XIII- Lighting

- Lamps
  - “Light Bulbs” are referred to as lamps.
  - Light output is measured in lumens.
  - The amount of light reaching a surface is the illuminance and is measured in footcandles.
  - Lamp efficiency is called efficacy and is measured in lumens/watt.
  - Lamp types include:
    - Incandescent
    - Fluorescent
    - High Intensity Discharge (HID)
    - LED
    - Induction fluorescent

Narration:

Different types of lamps (bulbs) are labeled by their metric length. For example, T12 lamps are 12/8 of an inch (an inch and a half). T8 is 8/7 of an inch (one inch). T5 is 5/8 of an inch. T5 does not fit well into a T8 lamp.

Switching from T12 to a new T8 will generate about 30 percent savings, which is a standard recommendation in buildings. The amount of light output is measured in lumens, which determines the efficacy (efficiency of lighting).

The cost of LEDs is beginning to come down, but these are still relatively expensive. For example, a T8 lamp is roughly $3. An LED retrofit may cost around $25. However, by going from 40 watts to 32 watts, the savings is about 30 percent.
• **T8 and Electronic Ballasts**
  - High Performance “Super” T8 systems can produce energy savings as high as 40 percent over standard T8.
  - To identify a Super T8, look for lamps that are at least 3,100 initial lumens (as opposed to 2,850 for a standard T8) and have a barrier coat design and high lumen maintenance.
  - Super T8 lamps include the 800 series SYLVANIA “Octron,” Philips “Advantage” and GE “HL.”
  - Ballasts include the SYLVANIA “Xtreme,” Advance “Optanium,” Universal Triad “HE” and GE “UltraMax.”

**Narration:**

Although some T8s were originally more efficient than others, the modern high performance T8s are generally all efficient. The high efficiency T8s are the 800 series lamps, while the 700 series was the previous version. Magnetic ballasts should also be replaced with electronic ballasts, and that combination of the two is what makes it more efficient. The lamps cannot be replaced alone.
• Lamp Efficacy

The energy performance of lamps is expressed as efficacy which is a measure of light output, in lumens, per watt of electrical input (lumens per watt). The efficacy of a regular incandescent light bulb is only a fraction of the efficacy of a fluorescent bulb.
- **T12 to T8 Retrofit**
  - It’s standard to go from 4 lamp T12 to 3 lamp High Performance T8.

**Narration:**

This is a little photo of a reflector that has been put in. Normally without a reflector, it would go from a 4 lamp T12 to a 3 lamp T8 because these produce more light, so you don’t need as many lamps. In this case, the school went from a 4 lamp T12 to a 2 lamp T8 with this reflector. Some larger stores, such as Target, have done this too. Many clients have also gone from 4 lamp T12 to 4 lamp T8.
• **T8 Choices**

  ![Image of T8 lamp]

  - This client is using reduced wattage 28W lamps and saving an additional 12%.

• **T5 Options**

  - T5 are the same efficacy as a high performance T8.
  - T5 lamps are a metric length so they require a new fixture.
  - But some designers like that since they can’t be mistakenly replaced with a standard T8 lamp.

• **U Tube T8**

  - These lamps are fairly expensive ($16) and many designers recommend just replacing the fixture.

  ![Image of U Tube T8 lamps]
HID to Fluorescent Retrofit

- Existing System:
  - 400 watt High Pressure Sodium and 400 watt Metal Halide
  - Each fixture uses 455 watts (400 for lamp, 55 for ballast)

- Retrofit:
  - Each fixture uses 234 watts (lamps and ballast combined)
  - Light levels increased 10-20%
  - Instant on is a huge benefit for schools.
Narration:

In gyms and warehouses, HID (high intensity discharge) high bay lights are being replaced with fluorescent high bay lights. The color of these lights is less harsh and yellow than the HID. Gyms like it because these lights turn off instantly and turn on instantly. If you turn the HID lights on and off, there’s a 5 to 10 minute wait period before they turn back on, which is a safety concern as well. So people would leave these lights on all the time, but now a high school gym can just turn these lights off when they’re not in there. They also save about 50 percent of the wattage.

- Exterior LED
  - LED Parking lot fixtures mainly save energy by having better directionality.

  - There is also potential for occupancy sensors, and dimming.
Narration:

Above is a before and after of a parking lot that was retrofitted with LED. It’s a much nicer white light, and a much better distribution as opposed to little cones. In places with cameras, it is easier to distinguish yellow cars from red or green ones. There’s also a 50 percent reduction in exterior lighting when switching from HID to LED. An engineer or lighting designer can ensure this is being done correctly.

- **LED Traffic Signals**
  - Application is very popular.
  - Energy savings 50 to 75 percent.
  - Good LED application: directed light and switched on and off.

Narration:

Many traffic signals are now using LEDs rather than incandescents, which means the signals are now using 90 lumens per watt rather than 10 lumens per watt.

**LED Exit Signs**

- Payback is quick: $30/$30/yr= 1 yr
- Rebates available
- Very basic lighting energy savings measure
- Chicago requires more expensive versions
Narration:

LED Exit Signs are on 24/7. Rather than using $34 per year, these are now using $30 per year. (use or save)? These cost about $30 to install. Unless an entirely new fixture is required, this is a standard retrofit. Chicago, for instance, requires the more expensive metal fixture, which is about $100 to retrofit.

- **Street and Parking Lot Lighting**
  - Probe Start HID to Pulse Start HID a typical retrofit
  - Fluorescent Induction, and LEDs making moves into market
• **Probe vs. Pulse Start**
  - Probe start has 3 leads
  - 460W Probe to 320W Pulse