Energy Consumption (Ways to Reduce it)

Sustainable Facilities Workshop

August 7, 2013

Discussion Topics

- Introduction
- Why energy consumption matters
- What you can do
  - Insulation
  - Windows
  - Door closers
  - Lighting
  - Furnace air filters
  - Thermostats
  - Monitoring real-time
- Electricity vs. natural gas
- Grace United lessons learned

Introduction

- Max Sherman – Project Manager
  - Board Member, FOSS
  - Board Chair, Grace United Community Ministries
  - Saturday crew leader, Housing and Construction Ministry, Church of the Resurrection
  - Project Manager for power engineering firm
    - 37 years in energy & electric power supply (mostly utilities)
    - 2 power plants developed & built; worked on 2 nuclear plants
  - Econ Development Co-Chair, Church of the Resurrection
  - Member, Clarksdale/Coahoma County MS Chamber of Commerce & Industrial Foundation

Caveats and Weasel Words

- The opinions of the speaker are his own
- The future will not turn out as projected
- Your mileage may vary

Why energy consumption matters

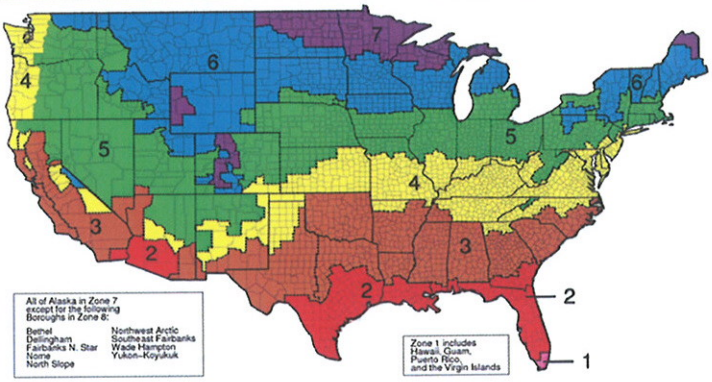
- Green – Washingtons, Lincolns, Hamiltons and Franklins
- Energy can be highest cost after labor
- Mandates on utilities increase electricity costs to customers
  - Renewable portfolio standards (RPS) & transmission upgrades
  - Environmental upgrades at coal plants. ~¾ of production capacity in MO/KS is coal-based
- Electricity demand not fully recovered from Great Recession
  - Fixed costs spread over a smaller sales base
- Other policy issues now trump cost to the customer
- GUCM all-in electricity cost (¢/kWh) up 95% since 2006

Insulation

- R-value – the higher the number, the more resistance to heat transfer (e.g. better)
- Insulation materials – fiberglass, cellulose, rock wool, rigid foam panels
- Fiberglass comes in rolls or batts (faced or unfaced), or blown
- Rigid foam panels are expensive
- Cellulose degrades if wet
- Fiberglass relatively inexpensive; easy to install

Retrofitting Wood-Framed Buildings

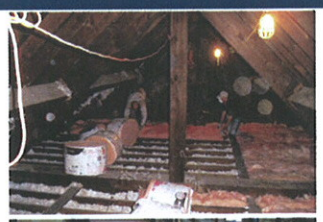
EPA recommends R38 to R-60 in attics; R-25 to R-30 in Floors (Zone 4)



Insulating Attics

- Objective – thermal barrier; allow attic to breathe (do not block soffit or other vents)
- Typical products – rolls of unfaced R-30 or blown-in fiberglass insulation
- Unskilled volunteers can do this – wear N-95 masks, gloves, long-sleeved shirts
- Avoid contact with knob and tube wiring

Attic & floor insulation photos



Insulating walls with exposed studs

- Typical stud spacing – 16" on center
- If walls exposed on one side
  - Use faced fiberglass insulation
  - Attach with staple gun or hammer stapler
  - Wear N-95 masks & long sleeve shirts
  - Avoid knob-and-tube wiring
- If studs are 2"x4" use faced R-13 or R-15
- If studs are 2"x6" use faced R-19

Insulating walls exposed on one side

Blown-in insulation on covered walls

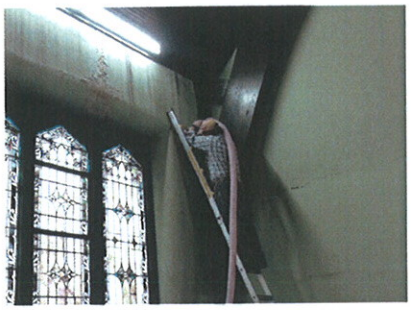
- Drill 3" or 3¼ " holes between studs below top of walls with corded drill and hole saw (carbide-coated teeth – see photo)
- Check depth of open cavity (fish tape)
- Insert hose from AttiCat machine & press the On button; cavity will fill in seconds
- Afterwards patch the holes – drywall discs with wood backer strip; mud & tape
- If insulating between stone and lathe & plaster, expect a lot of holes (~60 - 70 in GUCM sanctuary)

AtticCat & compressed insulation

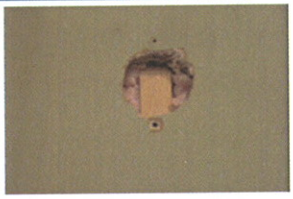
AttiCat machine at Home Depot

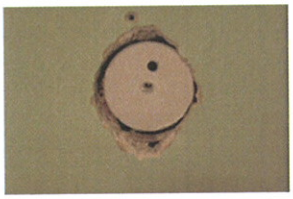
- Rental fee ~$35/day; waived if you buy 10-20 compressed insulation bundles (# varies). Pay the rental instead or ask for a free day.
- Need pickup or SUV to move the machine
- Comes with 100' hose with controls at end
- Machine very easy to use
- Each insulation bundle presently costs ~$33
- Area covered printed on package

Blowing in insulation



Hole saws, drywall plug & backer





Residential Photos (Christmas in October)

LADDER SAFETY!

- Use Class I or II ladders – not light-duty Class III
- Follow mfgr instructions to set up; not too steep
- Properly place on floor & walls (no 3-point supports)
- In attics, use plywood on floor joists as floor
- 2 person teams – always have someone at the base
- If it doesn't look or feel safe, don't do it
- Accidents can occur without warning

How to insulate inexpensively

- Qualified volunteers can do this – avoids cost of hiring a contractor
  - Volunteers take time but get a lot done at low cost
- When buying insulation, compare cost/SF for the selected R-value
- Big box stores – HD, Lowe's, Sutherlands, Menards
- Ask your Christmas in October crew leader to contact CIO for free R-30 insulation
- If you think plaster contains asbestos, STOP and have it tested before proceeding

Windows

- Replace single-pane with double-pane
- Vinyl is less costly than wood
- Quality matters
- Specify Low-E, Argon-filled space between glass
- Double-hung less costly than casement; has security features
- Many manufacturers, suppliers & contractors
- Volunteers can install (watch the videos first)

GUCM experience

- Suppliers
  - Great American Building Materials (John Amor)
  - Columbia Windows
  - Window World (installation, lifetime warranty, old window disposal & aluminum wrap on exterior trim).
- Proper measurement of opening is key.
- Installation requires some skill; bring a planer.
- Pricing experience ~$200 each from suppliers; Window World ~$300 to 350 each (installed).
- Personal experience – big box store contractors were more expensive

Door closers

- Why – keeps hot or cold air out
- GUCM uses Norton (name brand; made in US; catalog & instructions on line; parts & service available)
- We buy them new on eBay for $55-$75 each vs. ~$150+ from dealer
- Come with instructions; skilled volunteer installs
- Typically Model 8500 series (adjustable)

Door closers on basement doors

Lighting

- Most people buy lamps based on wattage (power)
- Light is measured in lumens (on the package)
- Compare lumens before you buy
- Types of lamps (bulbs)
  - Incandescent – invented 1879. Pleasing light, least efficient, being phased out under federal law.
  - Fluorescent (often 4' tubes in ceiling troffers)
  - CFLs (compact fluorescent lamps)
  - LED (light emitting diode)

Ceiling troffers
Install lower-wattage lamps?

- Older troffers use T-12 lamps (40 watts, usually 4 lamps each)
  - 34 watt lamps $1.27 to $1.80 each (case price); 20,000 hour rating
  - Savings are in energy (kWh) & demand (kW)
  - Example – If troffer is on 30 hours/week, monthly savings/lamp = energy + [demand & facilities] savings (lag on demand/facilities)
    = [30 hrs/wk x 4 wks/mo. x 6 watts x $0.07/kWh x 1 kWh/1000 watts] + [~$5/kw-mo *(6 watts x 1 kW/1000 watts)] = $0.08/month/lamp
  - Payback period = ($1.27 - $1.80)/$0.08 savings = 16 to 23 mo
    - Use 23 months due to lag in reduction in demand charges
    - 20,000 hour life ~12.8 years @ 30 hours/week
  - Estimated monthly savings -- # fixtures x # lamps/fixture x $0.08
  - **Estimated annual return exceeds 50%**

Last slide on lighting

- New troffers use T-8 lamps (32 watts).
  - 25 watt lamps $6.07 – 6.29 case price @ Lowe's.
  - Changing from 32 to 25 watt lamps is harder to justify
- Price of lamps vary w/color temperature (4100K should be fine)
- CFLs replace incandescent bulbs.
  - 13 watt CFLs replace 60 watt incandescent
  - 23 watt CFLs replace 100 watt incandescent
  - Take several minutes to achieve full brightness
- LEDs are very efficient but expensive
  - $20 to 30 to replace a 65 watt interior flood lamp
- Recommendations – replace 40 watt T-12 lamps w/34 watt lamps ASAP. Replace incandescent bulbs w/CFLs.

Furnace air filters

- Dirty filters increase pressure drop; more work for fan motor (more time to heat or cool)
- Expensive pleated filters can also increase pressure drop
- Recommendation – use inexpensive filters; change monthly or bi-monthly

Thermostats

- Choices – programmable or not; heat pumps or not; WiFi, touch screen, Brand X or Honeywell
- Non-programmable – digital, manual, heat only, heat & cool
- Programmable – 7 day, 5-1-1 day, 5-2 day, 1-week.
- WiFi – control from any internet/wireless device. "Early Adopters" are installing Nest Learning Thermostat ($249)
- Pricing -- $24 to $200 each; install yourself
- Some think setting a very high or low temp will make unit heat or cool faster – NOT TRUE
- KCP&L offers units they can control (peak shaving)

Mid-priced Programmable Units ($100 & $80)

Thermostats (continued)

- GUCM experience
  - Honeywell very reliable
  - Programming is beyond most member & staff expertise
  - Security boxes to enclose thermostats did not work
  - Swings in heat pump temp settings can trigger strip heaters
  - Better control in manual mode; fan in "Auto"
  - No WiFi experience
- Recommendations
  - Honeywell; read the reviews; avoid spending over $100 each; keep it simple; check settings daily.

Monitoring electricity consumption

- Old school – record & track bill data with Excel spreadsheets
  - Bills show kWh this month, last month, last year
  - Customer, Demand, Facilities, Energy charges
  - KCMO franchise fee (11% for commercial customers)
- KCP&L customers can get daily data
  - Meters transmit radio signals to utility
  - Sign up on KCP&L web site
  - Observation – worthwhile during peak seasons but must learn to take the time

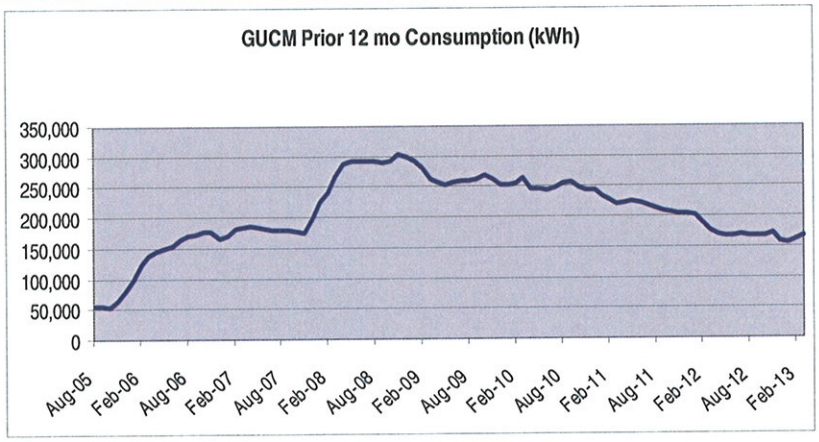
Electricity vs. Natural Gas

- Natural gas heat is generally less expensive (electric heat pumps help narrow the gap)
- Gas furnaces often more expensive to buy but have lower operating costs
- Hydraulic fracturing created a **"shale gale"** in U.S.
  - Speaker's home gas rate/CCF down 37% since 2006; electric rate/kWh up 59%
- KCP&L all-electric rates remain but discounts are small or zero (thanks MoPSC; env. issue)
- Before a large purchase is made, try to estimate operating costs for the alternatives.

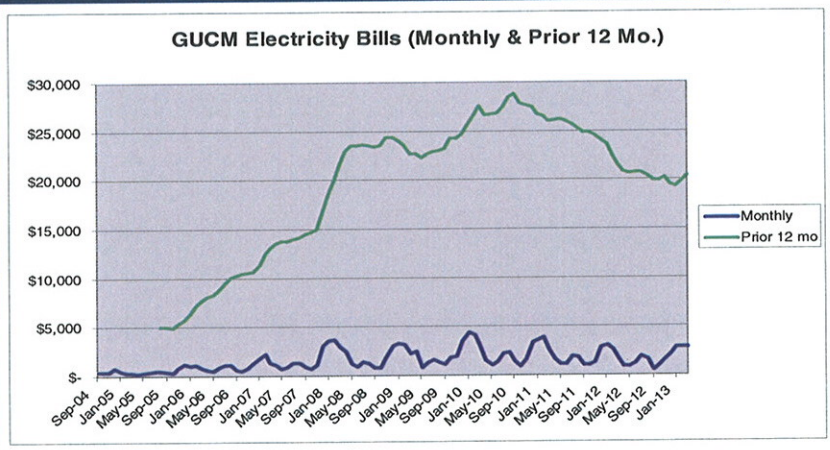
GUCM Lessons Learned

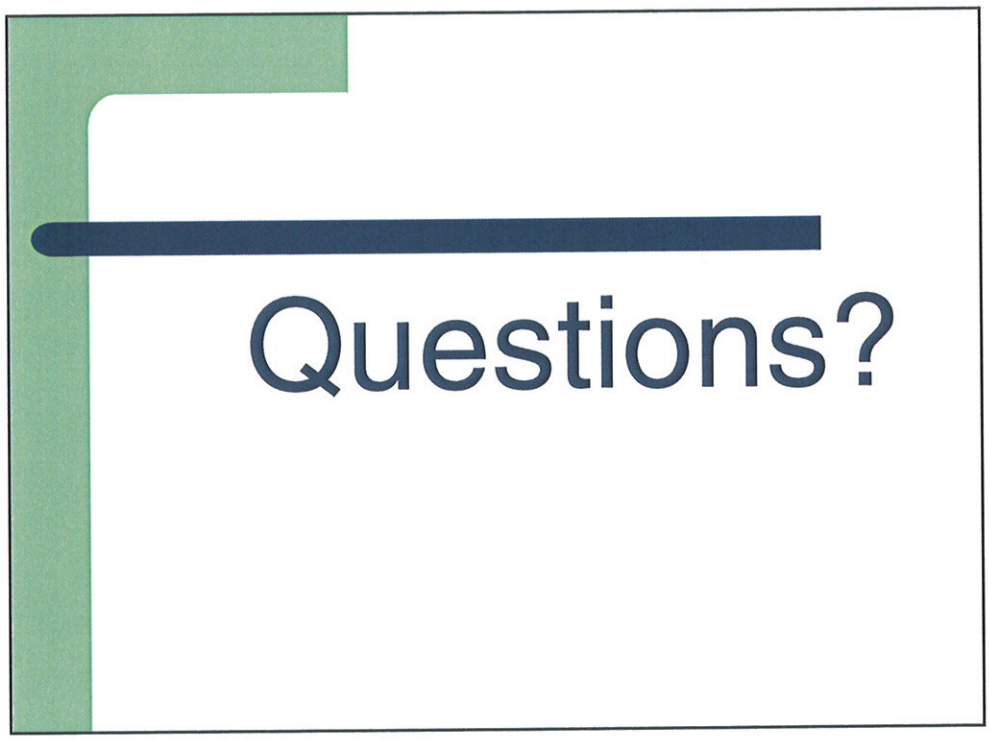
- Takes time & lots of volunteer labor but well worth the effort
- Rome was not built in a day. Nor will making your building energy-efficient.
- Start small; keep the effort going. Insulation in small bites is cheap. So are door closers. It will add up.
- Replacing only a few windows a year will add up.
- Payback hard to measure but will become obvious.
- You cannot afford not to make the effort.

Results – kWh usage down 45% from November 2008



Results – Electricity annual cost down 16% from Nov. 2008; 29% from peak




Questions?