WELS National Conference of Worship, Music, and the Arts; July 22-25, 2014
Greening Your Sacred Space
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1. Motivations for "Greening your sacred space"
    a. Better energy efficiency = lower utility costs = more money for mission of the church
        i. Utility costs as a percentage of church budget
    b. Being better stewards of God's natural resources
    c. Also provides better environment for parishioners and guests
        i. As we age, the amount of light needed increases
            1. As we age, our eye lenses thicken and become more opaque.
            2. 80-year-old person needs 5 times the amount of light a 20-year-old person needs to have the equivalent level of vision
            3. Glare becomes a larger problem

2. Opportunities for improved efficiencies
    a. Lighting
        i. Definitions
            1. Lumen—amount of light output; also there may be a difference between lumen output and delivered lumens (under shell vs. beyond shell)
            2. Watt—amount of power used to generate light
            3. Color rendering index-- is a quantitative measure of the ability of a light source to reveal the colors of various objects faithfully in comparison with an ideal or natural light source.
            4. Color Temperature—based on Kelvin scale, is the temperature of an ideal black-body radiator that radiates light of comparable hue to that of the light source
                a. 2700k represents a warm light, similar to incandescent bulb
                b. 5000k represents a light similar to daylight
            5. Footcandle-- one foot-candle is equal to one lumen per square foot

        ii. Consider switching from incandescent bulbs to CFL or LED bulbs
            1. Elimination of incandescent bulbs
                a. 100W bulbs eliminated in 2012
                b. Working down in wattage toward 40W bulbs
            2. CFL bulbs
                a. CFLs produce light differently than incandescent bulbs. In an incandescent, electric current runs through a wire filament and heats the filament until it starts to glow. In a CFL, an electric current is driven through a tube containing argon and a small amount of mercury vapor. This generates invisible ultraviolet light that excites a fluorescent coating (called phosphor) on the inside of the tube, which then emits visible light.
                b. 67% - 80% energy reduction vs. incandescent bulbs
                c. Last longer—8 to 15 times longer than incandescent bulb
                d. Output decay occurs as phosphors wear out
                e. Color rendering index typically at 80—prefer index of 84 or above
                f. Color temperature is noticeably different—hard for CFLs to get below 3000k

g. Offer omni-directional lighting
h. Lights can come in ballasted strips
i. T-12 (1 ½" diameter)
ii. T-8 (1" diameter, most commonly used today)
iii. T-5 (5/8" diameter, newer product, more expensive)

3. LED bulbs
a. LED lighting products use light emitting diodes to produce light very efficiently. An electrical current passed through semiconductor material illuminates the tiny light sources we call LEDs. The heat produced is absorbed into a heat sink.
b. LEDs use about 10% of a normal incandescent bulb
c. Last over 25,000 hours
d. Generally more expensive, particularly for higher wattage bulb s
e. Difficult to provide omni-directional lighting—meaning the light goes only in one direction—so take a close look at the fixtures you are using to see if that would be a problem.
f. Challenge is finding bulbs with a lighting color that everyone prefers
i. 2700k represents a warm light, similar to incandescent bulb
ii. 4100k represents a light similar to daylight

iii. Solutions available to improve lighting
1. Provide more level lighting throughout nave; reduce glare
a. Ambient lighting should provide a base of 25 footcandles; task lighting, such as reading in the pew, would like upwards of 75 footcandles
2. Consider new lighting fixtures, or new lighting fixture locations—consider wall sconces or direct-indirect lighting to provide more balanced ambient lighting
3. Provide lower lighting for reading
4. Occupancy sensors—make sure lights do turn off when not in use.

b. Water
i. Costs for water service increasing
ii. Newer products and designs can help reduce water use
1. Lower flow toilets
a. Current GPF (gallons per flush) for U.S. products is 1.6
b. "Low flow" reduces usage to 1.28 gpf
c. "Dual flush" products offer 1.6 or 0.8 depending on the need
d. Waterless urinals
2. Aerators on faucets—reduces water consumption

c. HVAC / Building Envelope
i. Existing analysis
1. Heating costs account for 45% of the average energy usage
2. Cooling costs account for 6% of the average energy usage
3. Natural gas costs have increased approximately 60% over the past two years
ii. Definitions
1. BTU—British Thermal Unit
2. "ton" of cooling = 12,000 BTU/h; term referred to the amount of energy required to freeze a "short" ton (0.907 tons) of water into ice in 24 hours

3. 1 therm = 100,000 BTU
4. R-Value = A unit thermal resistance for a particular material or assembly of materials; often measured per inch of material; used for wall and roof assemblies
5. AFUE = Annual Fuel Utilization Efficiency
6. Consider the SEER (Seasonal Energy Efficiency Ratio) = The SEER rating of a unit is the cooling output during a typical cooling-season divided by the total electric energy input during the same period; Energy Star expects a rating of 14 or higher

iii. Types of typical heating systems
    1. Furnaces—typical in residential
    2. Boilers—typical in commercial, particularly for churches
    3. Heat Pumps
    4. Solar Heating
    5. Electric
    6. Before you replace your heating plant, consider maintenance items
        a. Programmable thermostat—can save up to 10% of your normal heating costs
        b. Improve air sealing in walls and attic—behind outlets, R-38 roof insulation
        c. Make sure air ducts are properly sealed, and insulated if moving through unheated spaces
        d. Add ceiling fans to keep warmer air down.
        e. Keep vents, baseboard heaters and radiators unobstructed
    7. If you do consider replacing your heating equipment, look for:
        a. For boilers and/or forced air furnaces:
            i. AFUE > 90% effiency
            ii. Multiple stage system, only heat what you need (use only one boiler out of three when necessary)
        b. Point of use water heaters vs. large water heaters
            i. Heat only what you need—better efficiency
            ii. Works well at sinks for bathrooms
        c. In floor radiant heat
            i. Keeps heat near our feet and body
            ii. Works well for daycare centers and other places with little children
iv. Types of typical cooling systems
    1. Central
    2. Room
    3. Ductless, Mini-split—cooling individual rooms
    4. Ways to improve your environment before replacing equipment
        a. Provide as much natural ventilation, with fans, as possible—adding fans can allow the thermostat to raise up to 4 degrees without noticeable difference in comfort
        b. Replace or clean air filters—cleaning filters can reduce energy use by 5-15%
        c. Maintenance on air conditioner's evaporator coil

        i. Use fin comb to straighten any bent coil fins
        ii. Keep central air units open to disperse heat more easily
    d. Inspect seals around window units to prevent leakage
    e. Insulate and seal ducts
    f. Provide programmable thermostat
    g. Tinting windows with film or new windows with tint included
        i. Solar Heat Gain coefficient—refers to the amount of solar energy transfer through a window or door. Often refers to the glass in a window, based on a scale from 0 to 1. The lower the number, the lower amount of heat gain
        ii. Visible light transmittance—amount of light hitting the glass surface(s) and able to pass through the material, measured in a percentage

3. Partners to assist in process
    a. Focus on Energy (Wisconsin)
    b. Program to visit your church and do an energy audit
        i. Show youtube video
    c. Incentives available for replacement of equipment
        i. LED / CFL lighting
        ii. HVAC systems, including boilers

For a direct link to the Prezi presentation:
http://prezi.com/hpvfojisvcpu/?utm_campaign=share&utm_medium=copy&rc=ex0share