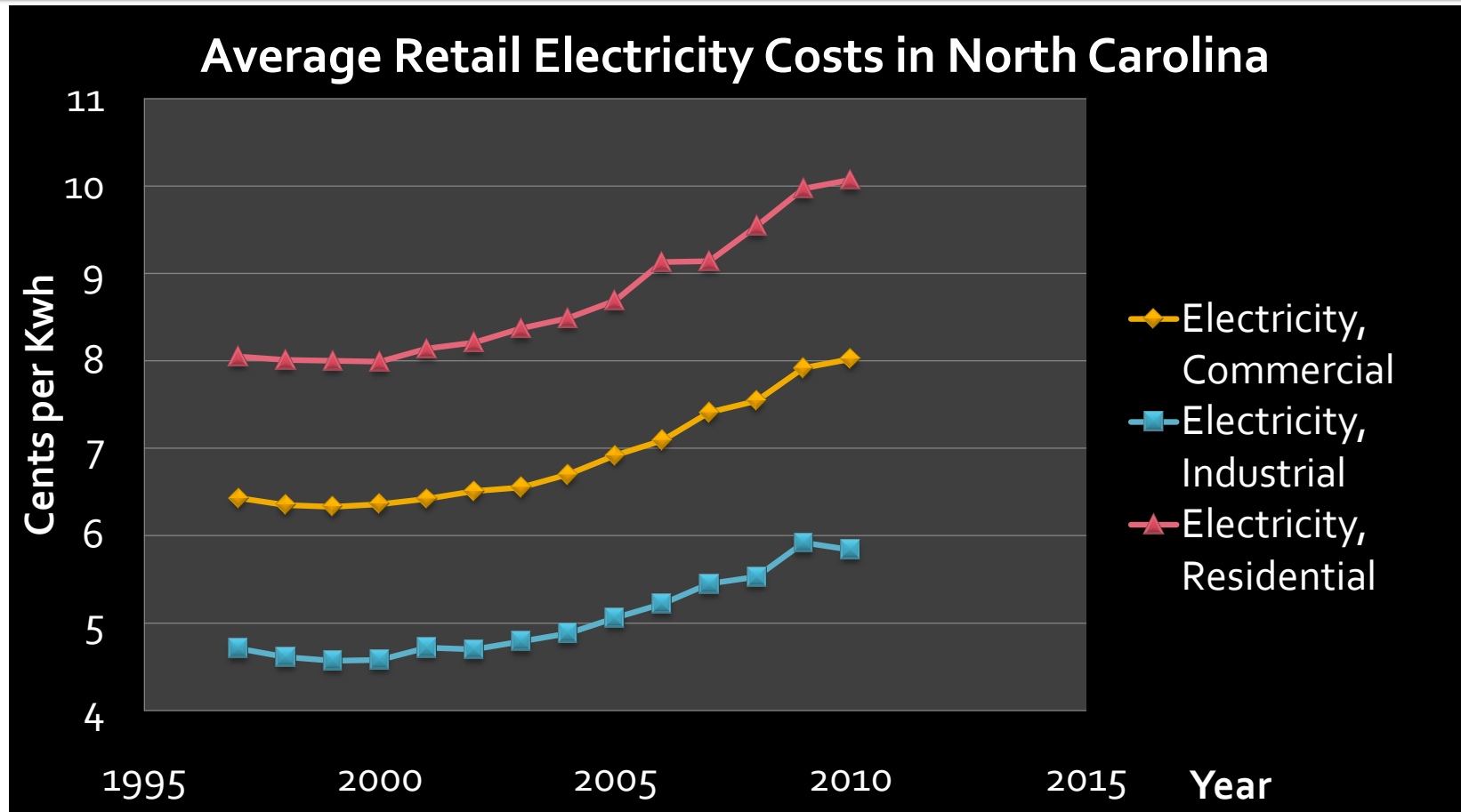


Waste Reduction Partners:

LIGHTING ENERGY EFFICIENCY



Energy Cost Trends



Source: EIA

- Lighting typically accounts for 20 to 30% of a building's energy usage
- Upgrading older fluorescent fixtures can reduce lighting energy cost by 1/3.

Lighting Basics

How much light is enough?

- Illuminating Engineering Society of North America (IES) sets officially recognized standards
- Measured in foot candles

<u>Space / Task</u>	<u>Foot candles, fc</u>
Typical Offices	30-50
K-12 Classrooms	50
Lobbies , Reception Areas	<20
Hallways	30
Public Assembly	10-20
Parking Garage	10

Lighting Basics

Linear Fluorescent Lamps Rated By:

- Length
- Diameter (T12 = 1.5 inch, T8 = 1 inch, etc)
- Watts
- Lumens (light output)
- Rated Life (hours)
- Color Rendering Index, CRI
(current lamps adequate for general purpose)
- Color Temperature

Lighting Basics

Color Temperature

- Measured in degrees Kelvin
- Increasing temperature shifts from yellow to blue

Incandescent

- 2700K – Typical warm yellow color

Fluorescent lamps

- 3000K - Warm, personal (restaurant, libraries)
- 3500K - Neutral, friendly (showrooms, bookstore)
- 4100K - Cool, neat, clean (classrooms, hospitals)

The right lamp color is important to creating a pleasing work environment

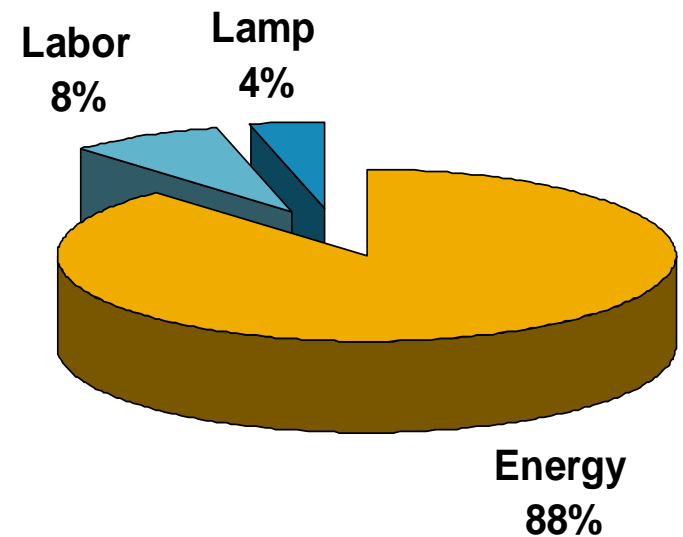
Ways to Save

No Cost

- Get staff to turn off lights in unoccupied areas
- De-lamp overlit areas

Modest Investment

- Upgrades or replacements
- Consider occupancy sensors



Energy cost dominates the life cycle cost of lighting equipment

Staff Training

One light switch in County Courthouse



- Controls 4 fixtures drawing 0.5 kW
- Turned on 56 hours in one week – about 2800 hours per year
- Costs \$94 per year

Turning switch off for 1 hour per day would save \$8 per year



Little steps add up to big savings when the entire staff contributes

Address Overlit Conditions



De-lamping

Remove 1 to 2 fluorescent lamps from a fixture

- Rule of thumb: Have at least two 4-foot lamps per 64 square feet
- Disconnect ballast for more savings
- Removing one T-12 lamp will cut cost by about \$8 per year

Reduce Lamp Wattage in Existing Fixtures

- 40 W to 32 W four-foot fluorescent
- 400 W to 360 W metal halide

Delamp vending machines

Save > \$50 per year



Upgrade Fluorescent Fixtures



Lamp and ballast replacement using existing fixture

- Older facilities are likely to have 1 1/2 inch fluorescent lamps (T12) with magnetic ballasts
- Replace with 1 inch high-performance fluorescent lamps (T8) and electronic ballasts
- 30 –39% higher system efficiency

Ave 64 watt reduction for 4-lamp fixture

$0.064 \text{ kW} \times 3000 \text{ hours} \times \$0.08 \text{ per kWh} = \$15 \text{ per year}$

Benefits of T-8 Lighting Systems

Electronic Ballasts

- 2 x life
- 30% more efficient, less heat generated
- No hum
- Can power 4 lamps, 120/277 voltages

Lamps

- Better color rendering (reds look red)
- Higher lumen per watt output
 - T-12 = 57 lumens per watt, T-8 = 90+ lumens per watt
- Dimmable
- Low mercury ratings
- Long life (25,000 – 36,000 hours)

Lighting Retrofit Example

T-12 to High-performance T-8 System

OLD

- 2' x 4' ceiling fixture with lens
- 4-lamp
- 2 magnetic ballast, .9 ballast factor
- Old lamps - some 40watt, some 34 watt

NEW

- 1 electronic ballast (instant start)
- Ballast factor .77
- 4 28-watt lamps
- Equivalent lumen output
- Less lumen depreciation over life of lamp

Lighting Retrofit Example

Cost / Benefit Analysis

➤ Energy and Cost Savings per Fixture

■ Fixture wattage	64
■ Annual kilowatts kWh (3000 hr/yr):	192
■ Annual Utility cost savings	\$15.36

➤ Project Cost per Fixture

■ Materials	\$27.00
■ Labor	\$20.00

➤ **Simple Payback (w/o rebates)** 3.05 years

Other Upgrade Considerations

Occupancy
Sensors

Dimmable
Ballasts

Dual Lamp
Switching

Task Lighting

Other Lighting Efficiency Opportunities

Exit Signs

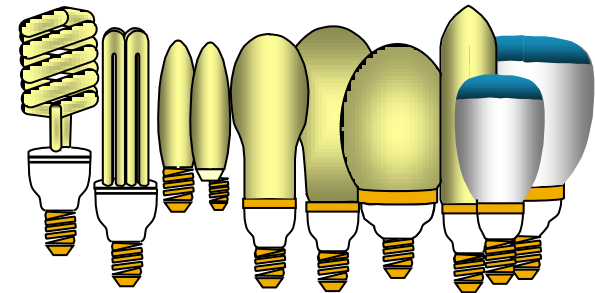


Replace 10-40 watt incandescent with 1-3 watt LED
25 watt reduction saves at \$.08 per kWh - saves \$18 per year

Incandescent Bulbs

Replace incandescent with compact fluorescent (CFL)

50 watt reduction saves at \$.08 per kWh - saves \$55 over the 10,000 hour life of the CFL



Caution: The common varieties of CFLs will not work with dimmers or outside.

2010 Energy Efficiency Measure Implementation Study - WRP

Energy Conservation Measure	Simple Payback Range	Percentage Implemented
Upgrade Lighting	2.7 – 5.0 years	64
De-lamp Vending	No-cost	25
Reduce Lighting	No-cost	50
Exit Light Upgrade	< 2.0 years	75
Occupancy Sensors	2.3-4.6	29

Resources

- **Your Utility Representative**
 - Energy Efficiency Rebate
- **Waste Reduction Partners**
 - www.wastereductionpartners.org
- **State Energy Office**
 - Grants , USI, Performance Contracting
 - Len Hoey - 919 733-1891
- **Division of Environmental Assistance and Outreach**

WRP Contacts

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