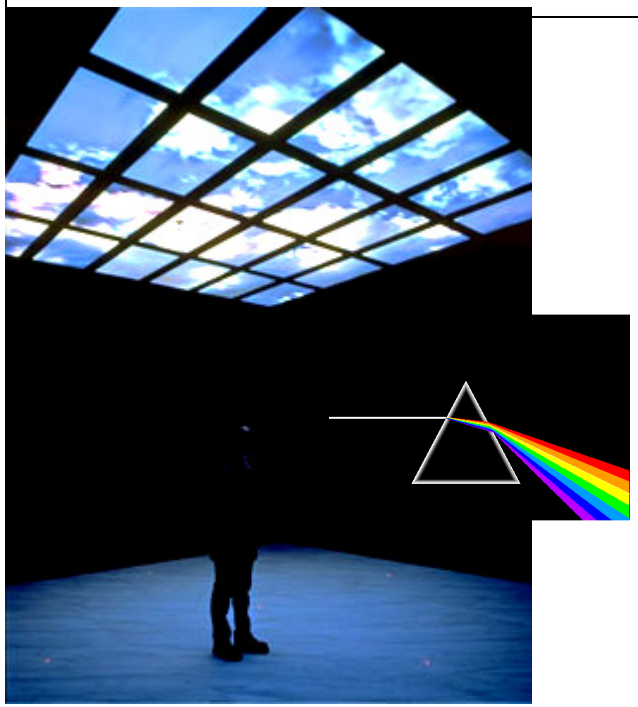
ZERO ENERGY LAB,
ENERGY-EFFICIENT LIGHTING DESIGN WITH L.E.D

IPRO 337



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WHAT ?

Design a lighting system that incorporates existing and emerging energy-efficient lighting technologies into an existing 6,000 ft^2 space, thereby adding to the transformation of the space into a new useful zero-energy lab. The only source of power supplied came from a 5.5 kW photovoltaic panel.

WHY ?

To save money AND making the Earth's atmosphere cleaner by reduction in electricity usage. Electricity is generated from coal-fired power plant that releases CO_2, the primary cause behind global warming.

WHERE ?

Most of the construction and mock up were done on the 4th floor of IIT Machinery Hall. The final design can be implemented in residential or commercial space everywhere.

WHO?

The group made up of dedicated and hardworking students from a wide range of professional disciplines from engineering to computer science to architecture.

HOW ?

The design process has three main steps:

1. Study of space.
2. Products research.
3. Mock up and implementation.

***Step 1*:** Site visits were conducted. Data was collected (i.e. ceiling's height, windows' size, sunlight)

Step 2: Two categories of products were considered. Conventional light and LED light.

- Conventional lights are structures that supported T-type bulbs.
- LED lights are the emerging technology that has very respectable efficiency (more than that of the first case).

***Step 3*:** Fixtures were designed to further maximize the reflected light and improve lighting condition without using extra electricity.

OBSTACLES?

Time to obtain research on lighting technologies and agree upon which we should us delayed our process on reaching our ultimate goals of providing more analyzed data on our own designs and fixtures.

RESEARCH

Incandescent, the age-old problem.

Incandescent bulbs were eliminated right off the bat because of their extreme inefficiency (on average they are about 5% effective, this translate to roughly 80-90% power wasted!).

Fluorescent, tried-and-true.

Fluorescent bulbs are the preferred type of lighting among energy-conscious consumer. They offered better efficiency, longer life hours and use less power.

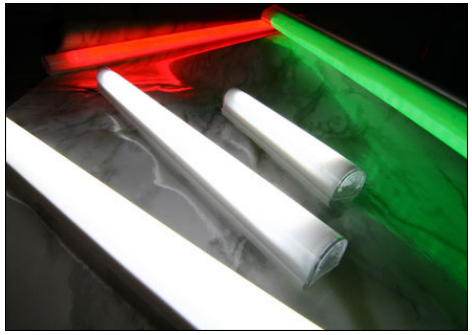
LED, the emerging player

LED-base lighting applications are slowly becoming more readily available to the public through various manufacturers on the internet. LED light has very low power consumption rate and lasts five times as long as the conventional bulb. The drawbacks are development cost and solid-state technologies which make it slightly more expensive with a so-so light output.

NOTABLE PRODUCTS

- *Axis Daylight Harvesting Dimming Ballast* from Axis Technologies, Inc. This ballast's most attractive feature is the incorporation of a light sensor built into the fixture. User can set the light level to maintain and whenever there are too much light, the ballast will dim the bulbs in the fixture.

- **Sealed LED Tube Light** from the LED manufacturer LEDtronics, Inc.
  This sealed LED tube provides respectable light output at a convenience sizes (12'', 24", 48"). The cost is comparable to that of fluorescent with a life rating of more than 100,000 hrs. This is one of the better candidates for general illumination purpose in the design.



IMPLEMENTATION

One section of the space was selected for the team to design mock-up. Three components of the mock-up are:

1. The scoop.
2. The light.
3. The fixture.

The scoop is used to reflect sunlight from the upper windows on to the floor. It is positioned directly across from the windows.

The lights were T-type bulb and sealed LED tubes. NO incandescent.

The fixtures are used to prevent light from propagating upward (nothing is on the ceiling so this translate to light lost) and were made up of Aluminum flashing.

USABILITY

The lights are available at www.ledtronics.com and www.axistechnologyinc.com . Other materials are readily available at local home improvement stores. All of these make the project accessible for everyone and thus the usability is extremely high.