, recent data and other relevant factors, forecast what current energy use should be and compare that to the actual use. We do this every five seconds. The mood score communicates with the action script in the flash animation, desktop widget or in the Unity3D plugin to drive the proper animation.

**Display:** We approach data display as an opportunity to turn data into a meaningful story and teach about impacts, rather than a way to simply show numbers. Our displays try to be simple yet effective. The main display ties the health and happiness of an animated polar bear to the energy reduction "mood score". By creating an emotional connection between energy used and the impacts on the environment, people will be more motivated to change behavior and conserve energy.

**Social Networking:** We provide feedback in several ways to keep it fresh, hold attention and make it easy to access. A desktop widget, a facebook app, competition mode, a student carbon footprint calculator specific to Dartmouth, displays in public places and on the Dartmouth TV station, make GreenLite a part of the culture on campus.

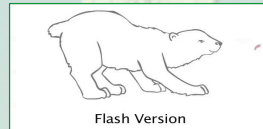
### How often has the GreenLite display encouraged you to adopt more energy efficient habits?



### Why it Works

GreenLite Dartmouth consists of an **information visualization** system that uses interactive animations to display **real-time** energy use data provided by digital metering systems. We motivate students to conserve energy through **behavioral changes**.

We start with an animated polar bear. When electricity use is low, for example, the bear is happy; when electricity use is high, the bear's health and happiness are endangered. The flash and 3D versions of the animation are pictured below.



We provide competition between dorms and floors, a desktop widget and a Facebook app. Students working together towards a common goal of **energy reduction** encourage each other to turn off electronics and lights to save the bear.

Students using the GreenLite system report they are more aware of their daily behavior and feel more engaged in conservation efforts. Forty percent of students who had a GreenLite system in their dorm reported a **shift in their over-all attitude** towards conservation and the environment. By grouping students together, as allies in the effort, we create new social norms and attitudes. We work with sociologists to better understand these trends and how to attract and maintain student interest.

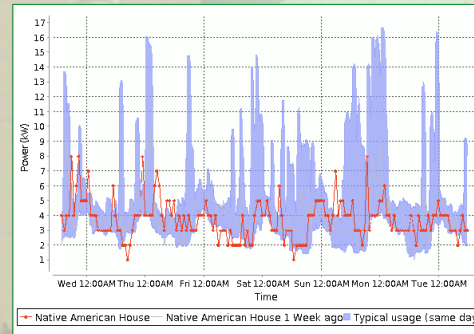
**HELP SAVE THE POLAR BEAR!**

**By reducing your energy use**  
The bear is happier the less energy we use in these buildings

It's easy to make a difference, and every small savings counts...

- Connect to a strip! Plug in many devices you can't use a power strip.
- Turn the strip off whenever you can! Disconnect the device or unplug it to a 100W safe energy consumption.
- Turn off your lights! Turn the lights in the bathroom - they DO save off your car keys.
- Take the stairs! The benefits of the stairs and walking is better than ever.
- Keep your computer in sleep mode! It can still use electricity and use CPU resources to run a 1000 programs per year.
- Keep your refrigerator as full as possible! A full refrigerator has energy that an empty one, so fill it up or take with a friend.
- Use a clothes line or rack to air dry instead of using a dryer!

To learn more, go to <http://greenlite.cs.dartmouth.edu>



### Results

•Reductions at Dartmouth average 10%, at Brooks School they average around 11%, and can be as much as 34%

- 80% of students look at the display when they pass it.
- 67% say the GreenLite system encourages them to adopt energy saving habits
- 48% say they adopt energy saving habits beyond those being monitored (start using drying racks for laundry).



"So far, this has greatly exceeded even my most optimistic forecasting. Everywhere I go on campus, it's all people want to talk about." (Brooks School Sustainability Manager)

"This is so cool. Everyone is totally into it and working together to turn things off." - Brooks Student

"It helps having a five-year-old who is madly in love with Pasha the bear and turns everything off to keep her happy." - Dorm parent at Brooks School

**GreenLite Dartmouth**  
Competition between dorm floors

The following is the ranking of dorms with GreenLite displays. Winners have the largest percentage of electricity reduction from Thurs-Thurs.

Rank	Meter	Weekly % change sorted by
1st	Native American House	-15%
2nd	Thomas	-9%
3rd	New Hamp 3	-5%
4th	EKT	-5%
5th	New Hamp 2	-5%
6th	Rauner/Bildner 2	-5%
7th	New Hamp 4	-4%
8th	New Hamp 1	-1%
9th	Rauner/Bildner 3	-0%
10th	SLC	-0%
11st	Rauner/Bildner 1	6%

### User Study

#### GreenLite Study (Dartmouth)

Question: What were students' energy habits and attitudes before GreenLite was launched?  
Result: Students were not concerned with energy consumption in their daily activities. (66%)

"The polar bear animation had the biggest effect because it made the problem seem more real and made me feel guilty."

"We held our sorority meetings in the dark to save the bear."

"I never thought of myself as an environmentalist but now I really care. I look for ways to save energy and tell my friends to do the same."

