

Prioritizing Energy Savings: What's Important?

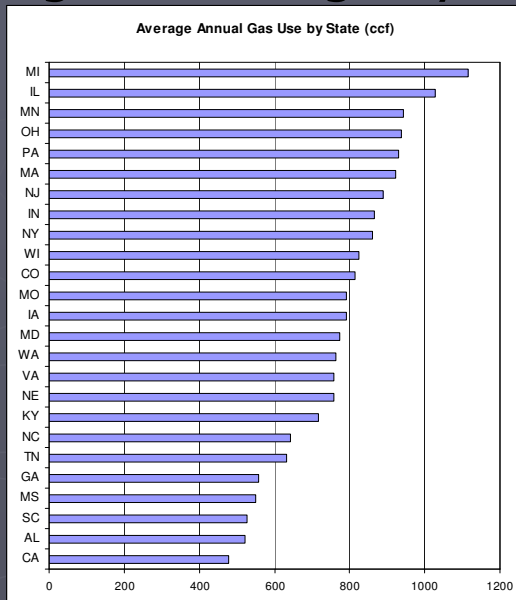
ACI Home Performance Conference 2008, FUND 3
April 8, 2008 3:35PM – 5:15PM
Pittsburgh, PA

Presented by: Michael Blasnik, M. Blasnik & Associates
michael.blasnik@verizon.net

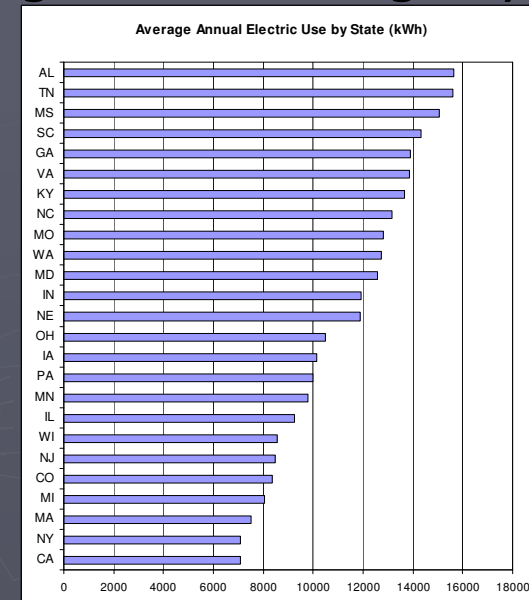
Energy Savings Opportunities

- ▶ Savings come from stopping waste
 - Assess Prior Energy Usage Levels
 - ▶ Look at all fuels, seasonal patterns
 - ▶ Low Usage = Few opportunities, High Usage = More
 - ▶ Average gas usage in cold climates ~ 700-950 th/yr
 - Low use <800, high use >1200, very high use >1600
 - ▶ Electric Usage varies widely depending on end uses
 - 9000 kWh=high use if gas home in cool climate, but low use if electric hot water and hot climate
 - Rule of thumb
 - ▶ Highest winter bill = savings potential from typical retrofits
 - ▶ Can do better on higher use homes or if longer paybacks OK
- ▶ Computers can't help much, except to sell the job...
 - ▶ Modeling has many uncertain inputs and shaky assumptions
 - ▶ Measured savings typically ~60% of predicted savings
 - ▶ Rough estimates can work as well or better

Average Gas Usage by State

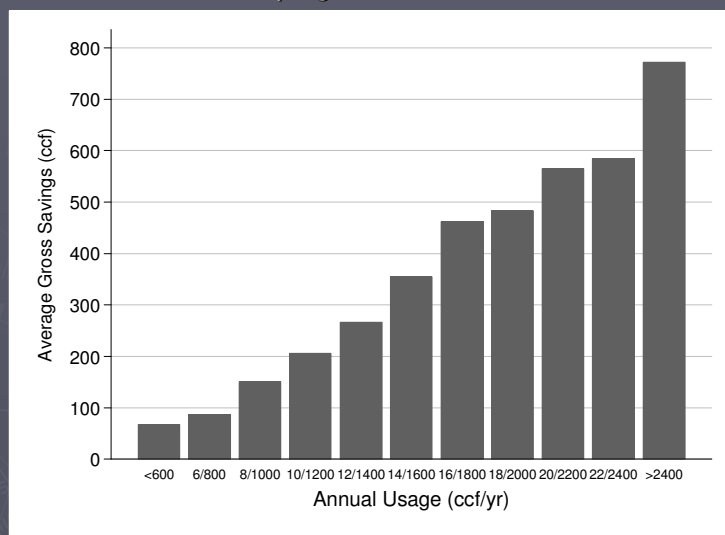


Average Electric Usage by State

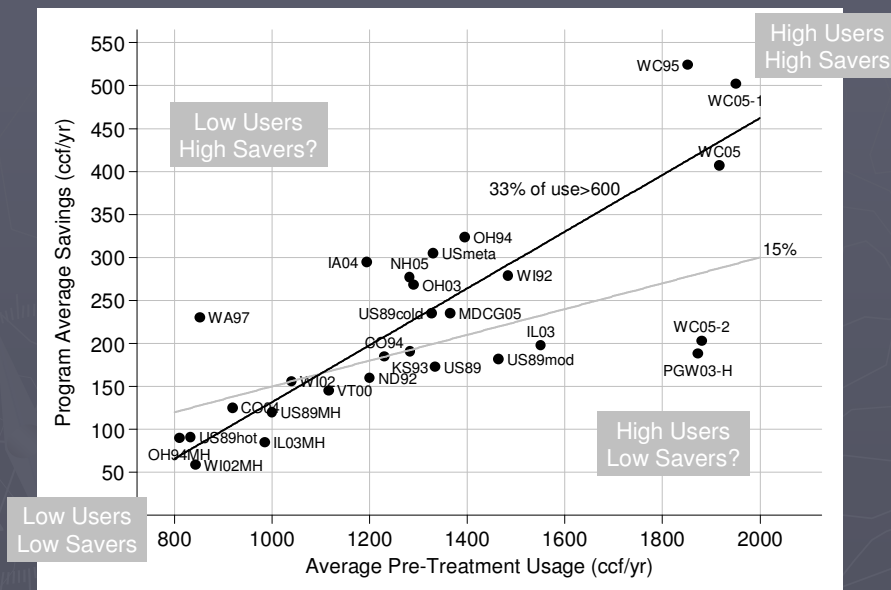


Energy Savings vs. Usage

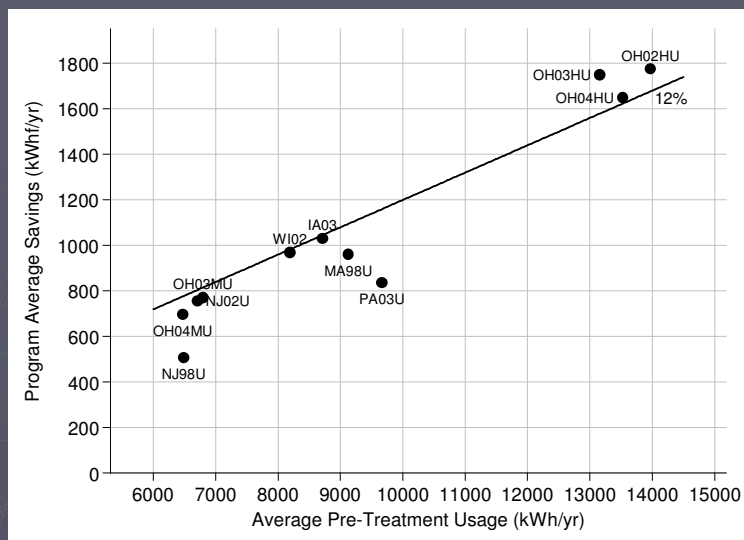
Wx program: Ohio WAP 94



Wx Program Evaluation Results

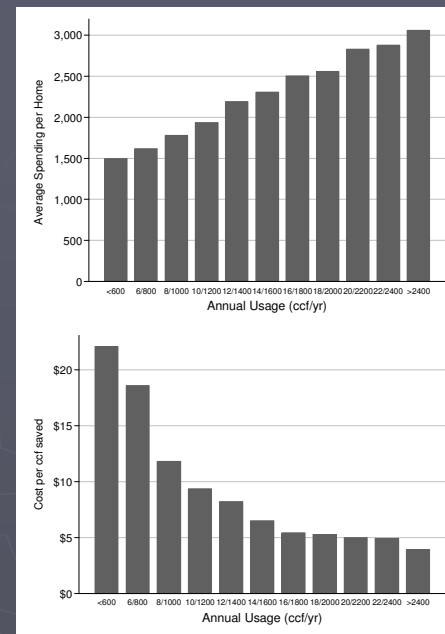


Electric Baseload Program Evaluation Results



Usage & Cost Effectiveness

- ▶ Spending increases sharply with usage in diagnostically driven programs
 - Spending doubled from lowest to highest users
- ▶ High users much more cost effective
 - Cost per ccf saved dropped dramatically



Finding Energy Waste

- ▶ If usage is high, find out why
 - Big house?
 - Lack of efficiency measures - install them
 - ▶ Insulate walls and attics
 - Inefficient Stuff - replace or improve
 - ▶ Heating system, refrigerator
 - Extra Stuff - unplug it / remove it / turn it off / control it
 - ▶ 2nd fridge, freezer, humidifier, all night outdoor lighting
 - ▶ Harder to deal with: swimming pool, aquarium, grow lights
 - Defects - find and fix
 - ▶ High air leakage rate with lots of attic bypasses
 - ▶ Thermal/Pressure Boundary Issues – split level, kneewall, porch, balloon framing
 - ▶ Hot water leaks
 - Behavior (educate)
 - ▶ Thermostat settings, lack of setback
 - ▶ Leave stuff on 24 hours/day: lights, computers, TVs, fans, furnace fan

Energy Saving Treatments

- ▶ Things that work
 - If opportunity (easy to determine) is there
 - If diagnostics indicate (harder to determine)
 - Look...no computer needed!
- ▶ Things that usually don't save much
 - Some are worthwhile if you've done everything else and don't mind long paybacks
 - Some are trivial

Things That Work: Building Shell

- ▶ Insulate uninsulated walls and attics
 - Save about 0.2 th/ft²/yr. in heating climates
 - Partially/poorly insulated attics
 - ▶ worth insulating if you also fix bypass leakage problems – saving ~0.1 th/ft²/yr.
- ▶ Air seal leaky homes
 - Use blower door to measure and find leaks
 - save 5-8 th/100 CFM50 reduction
 - Often the largest unexploited savings
 - ▶ few people know how to do it
- ▶ Hot Climates
 - radiant barriers or cool roofs if ducts are in attic
 - ▶ save ~10%-20% of cooling load
 - solar control for windows – screens, films, etc.

Things That Work: HVAC

- ▶ Turn down thermostat and/or use setback
- ▶ Seal ducts in attics, crawlspaces, garages
 - Save 8%-20% of HVAC loads
 - ▶ savings highest for attics, lowest for crawlspaces
- ▶ Replace Inefficient Heating Systems
 - Usually only cost-effective if high usage
 - ▶ Heating use of 1200-1400+ th/yr needed for OK payback
 - ▶ Save 20%-25% of heating usage if old 70% ->92%
 - ▶ Always select 92%+ furnace if replacing anyway
- ▶ Air Conditioners
 - ▶ premature replacement rarely cost-effective: only if very high use and very old unit
 - ▶ tune-ups – depends on approach and situation...

Things That Work: Hot Water

- ▶ Fix Hot Water Leaks
 - Tremendous savings potential when found
- ▶ High Efficiency Clothes Washer
 - Save ~ 800 kWh or 35 th and 11,000 gals water vs. old units
 - Save ~ 300 kWh or 12 th and 7,000 gals vs. std. new units
 - ▶ savings depend on hot water and dryer fuels, assumes ~1 load/day
 - Cost-effective for premature replacement if
 - ▶ high energy or water costs
 - ▶ high laundry usage: 2 loads/day or more
 - Or...wash clothes in Cold or Warm more often
 - ▶ Save 350 kwh or 15 th per year if 50% cut in hot water use
- ▶ Very Low Flow Showerheads
 - most existing showerheads already low flow
 - but 1.5 gpm showerheads may save ~ 10 th/yr, if kept

Things That Work: Electric Baseload

- ▶ Replace inefficient refrigerators
 - Based on rated usage or short term (1-2 hr) metering
 - Save ~600-900 kWh/yr, up to 2,000 kWh if 1970's side-by-side
- ▶ Lighting
 - CFLs & Fluorescent fixtures
 - ▶ save 20-50 kwh/bulb/yr
 - ▶ savings less than predicted due to removal, burnout, hours of use
 - ▶ still cost-effective
 - Motion detectors, esp. all night outdoor lighting
- ▶ Remove/unplug/shut off unneeded stuff
 - Furnace/AC air handler set to "On" can cost 3,000 kWh/yr !
 - Secondary fridges, freezers can use 400-2000 kWh/yr
 - 24 hour stuff: Computers, lights, TVs, fans, etc.
 - ▶ Can waste 100-500 kWh/yr each
 - ▶ Often no real benefits – misinformed occupants
 - Vampire / Phantom / Standby loads
 - ▶ Not really huge, but growing, use (smart) power strips

Things That Work: If Diagnosed

- ▶ Advanced air sealing, strategic dense packing and stuff you learn about at this conference
 - Use blower door, infra-red, zonal pressures, etc.
 - Problems common in split levels, kneewalls, cantilevers, porch connections, balloon framing, McMansions
 - Often addresses comfort, moisture, IAQ and other problems
- ▶ Air conditioner commissioning / tune up
 - Must measure charge and air flow
 - Save ~ 5%-12% cooling use – worthwhile if big cooling load
 - ▶ Usually doesn't help at all if done by typical HVAC contractors
 - ▶ Need to test charge and air flow, TXV units may not benefit much
- ▶ Duct balancing / pressure relief MAD-AIR
 - More common problem in tighter new homes

Things that don't save enough (1)

- ▶ Window replacements:
 - Savings ~ 2-3 th/yr per window, 100+ year payback
 - Somewhat better savings if:
 - ▶ Single windows without storms, жалюзи
 - ▶ Storm windows more cost-effective, but if you want windows...
- ▶ Routine Weatherstripping & Caulking
 - Savings ~ 0-15 th/yr
 - Most air leakage is in attic, basement, key junctures, not windows
- ▶ Floor Insulation: fairly costly with low savings
 - Any savings over typical basements?
 - Crawlspace: save 0 – 40 th/yr (~ .05 th/sq.ft.?)
 - ▶ must fix ducts

Things that don't save enough (2)

- ▶ Heating System Tune-ups
 - Gas: 0 savings? some for systems with problems
 - ▶ OK for safety, don't need very often
 - Oil more likely to benefit, savings still questionable
- ▶ Basement Duct Sealing
 - Savings = 1%-3% found in several studies
 - ▶ maybe more if basement is hottest room in winter, fix big holes
 - May be needed for health/safety reasons if depressurization problem
- ▶ Water Heater Replacements
 - May save 30-50 th/yr but generally too expensive
 - Tankless units perform < rated EF, can cause increased HW use
- ▶ Small behavior changes with trivial impacts
 - change furnace filters monthly, cook with lids on pots, clean fridge coils, close fridge quickly, close drapes at night

Priorities

(in reverse order)

- ▶ Saving a lot of energy
 - Most cost-effective things with biggest impacts first
- ▶ Not making things worse
 - Don't do air sealing or insulating or other shell treatments without health & safety protocols
- ▶ Finding & fixing related problems
 - Health, safety, IAQ, structural problems
 - ▶ Moisture, mold, rot
 - ▶ Combustion safety