

HOME AND OFFICE ENERGY SAVINGS

Anthony Holden
Renowned Problem Solver
Alabama Technology Network
824-6289
Anthony.Holden@uah.edu
www.atn.org

Vanessa Ennis
Energy Manager
UAHuntsville Facilities
824-6242
Vanessa.Ennis@uah.edu
<http://energy.uah.edu>



**Alabama
Technology
Network**



AGENDA

- Energy Consumption Overview
- Heating, Ventilation, and Air Conditioning (HVAC)
- Hot Water
- Appliances
- Lighting
- Office Equipment
- Energy Vampires
- Water/Sewer
- Incentives
- Contact Information
- Feedback



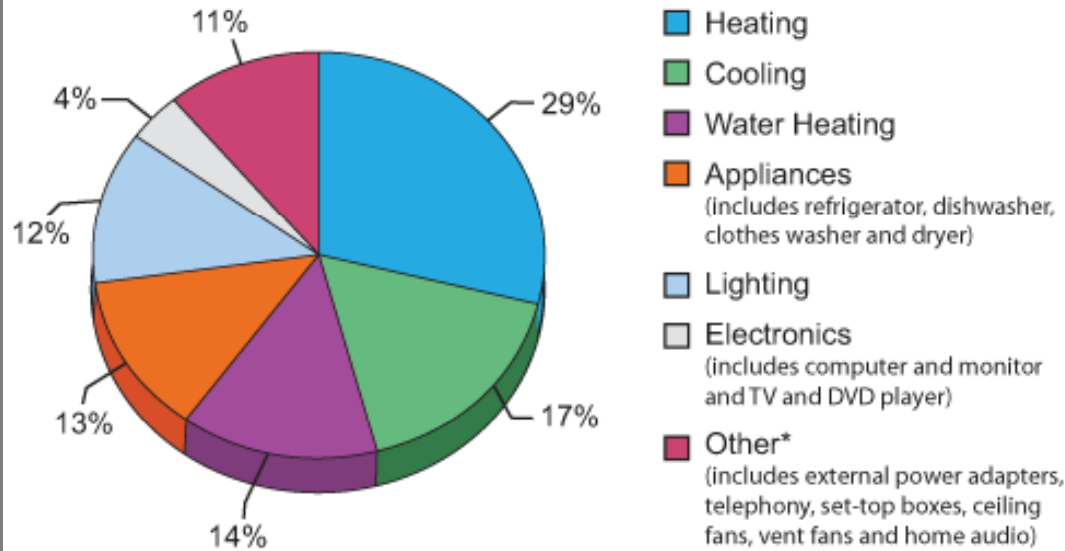
Alabama
Technology
Network



AVERAGE HOME ENERGY CONSUMPTION

Where Does My Money Go?

Annual Energy Bill for a typical Single Family Home is approximately \$2,200.



Source: <http://www.energystar.gov>

Average price of electricity is 11.3 cents per kilo-watt hour. Average price of natural gas is \$13.29 per million Btu.

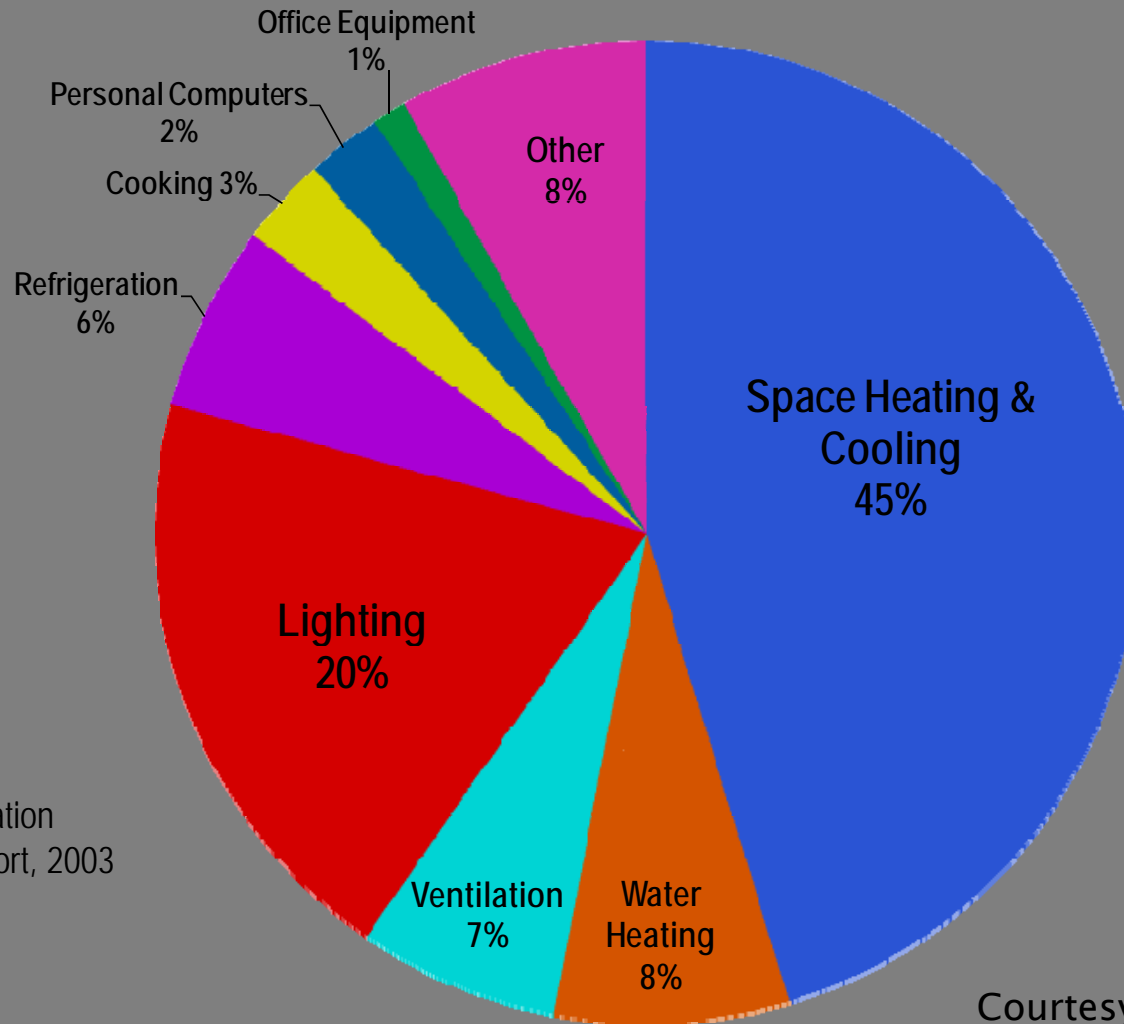
* "Other" represents an array of household products, including stoves, ovens, microwaves, and small appliances like coffee makers and dehumidifiers.



**Alabama
Technology
Network**



AVERAGE COMMERCIAL BUILDING ENERGY CONSUMPTION



Energy Information Administration Report, 2003

Courtesy of www.WRATT.org



FY 08-09

	Total cost	Total usage	
Electrical	\$3,791,322	44,713,864	kWh
Natural Gas	\$ 950,573	60,595,877	cubic feet
Water	\$ 129,135	59,882,133	gallons
Sewage	\$ 328,667	56,137,155	gallons
Fuel Oil	\$ 787	500	gallons
Total	\$5,200,484		



FY 08-09

	MMBtu	Tons CO ₂
Electrical	152,564	33,535
Natural Gas	60,595	995
Fuel Oil	70	6
Total	213,229	34,535

Source : <http://www.carbonify.com>

This is equivalent to 172,673 trees.



**Alabama
Technology
Network**



- HVAC is largest energy expenditure for commercial and residential consumers (~ half of energy costs)
- Nearly every building has HVAC systems, so we have big opportunities to save energy
- HVAC systems provide heating, cooling, humidity control, filtration, fresh air (indoor air quality), building pressure control, and comfort control



ENVELOPE

- Ensure the building is well insulated
- Ensure insulation and HVAC meet ASHRAE standards
- Install double or triple-paned windows
- Place tinting or films on windows. Also, can use shades/blinds to keep some of the sunlight out.
- Reduce solar heat gain in the summer by installing awnings, overhangs (keep high-angle sunlight out in summer but allow in low-angle sunlight in winter). Payback is usually in 3 to 5 years.
- Cool Roofing



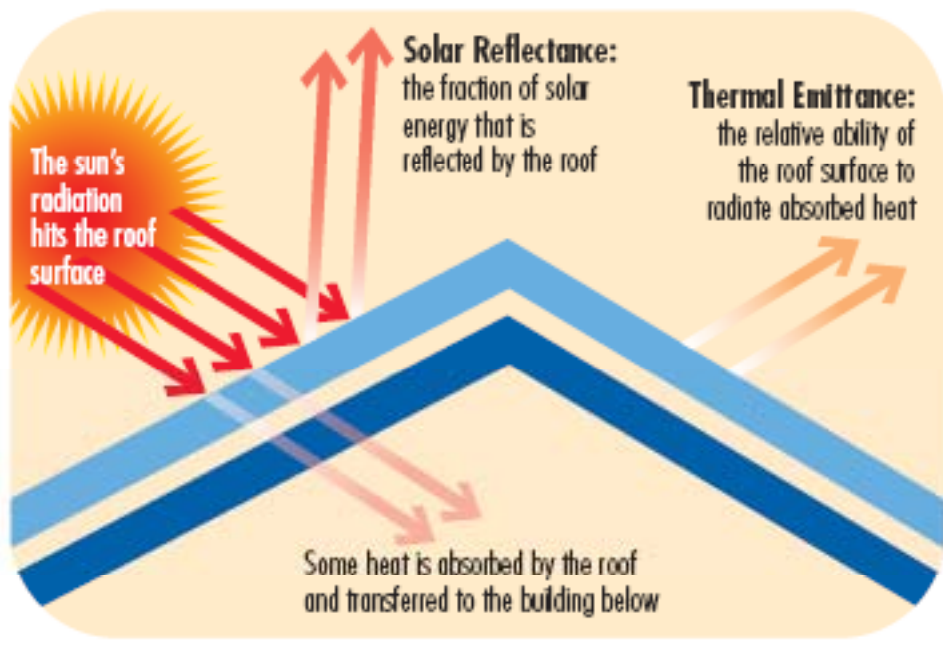
Courtesy of www.WRATT.org



Alabama
Technology
Network



COOL ROOFING



<http://www.coolroofs.org/coolroofing.html>

- In the wintertime, the sun is much lower in the sky and less intense. (Passive solar heating usually occurs from sunshine streaming through windows this time of year).
 - There is a higher incidence of cloudy days, and in some regions the roof is covered in snow for long periods.
- Winter days are shorter (fewer hours of sunshine)
 - A cool roof will not shed more heat proportionate to other types of roofing materials at night or on cloudy days. It will simply limit the amount of heat entering the building on hot summer days



Alabama
Technology
Network



INFILTRATION

- Fill in any gaps around doors and window frames.
- Install outlet gaskets
- Spray foam penetrations
- If your windows or doors have hard or cracked weather stripping, replace it.
- Install door sweeps on doors with a gap underneath



INFILTRATION

- Keep exterior doors/window and stairwell doors closed
 - Call Work Order Desk (Ext. 6490) if HVAC isn't operating correctly.
- Flexible windbreaks for loading areas
- Exhaust fans
 - Bathrooms
 - Fume hoods



OPPORTUNITIES

- Reduce the volume of conditioned indoor space.
- When cooling, bring in outside air when outside air temperatures are between 55°F & 65°F for “free cooling.”
- Use fans – a temperature setting 3-5 degrees higher can feel just as comfortable & can save ~3% on cooling costs.



Courtesy of
www.WRATT.org



Alabama
Technology
Network



TEMPERATURES

ASHRAE Standard 55-2004 Thermal Environmental Conditions for Human Occupancy.

Summer		Winter	
Temp	% RH	Temp	% RH
(T _{db} °F)		(T _{db} °F)	
74	65	68	60-80
75	50-65	69	40-80
76	40-65	70	20-78
77	30-60	72	10-75
78	10-60	74	10-65
79	10-55	76	10-55
80	10-55	77	10-35

Set thermostats to broadest comfort range which is 76°F summer and 70°F winter. This automatically creates a 6 degree dead-band within neither heating nor cooling is required.

UAHuntsville Temperature Guidelines		
	Summer (air conditioning)	Winter (heating)
Occupied Space	74-76 degrees F	69-71 degrees F
Unoccupied Space	85 degrees F	55 degrees F

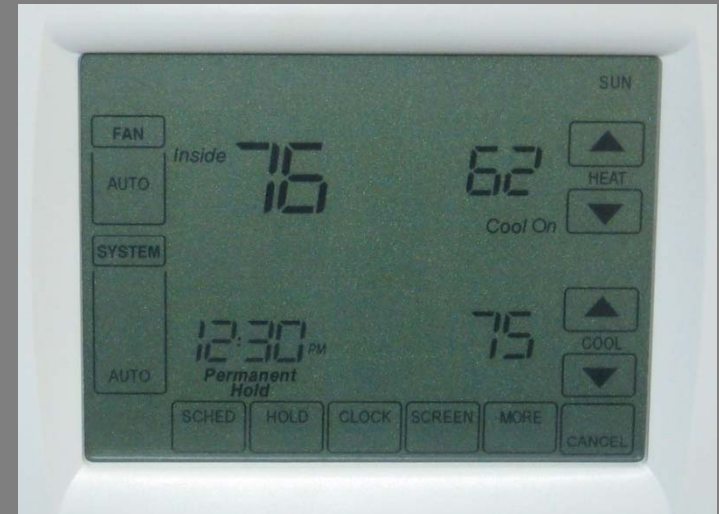


Alabama
Technology
Network



TEMPERATURES

- Install a programmable thermostat to limit heating and cooling to the hours you need it. Cost is typically \$25 to \$150, and it can cut your HVAC costs up to 30%.
- Dress appropriately for the season.
- Adjust blinds and drapes to limit solar heat in summer and keep heat in on cloudy winter days.
- Note that space heaters are prohibited on campus. They are very inefficient.



Courtesy of www.WRATT.org



Alabama
Technology
Network



HVAC MAINTENANCE

- Schedule HVAC maintenance twice a year.
- Hire a professional to test, clean, and adjust your boiler/furnace.
- Inspect ductwork for leaks and insulation.
- Change air filters regularly.
- Change air filters (inside building) and if extremely dirty air filters, then clean evaporator coils (in unit inside building).
- Clean condenser coils (in unit outside building).



NEW/REPLACEMENT EQUIPMENT



- Ensure the proper unit size when replacing.
- Replacing HVAC fan/blower V-belts with cogged belt to save 2% or notched “tooth” to save 5% of HVAC fan/blower motor energy usage because less slippage. Payback is usually within 6 months.
- Replace HVAC fan and pump motors with high efficiency models to save 35 to 45% of investment annually.
- Install high efficiency units with **SEER** (Seasonal Energy Efficiency Ratio) at or above 14. Typically save 25% to 35% on your investment annually.

Note: SEER and EER are explained at <https://www.energystar.gov>

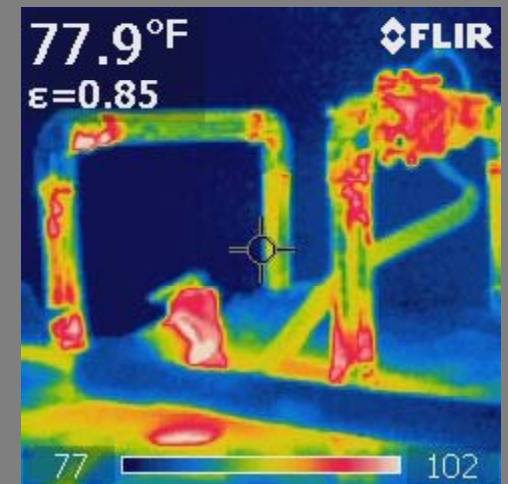
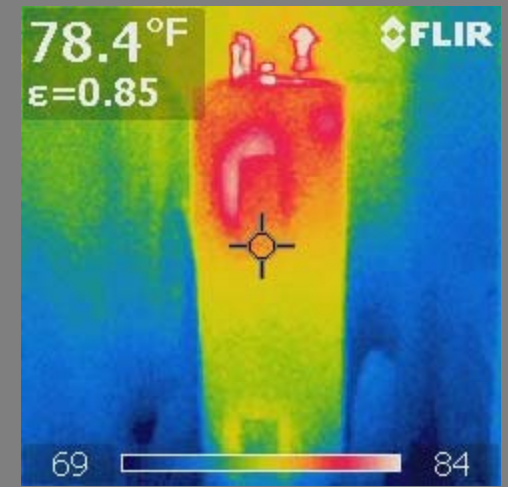


Alabama
Technology
Network



HOT WATER

- Reduce temperature on hot water tank.
 - Each 10°F saves 3-5%.
- Use temp boosters for dishwashers/clothes washers.
- Use full loads with washing clothes/dishes.
- Conserve water.
- Insulate water heater tank and pipes connected to it.
- Flush water heater sediment.
- Perform maintenance on all equipment.



WATER HEATER TYPES

Conventional storage water heaters

Offer a ready reservoir (storage tank) of hot water

Demand (tankless or instantaneous) water heaters

Heat water directly without the use of a storage tank

Heat pump water heaters

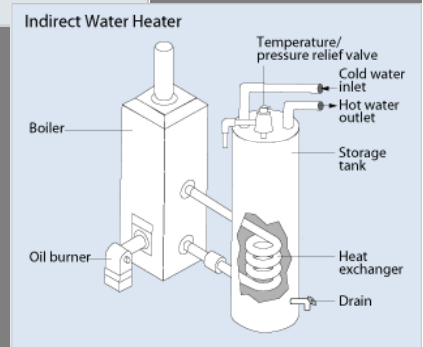
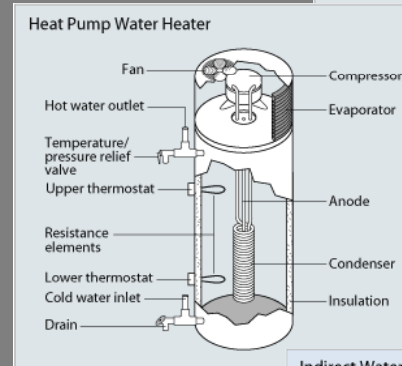
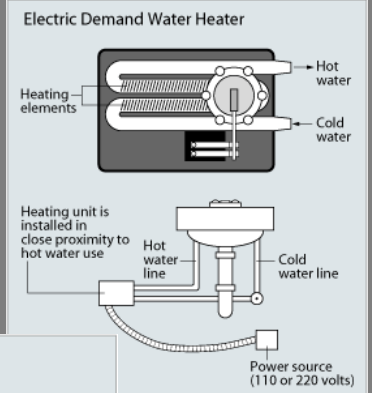
Move heat from one place to another instead of generating heat directly for providing hot water

Solar water heaters

Use the sun's heat to provide hot water

Tankless coil and indirect water heaters

Use a home's space heating system to heat water



Alabama
Technology
Network



SELECTION CRITERIA



Fuel type, availability and cost

The fuel type or energy source you use for water heating will not only affect the water heater's annual operation costs but also its size and energy efficiency.

Size

To provide your household with enough hot water and to maximize efficiency, you need a properly sized water heater.

Energy efficiency

To maximize your energy and cost savings, you want to know how energy efficient a water heater is before you purchase it.

Costs

Before you purchase a water heater, it's also a good idea to estimate its annual operating costs and compare those costs with other less or more energy-efficient models.

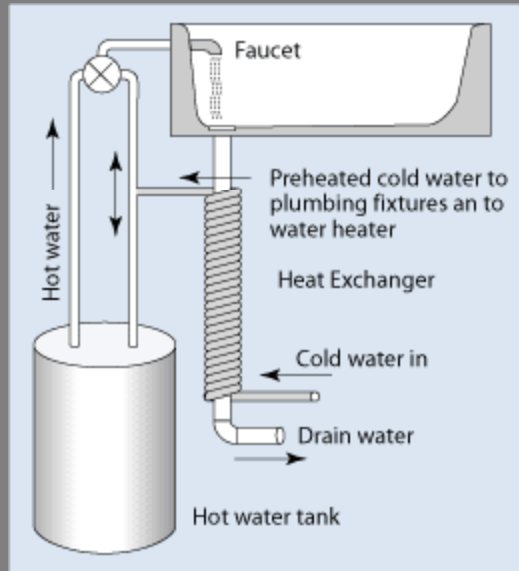
http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=12770



**Alabama
Technology
Network**



HEAT RECOVERY



Drain-Water Heat Recovery

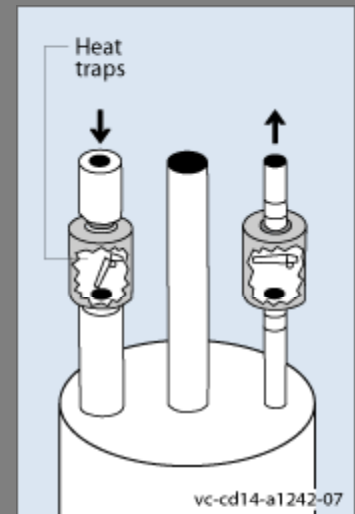
Any hot water that goes down the drain carries away energy with it. That's typically 80–90% of the energy used to heat water in a home. Drain-water (or grey water) heat recovery systems capture this energy to preheat cold water entering the water heater or going to other water fixtures

http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=13040

Heat Traps

If your storage water heater doesn't have heat traps, you can save energy by adding them to your water heating system. They can save you around \$15–\$30 on your water heating bill by preventing convective heat losses through the inlet and outlet pipes.

http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=13100



Alabama
Technology
Network



APPLIANCES

- Buy ENERGY STAR Appliances.
- Research the item you are planning to purchase.
<http://www.energystar.gov>
- Look for the Energy Guide Label.



Based on standard U.S. Government tests

ENERGYGUIDE

Refrigerator-Freezer
With Automatic Defrost
With Side-Mounted Freezer
Without Through-the-Door-Ice Service

XYZ Corporation
Model ABC-W
Capacity: 23 Cubic Feet

Compare the Energy Use of this Refrigerator with Others before You Buy.

This Model Uses 776 kWh/year	
Energy Use (kWh/year) range of all similar models	
Uses Least Energy 742	Uses Most Energy 836

kWh/year (kilowatt-hours per year) is a measure of energy (electricity) use. Your utility company uses it to compute your bill. Only models with 22.5 to 24.4 cubic feet and the above features are used in this scale.

**Refrigerators using more energy cost more to operate.
This model's estimated yearly operating cost is:**

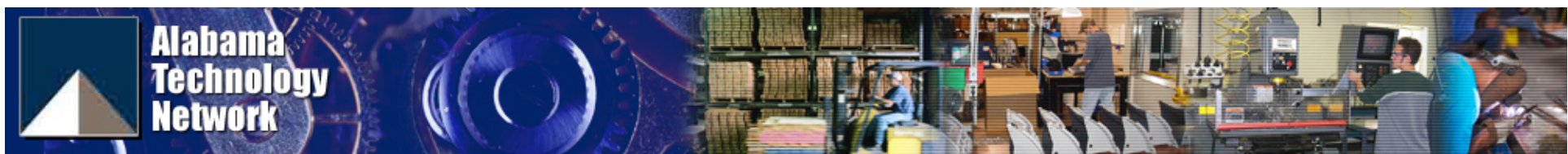
\$68

Based on a 1995 U.S. Government national average cost of 8.4¢ per kWh for electricity. Your actual operating cost will vary depending on your local utility rates and your use of the product.

Important: Removal of this label before consumer purchase is a violation of Federal law (42 U.S.C. 6302).

1

2



LIFE CYCLE COSTS

Purchase:

Model A - \$2,000

Model B - \$3,000

5 Year Electrical Cost

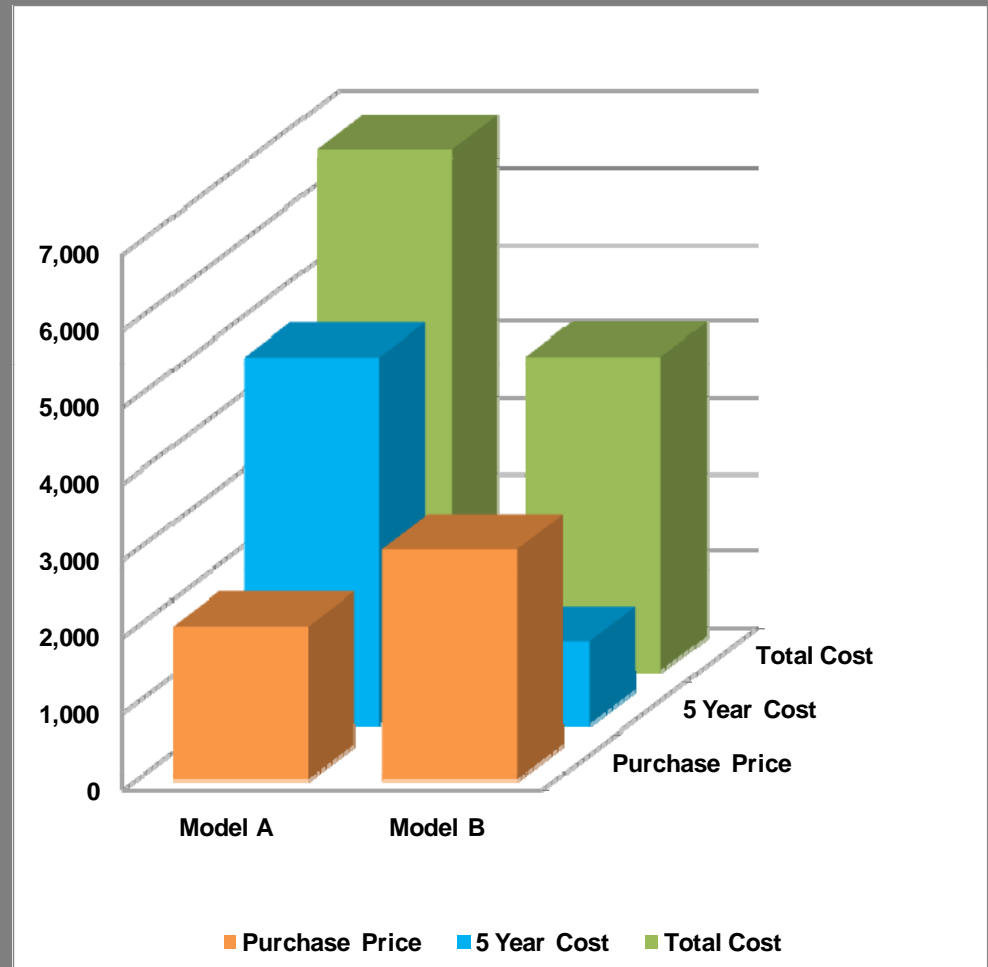
Model A - \$4,800

Model B - \$1,100

Total LCC @ 5 years

Model A - \$6,800

Model B - \$4,100



Alabama
Technology
Network



- All buildings (offices, homes, etc.) have lights, so we have opportunities to save energy.
- Energy efficient lights provide bright light and use up to 75% less energy than standard lighting, produce 75% less heat, & last up to 10 times longer than standard lights



TYPES OF LAMPS

- Incandescent
 - Standard "A" bulb
 - Tungsten halogen & reflector



- Fluorescent
 - Straight tube
 - Compact fluorescent lamp (CFL)



- High Intensity Discharge
 - Mercury vapor (MV)
 - Metal halide (MH)
 - High pressure sodium (HPS)



- Low pressure sodium (LPS)
- Light emitting diode (LED)
(LEDs will be best in future)

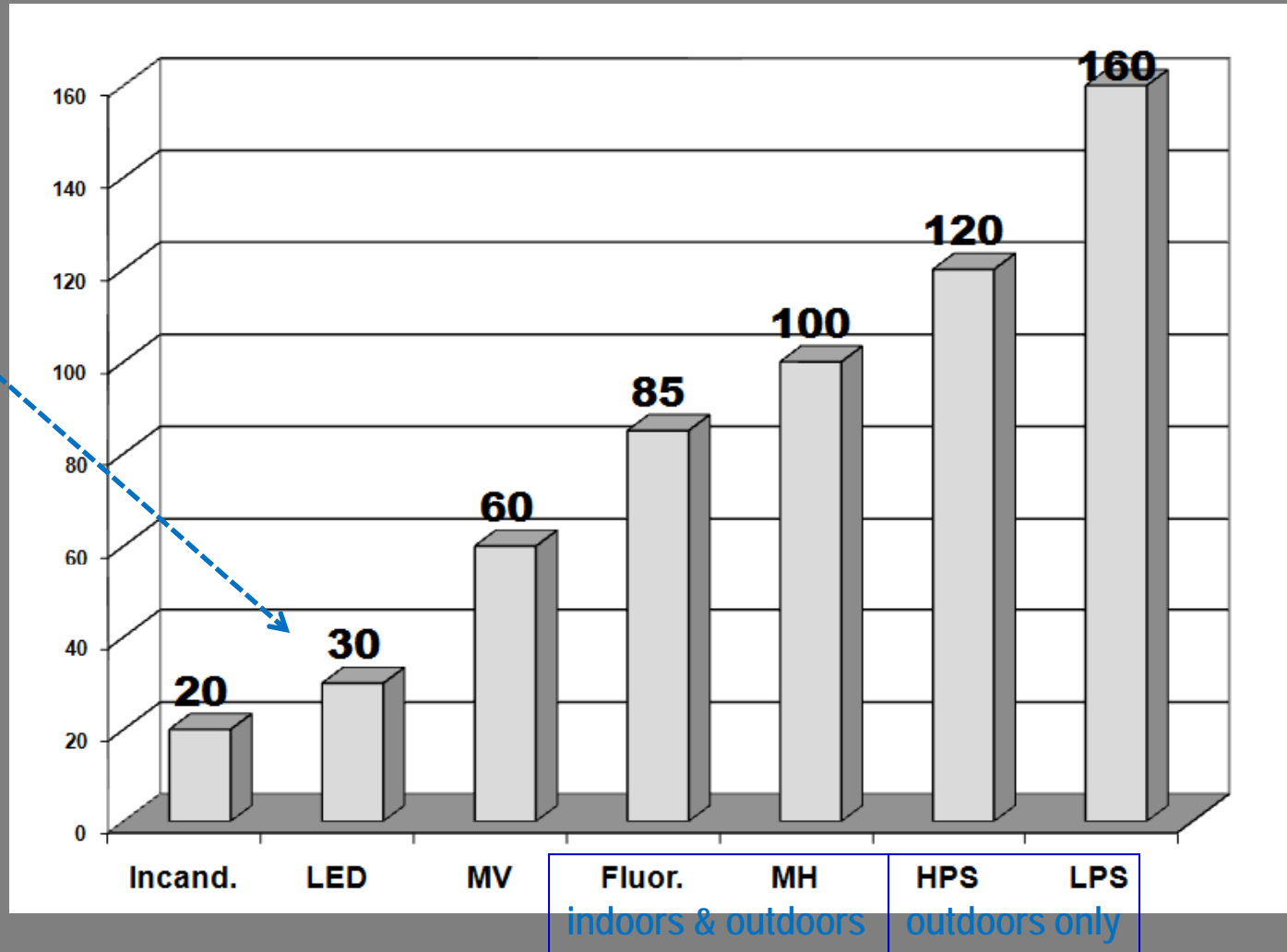


LIGHT PER UNIT ENERGY

Lumens per watt

NOTE:

Some LEDs are 60 lumens per watt and 131 has been achieved in labs so expect LEDs to be the best in future years



Alabama
Technology
Network



LIGHT COLOR

- **Color “Temperature”**

How the lamp itself looks when lit (turned on)

- **Color “Rendition”**

CRI = Color Rendition Index (scale of 0 to 100)

CRI describes the effect that a light source has on how a colored object looks when the light from a lamp shines onto the object

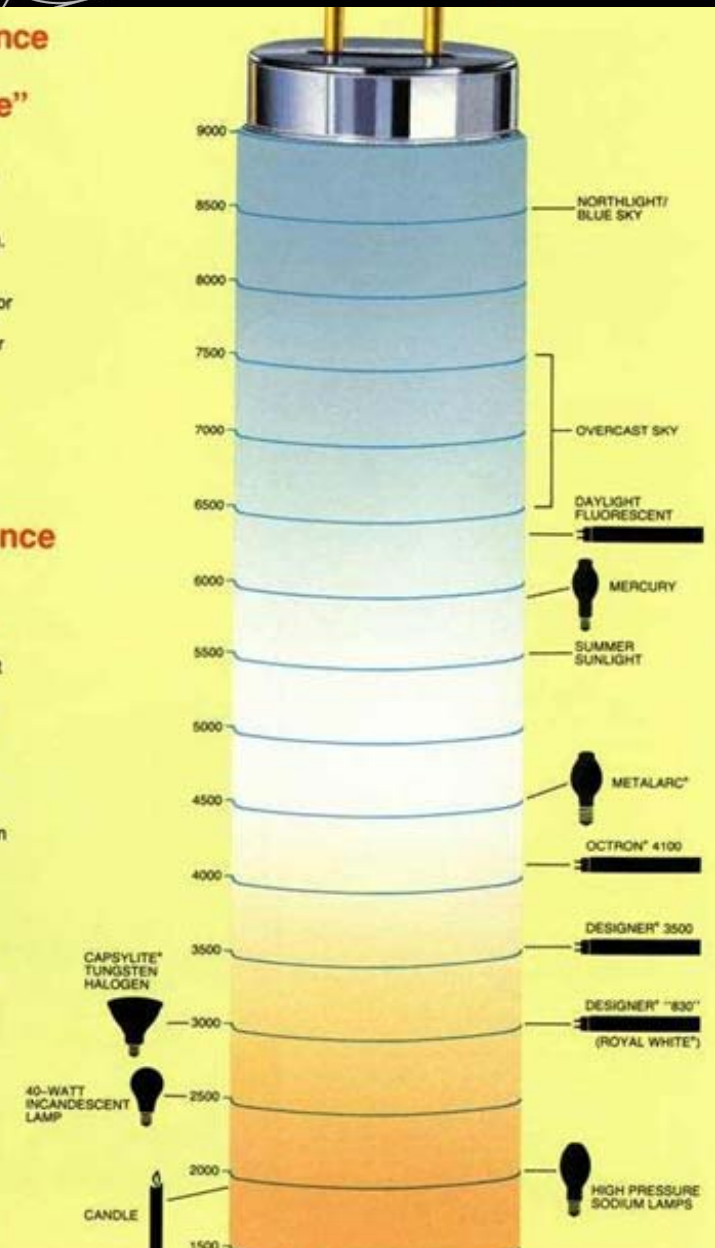
The color appearance of a lamp is “Color Temperature”

Color temperature describes how the lamp itself appears when lit. Color temperature is measured by “Kelvins” ranging from 9000K (which appears blue) down to 1500K (which appears orange-red). Light sources lie somewhere between the two, with those of higher color temperature—4000K or more—being “cool,” and those of lower color temperature—3100K or less being “warm.” Certain fluorescent lamps are “intermediate” types, lying somewhere between “cool” and “warm.”

The color appearance of an object when lighted is “Color Rendition”

Color rendition describes the effect a light source has on the appearance of colored objects. The color rendering capability of a lamp is measured as the Color Rendering Index (CRI). In general, the higher the CRI, the less distortion of the object’s color by the lamp’s light output. The scale used ranges from 0 to 100. A CRI of 100 indicates that there is no color shift as compared to a reference source, and the lower the CRI, the more pronounced the shift may be.

It is important to recognize that the reference source (and thus the CRI scale) is different at different color temperatures. As a result, CRI values should only be compared between lamps of similar color temperatures.



LIGHTING GUIDELINES



I. Illuminance Categories and Illuminance Values for Generic Types of Activities in Interiors

Type of Activity	Illuminance Category	Ranges low - medium - high		Reference Work-Plane
		Lux	Footcandles	
Public spaces with dark surroundings	A	20-30-50	2-3-5	General lighting throughout spaces
Simple orientation for short temporary visits	B	50-75-100	5-7.5-10	
Working spaces where visual tasks are only occasionally performed	C	100-150-200	10-15-20	
Performance of visual tasks of high contrast or large size	D	200-300-500	20-30-50	Illuminance on task
Performance of visual tasks of medium contrast or small size	E	500-750-1000	50-75-100	
Performance of visual tasks of low contrast or very small size	F	1000-1500-2000	100-150-200	
Performance of visual tasks of low contrast and very small size over a prolonged period	G	2000-3000-5000	200-300-500	
Performance of very prolonged and exacting visual task	H	5000-7500-10000	500-750-1000	
Performance of very special visual tasks of extremely low contrast and small size	I	10000-15000-20000	1000-1500-2000	Illuminance on task, obtained by a combination of general and local (supplementary lighting)



LIGHT TESTING

- To verify you have enough light at a work area, you can usually just look/decide by how it looks & ask workers how they like light level
- Or... ask the Energy Office to test work areas in your building.

- Light meters

- Example of light meter (~ \$150)
- Digital and analog display of light in foot-candles or lux
- Can measure 0 to 20,000 lux or equivalent foot-candles

(20,000 lux is maximum needed per prior slide)



Alabama
Technology
Network



LIGHTING CONTROLS

- Types of Light Controls
 - Timers
 - Occupancy Sensors
 - Vacancy Sensors
 - Photocells
 - Dimmers
 - Energy Management System (EMS)



- Controls can be used in conjunction with natural lighting
 - Skylights
 - Windows

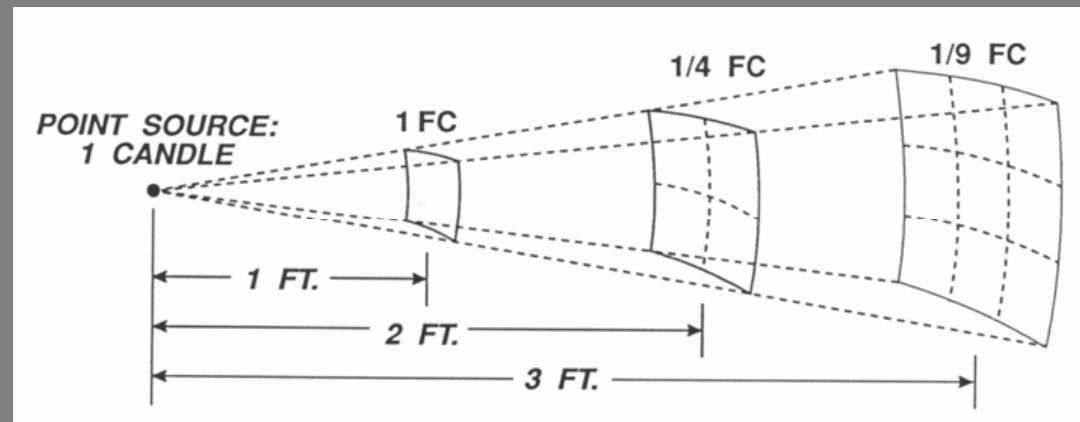


LIGHTING OPPORTUNITIES

- Locate light fixtures near/above the work area where light is needed. Small changes in mounting height/location of a light can have a significant influence on lighting level.
- Use optical aids and task lighting



Indirect lighting reflects most of the light off the ceiling.



Alabama
Technology
Network



LIGHTING OPPORTUNITIES



- Turn off lights when not needed.
- Clean lights regularly to ensure the best light output and light expectancy.
- Install Compact Fluorescent Lights (CFLs) or other efficient lighting.
- Use natural light to your advantage.
- Use task lighting to decrease glare.
- Install occupancy sensors.
- Install LED Exit signs.



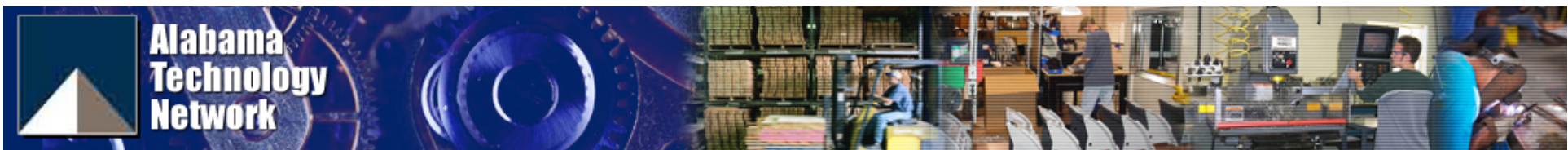
Alabama
Technology
Network



OFFICE EQUIPMENT

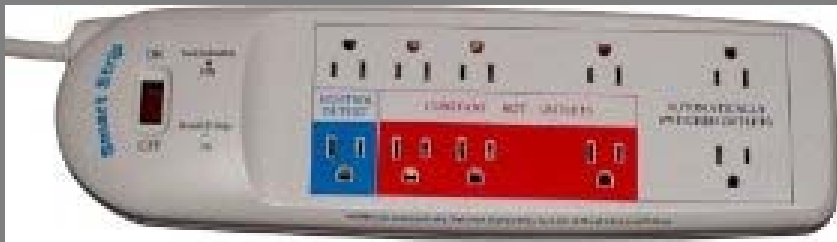
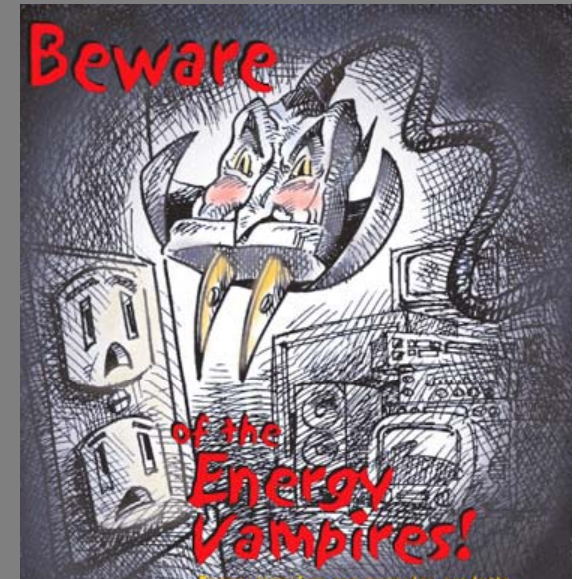


- Turn equipment off when not in use.
- Look for the Energy Star Logo when purchasing new equipment.
- LCD monitors use less than 1/3 of the energy used by conventional monitors.
- Network multiple computers to one printer.
- Enable power management software
- Print and copy double-sided.



ENERGY VAMPIRES

- “Energy Vampires” are devices that consume energy in standby mode.
- They have two teeth (the prongs of the plug) and suck electricity day and night - they never sleep!



- Sewage is charged on ALL water consumption. Ask for sewage credits when applicable.
- Use low flow faucets in bathrooms and kitchens. <2.5 gpm showers, 0.5 – 1.5 gpm sinks
- Use low flow toilets or use toilet tank fill diverter.
- Check for leaks.
- Use a pool cover.
- Use automatic faucets and toilets.
- Once through water systems for labs



MISCELLANEOUS



**Alabama
Technology
Network**



- TVA Energy Right Program
 - Free in-home energy audit
 - Reimbursement of 50% of installation cost of recommended improvements, \$500 max.
 - www.energyright.com



Alabama Appliance Rebates

http://www.energysavers.gov/financial/rebates/state_AL.cfm

The State of Alabama will implement a mail-in rebate program to help residents replace older, inefficient appliances with ENERGY STAR® qualified appliances. The program is **tentatively scheduled to begin in April 2010** and will run for three weeks. If funds remain after this initial program, the state may hold a second rebate period in October 2010 during Energy Awareness Month.

Eligible products include

- Refrigerators
- Freezers
- Clothes washers
- Dishwashers
- Room air conditioners



Alabama
Technology
Network



INCENTIVES



Products Eligible for Tax Credits Through 2010

http://www.energysavers.gov/financial/70010_print.html

The products in this section are eligible for tax credits at 30% of the cost, up to a total credit of \$1,500; they must be "placed in service" from January 1, 2009 through December 31, 2010.

- **Biomass Stoves**
- **HVAC**
 - Central Air Conditioning
 - Air-Source Heat Pumps
 - Furnaces and Boilers
 - Advanced Main Air Circulating Fan
- **Insulation**
 - Insulation and air sealing products
- **Roofing**
 - Metal roofs, asphalt roofs
- **Water Heaters**
 - Gas, Oil, Propane Water Heater
 - Electric Heat Pump Water Heater
- **Windows and Doors**
 - Exterior windows, doors, skylights
 - Storm windows and doors



**Alabama
Technology
Network**



Products Eligible for Tax Credits Through 2016

http://www.energysavers.gov/financial/70010_print.html

Tax credits for these products are available at 30% of the cost, with no upper limit, through 2016.

- **Geothermal Heat Pump**
- **Solar Energy Systems**
 - Solar Water Heater
 - Photovoltaic Systems (Solar Electricity)
- **Wind Energy Systems**
 - Residential Small Wind Turbines
- **Fuel Cells**
 - Residential Fuel Cell and Microturbine Systems
- **Vehicles**
 - Hybrid gasoline-electric, diesel, battery-electric, alternative fuel, and fuel cell vehicles
 - Plug-in Hybrid Electric Vehicles



**Alabama
Technology
Network**



LINKS



DOE Consumer Guide to Energy Efficiency and Renewable Energy

www.eere.energy.gov/consumer

ENERGY SAVERS

www.energysavers.gov

ENERGY STAR®

www.energystar.gov

TVA “energy right” Program

www.energyright.com

State of Alabama Appliance Rebate Information

http://www.energysavers.gov/financial/rebates/state_AL.cfm

DSIR Database of State Incentives for Renewables and Efficiency

<http://www.dsireusa.org/incentives/index.cfm?re=1&ee=1&spv=0&st=0&srp=1&state=AL>

Products Eligible for Tax Credits Through 2010

http://www.energysavers.gov/financial/70010_print.html

DOE Energy Savers tips on Saving Energy and Money at Home

<http://www1.eere.energy.gov/consumer/tips/index.html>



**Alabama
Technology
Network**



CONTACT INFORMATION



- **Energy Office**
824-6242
Vanessa.Ennis@uah.edu
<http://energy.uah.edu>
- **Work Order Desk**
824-6490
- **Alabama Technology Network**
824-6289
Anthony.Holden@uah.edu
www.atn.org



**Alabama
Technology
Network**



FEEDBACK



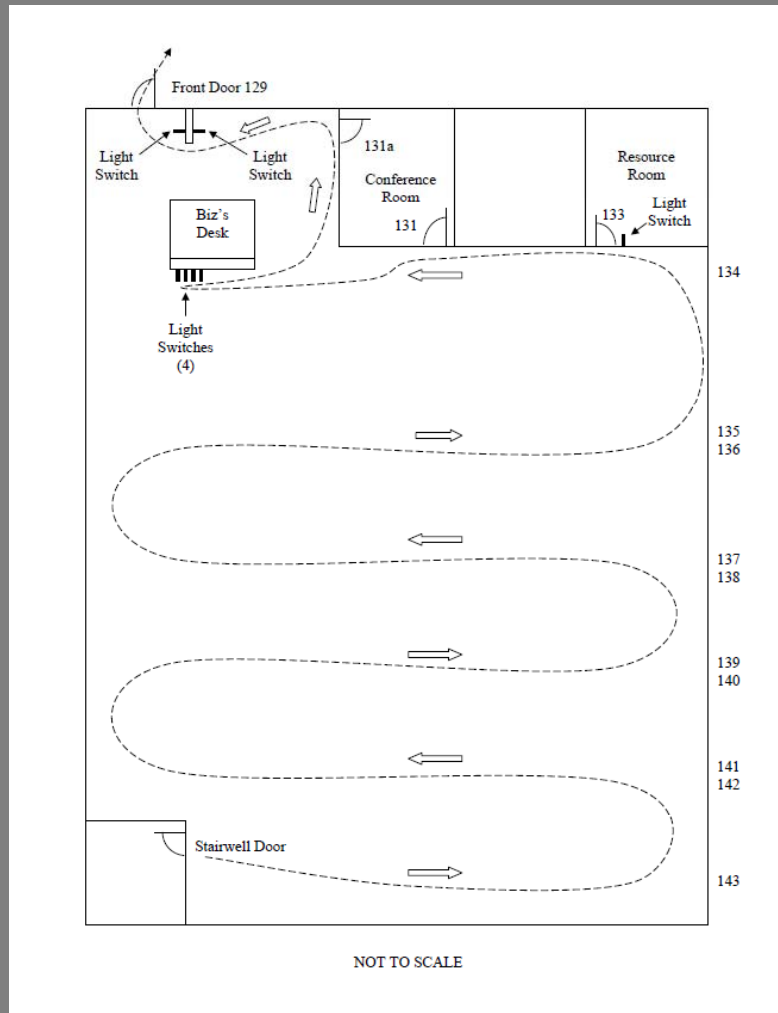
- Ideas/Suggestions?



Alabama
Technology
Network



EXAMPLE



**Alabama
Technology
Network**



THANK YOU!



**Alabama
Technology
Network**

