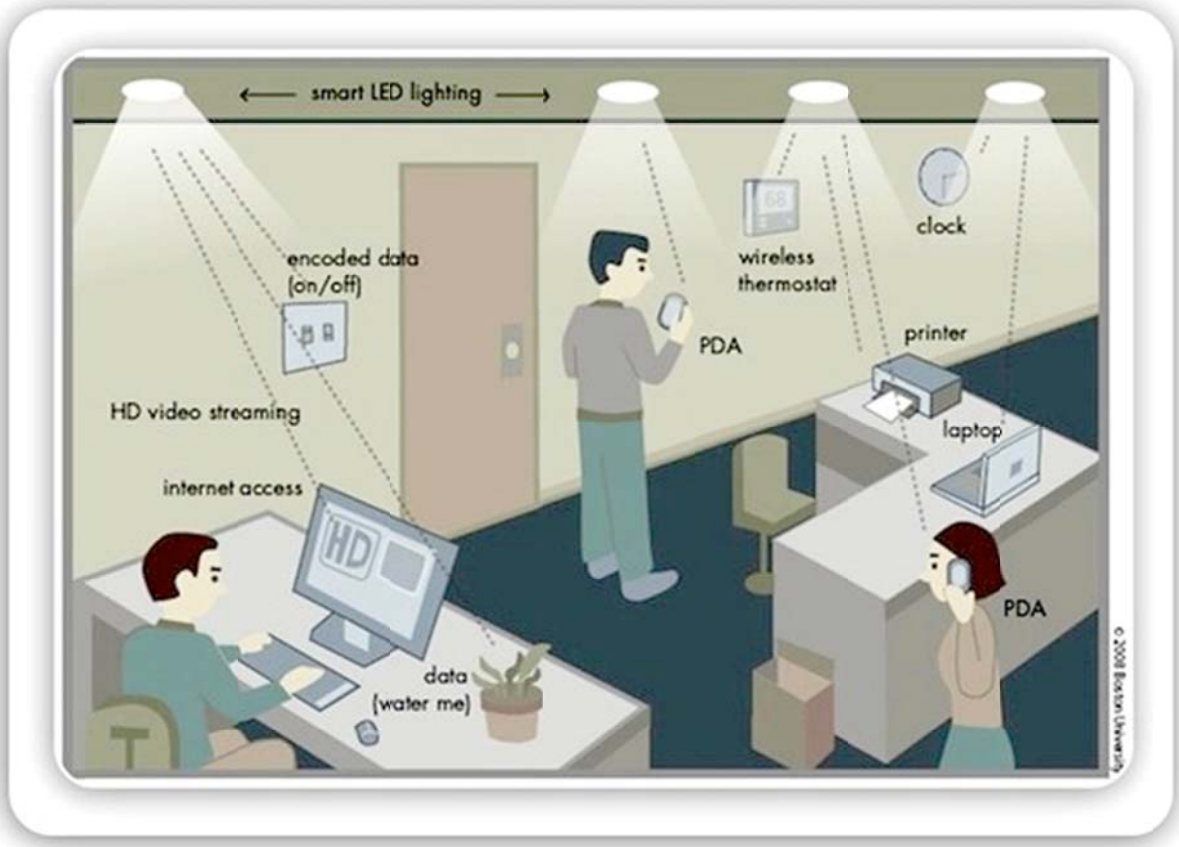
SMART LIGHTING

SMART LIGHTING ENGINEERING RESEARCH CENTER

Engineering Light for a Brighter Sustainable Future

Boston University Energy Club

Smart Lighting Challenge



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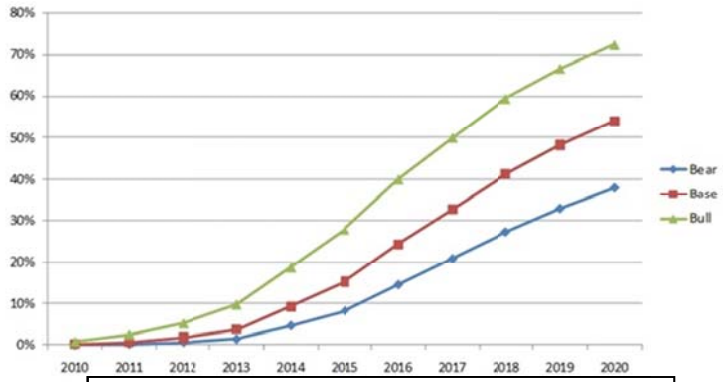
Overview

The Smart Lighting Engineering Research Center at Boston University is working to develop lighting technologies based on solid-state LEDs, as opposed to traditional incandescent or compact fluorescent (CF) bulbs. The possibilities presented through the use of such a lighting system have the potential to significantly alter not only the energy usage and lighting, but also in communications, building management systems, and operational planning. The center also focuses on entrepreneurial opportunities, and has developed an LED lighting device (a bulb or luminaire) called GreenLight that is not only more efficient than conventional lighting; each bulb also has an IP address which allows it to be controlled over the internet as part of an overall building lighting system. Your challenge is to present the most compelling argument for the development, improvement, or deployment of these new technologies.

GreenLight

The higher price of LED bulbs is offset by their longevity—typically 30,000 to 50,000 hours. In contrast, CF bulbs last about 5,000 hours, and incandescent bulbs last 1,000. Additionally, with 90% of the energy of an incandescent bulb lost to heat, LEDs can reduce air conditioning costs, and unlike CF bulbs, contain no mercury. On a large scale, worldwide deployment of solid-state lighting can result in financial savings of $18 trillion over a 10 year period. Although still in its early stages, (fig. 1) as solid state lighting becomes more widely adopted, the potential for energy savings will be greatly increased.



In addition to the efficiency savings, the unique aspect of GreenLight is the degree of control that the IP address gives the lighting system. Through this IP address, software applications can control the light in various ways, such as on/off, dimming, and varying the color.

Additionally, GreenLight will be equipped with sensors that will provide additional information on a per-bulb basis:

- **Motion Detection**: In order to prevent the lighting of unoccupied spaces, motion detectors ensure that only the rooms or areas of a building that are in use are illuminated.
- **Light Sensing**: through the use of light sensors, the system can adjust the level of brightness in a particular room. The amount of light output will modulate depending on the amount of natural light.
- **Heat Signature**: GreenLight can be equipped with sensors that can determine room occupancy based on the change in temperature of an area of a room due to each individual.

- **Localization**: The communication aspect of the lighting system can be used to locate mobile devices in the lighting field.

Common operating characteristics and assumptions of GreenLight include:

- GreenLight will be available in "bulb and "tube" formats. The tube format is expected to have less energy savings, but may be less expensive to manufacture.
- The bulb will be connected to a network infrastructure *(with either wired or wireless access).*
- GreenLight produces 120 lm/W (1200 lumens @ 10W)
- Typical 100W bulb: 12 lm/W (1200 lumens @ 100W)
- Typical T12 fluorescent tube: 60 lm/W (1200 lumens @ 20W)
- Average room uses 16 bulbs or tubes
- Average building has 500 rooms.

Currently, LED production costs are significantly higher than that of incandescent or compact fluorescent bulbs. However, as the technology gains acceptance and with volume production, new materials, and device development, these costs will fall. Additionally, although costs are expected to drop, in order to realize its unique qualities the following components must be integrated into every unit:

- Microcontroller, LED driver electronics, and PCB
- LEDs providing sufficient illumination
- Power conversion circuit (120VAC—DC)
- Heat sink
- Lens
- Enclosure

The Challenge:

The challenge is to present the most compelling argument for the development, improvement, or deployment of the GreenLight. Each team will deliver a 12 minute PowerPoint presentation, with five minutes of questions and answers from the judges. Imagine that this is your product, and you are pitching it to potential investors. Teams may use any outside resources as necessary for research. The scope of the submission can be as broadly or narrowly focused as the submitting team decides; however, the submission should be focused on one or more of the following directions:

- *Control strategies.* In addition to local information such as motion detection, light sensing, and heat signature, the GreenLight has the ability to incorporate information from external sensors into its decision making software, which can control the luminosity over a continuous spectrum. Therefore, submissions may include suggestions for control strategies for the lighting system, as well as suggestions of external sensors that could be deployed and included in control strategies. These strategies should consider energy saving as a primary motivation.

- *Communication Capabilities.* Submissions may include ideas for utilizing the two-way communication and localization capabilities of the GreenLight.
- *Building Management Systems.* Submissions may explore tying in the GreenLight with the building management system as a whole, and consider how the building itself may interact with the grid (assuming a Smart Grid future, or not) to connect the consumer and utility sides of the meter.
- *Community-level incorporation.* Submissions may consider how the deployment of GreenLights throughout a 'neighborhood,' may impact and improve quality of life within the local community.
- *Optimal production strategies.* Submissions may consider the design of the device, and optimize with respect to manufacturing costs or environmental impact.
- *Entrepreneurial opportunities.* Submissions may provide a deployment strategy from a business prospective including customer identification and characteristics, pricing models, and purchaser and user identification.

Criteria:

In general, presentations should be as creative and innovative as possible while remaining practical. Please explain all assumptions, and provide backing sources if possible. The submissions will be evaluated according to:

- *Feasibility of ideas*. Although reasonable underlying assumptions can be made, ease of implementation will be considered.
- *Topics addressed.* The goal of the competition is not to address all of the challenges described above, but to do a good job addressing a more narrow scope. Teams will have leeway to determine which areas are most important or relevant. In this way, there will be more variety among the presentations.
- *Explanation of logic and reasoning.* The teams that better present their arguments will be rewarded. The judging will favor the team that is better able to construct a proposal and convince the judges, rather than "the one that got the answers correct."

Any outside resources can (and should) be utilized, and a good start for understanding the technology can be found at: www.bu.edu/smartlighting

Good Luck, and have fun!

Fig 2: Web-Enabled LED lighting Prototype

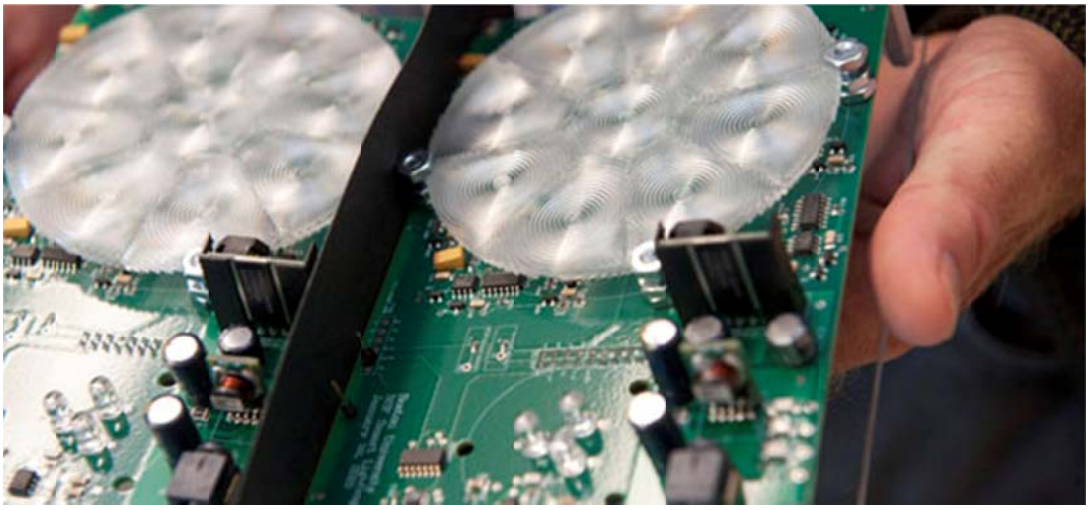


Fig 3: Consumer version of LED light

Smart Lighting Challenge Information: April 9, 2011

Teams should check in at 3:00 at the Boston University School of Management atrium (595 Commonwealth Ave, Boston, MA) and receive their room assignment. The first round will be held simultaneously in three separate rooms starting at 3:15. Please send an electronic copy of the presentation (PowerPoint preferred) to buenergy@bu.edu by 3:00, as well as be prepared to load it onto the classroom projector.

At 5:00, teams should report to the dining room on the 4th floor, where dinner will be served. If there are any dietary restrictions, contact Eric Power at epower@bu.edu (Chicken will be served, but a vegetarian option is available—please specify in advance). Please note that while there is no specific dress code for the event, jeans are not allowed in the executive dining room.

Following dinner will be a keynote address by Dr. Robert Karlicek, the director of the Smart Lighting Research Center. After the address, the winning team from each room will be announced, and they will present again to the final round judging panel.

Following the judges deliberations, the winners will be announced, and the reception will continue for the remainder of the evening.