Mythbusters: What Works, what saves?

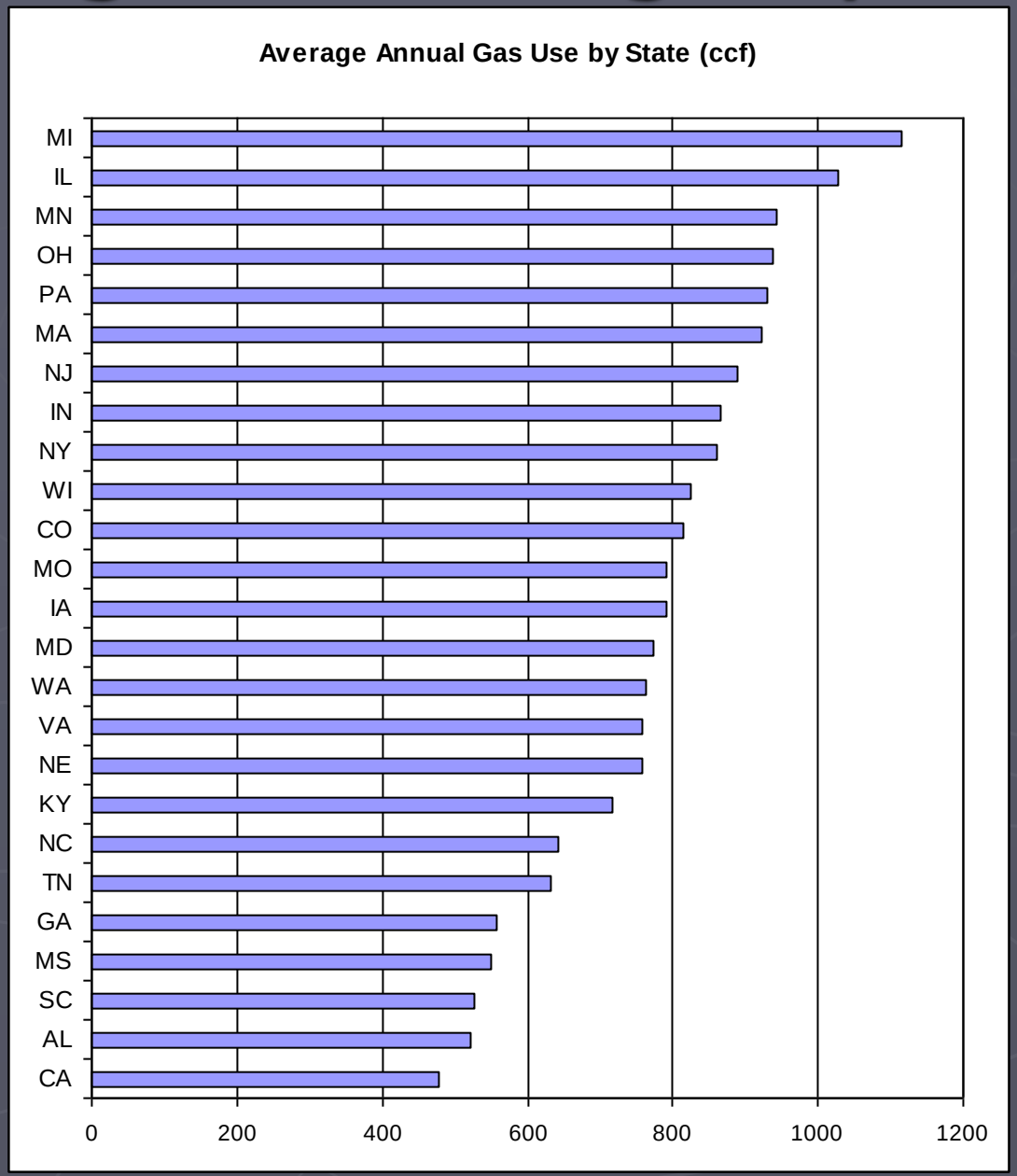
2008 National Energy and Utility Affordability Conference
June 16, 2008 3:45PM – 5:00PM
Denver, CO

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

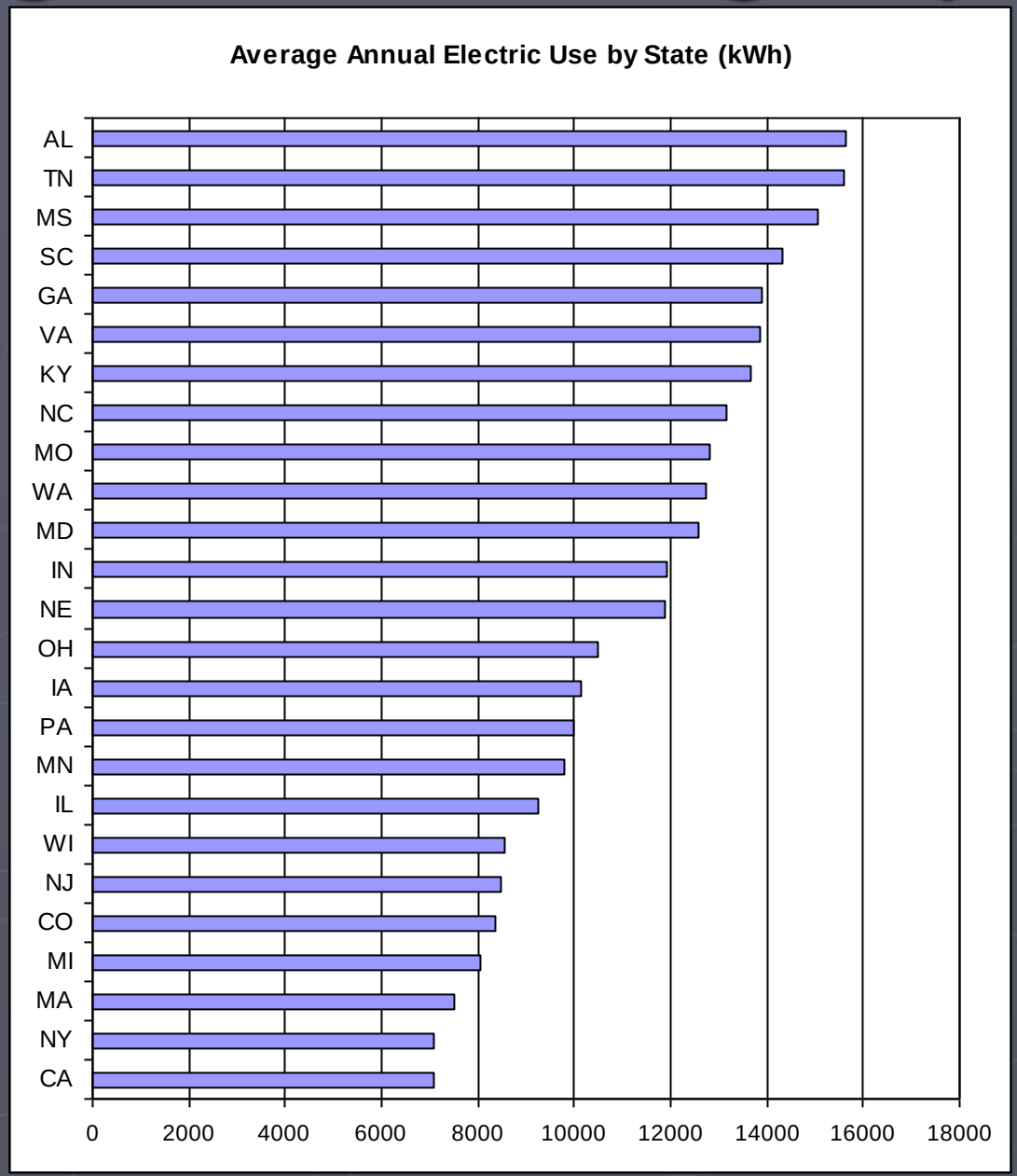
Saving Energy

- Savings come from stopping waste
  - Step 1: Assess Current Energy Use
    - Look at all fuels, seasonal patterns
    - Low Usage = Few opportunities, High Usage = More
    - Average gas usage in cold climates ~ 700-1,000 th/yr
      - Low use <800, high use >1,200, very high use >1,600
    - Electric Usage varies widely depending on end uses
      - example: annual use of 9000 kWh is:
        - high use if gas heat & hot water home in cool climate
        - low use if electric hot water and hot climate
  - Rule of thumb
    - Highest winter bill = savings potential from typical heating retrofits
    - Can do better on higher use homes or if longer paybacks OK
- Computers can't help much in decisions
    - Software models have many uncertain inputs and shaky assumptions
    - Measured savings typically ~60% of predicted savings
    - Rough estimates can work just as well or better
    - But software does provide a great program tracking system

Average Gas Usage by State

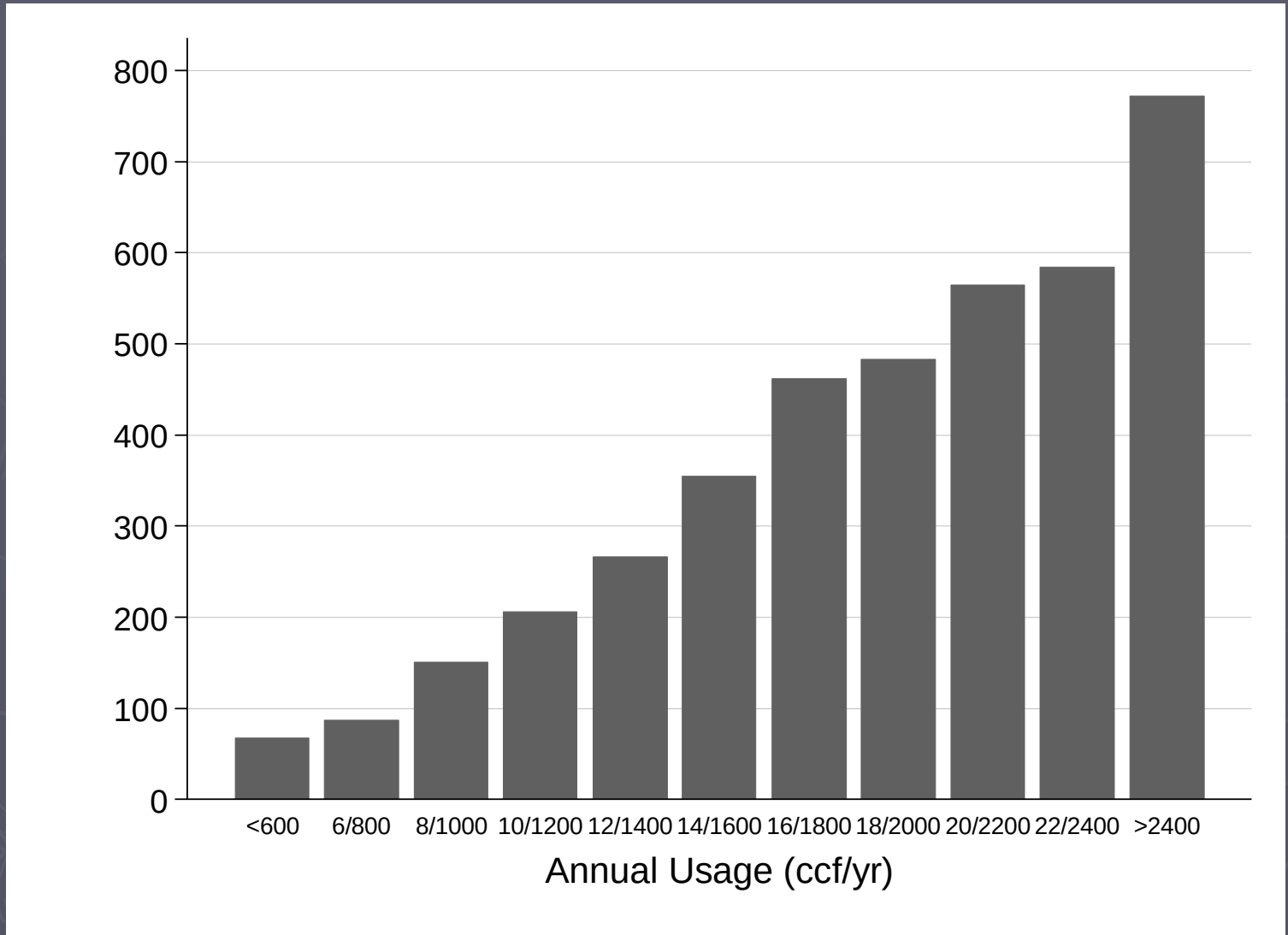


Average Electric Usage by State

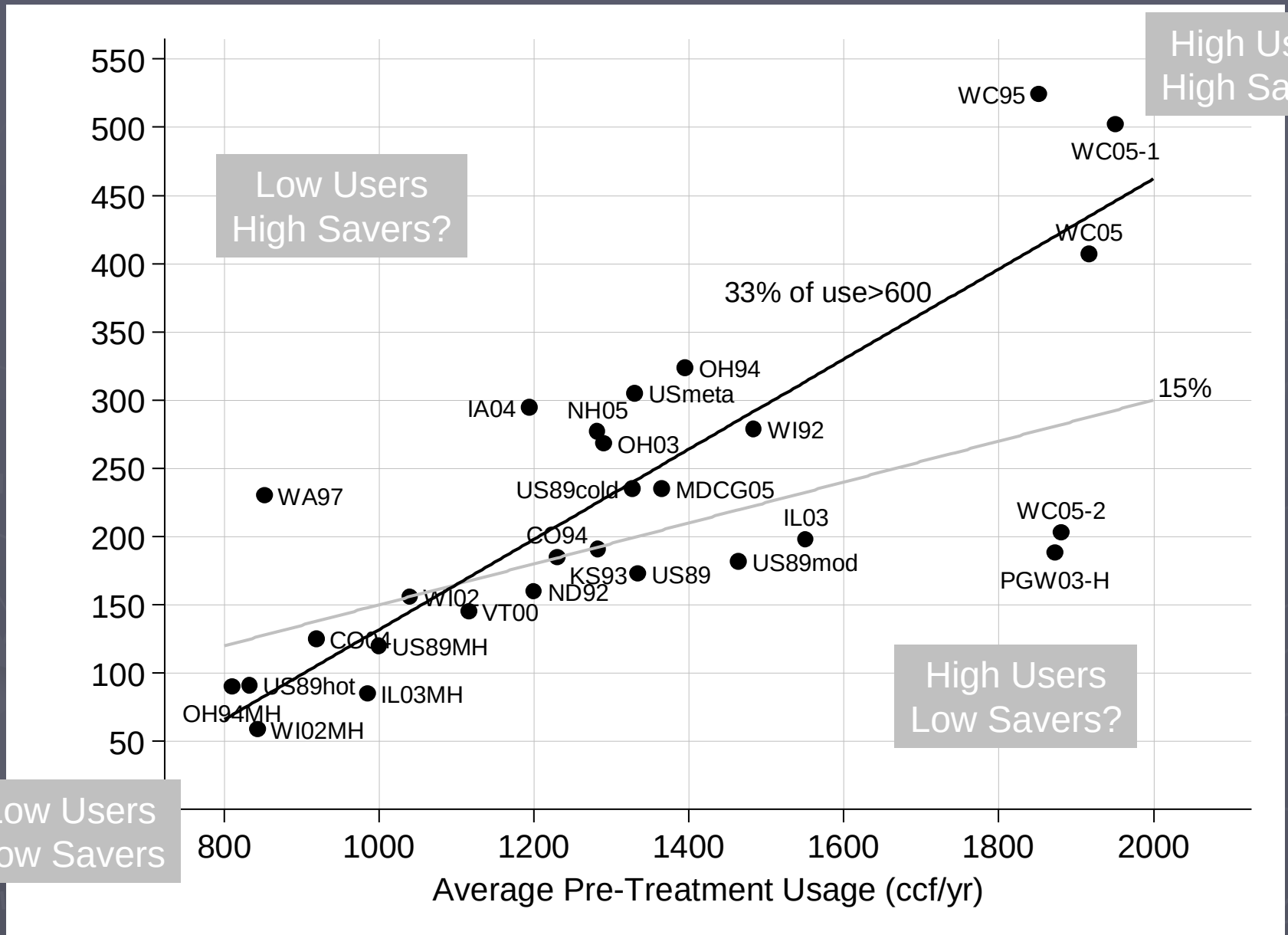


Energy Savings vs. Usage

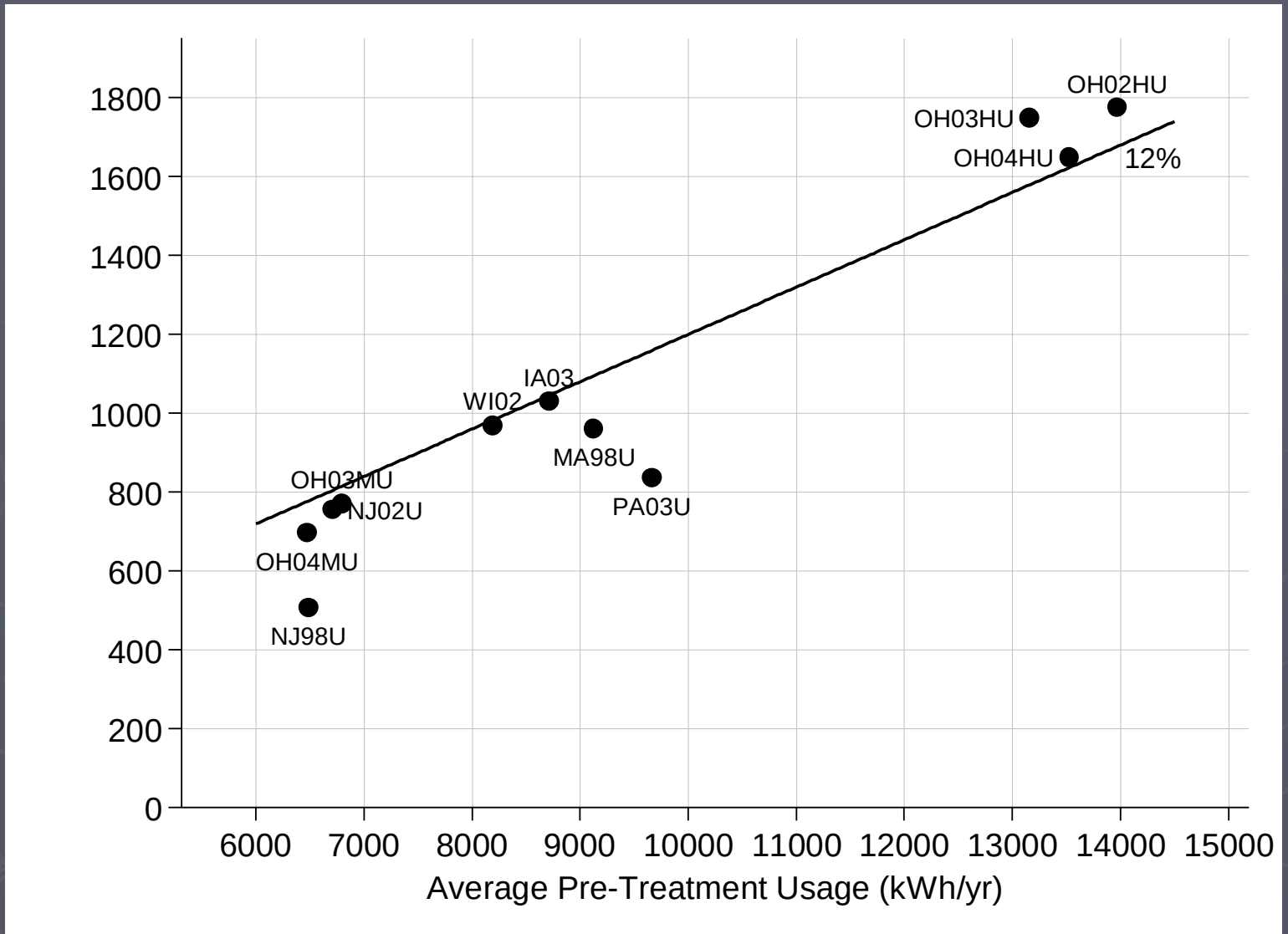
Wx program: Ohio WAP 94



Wx Program Evaluation Results

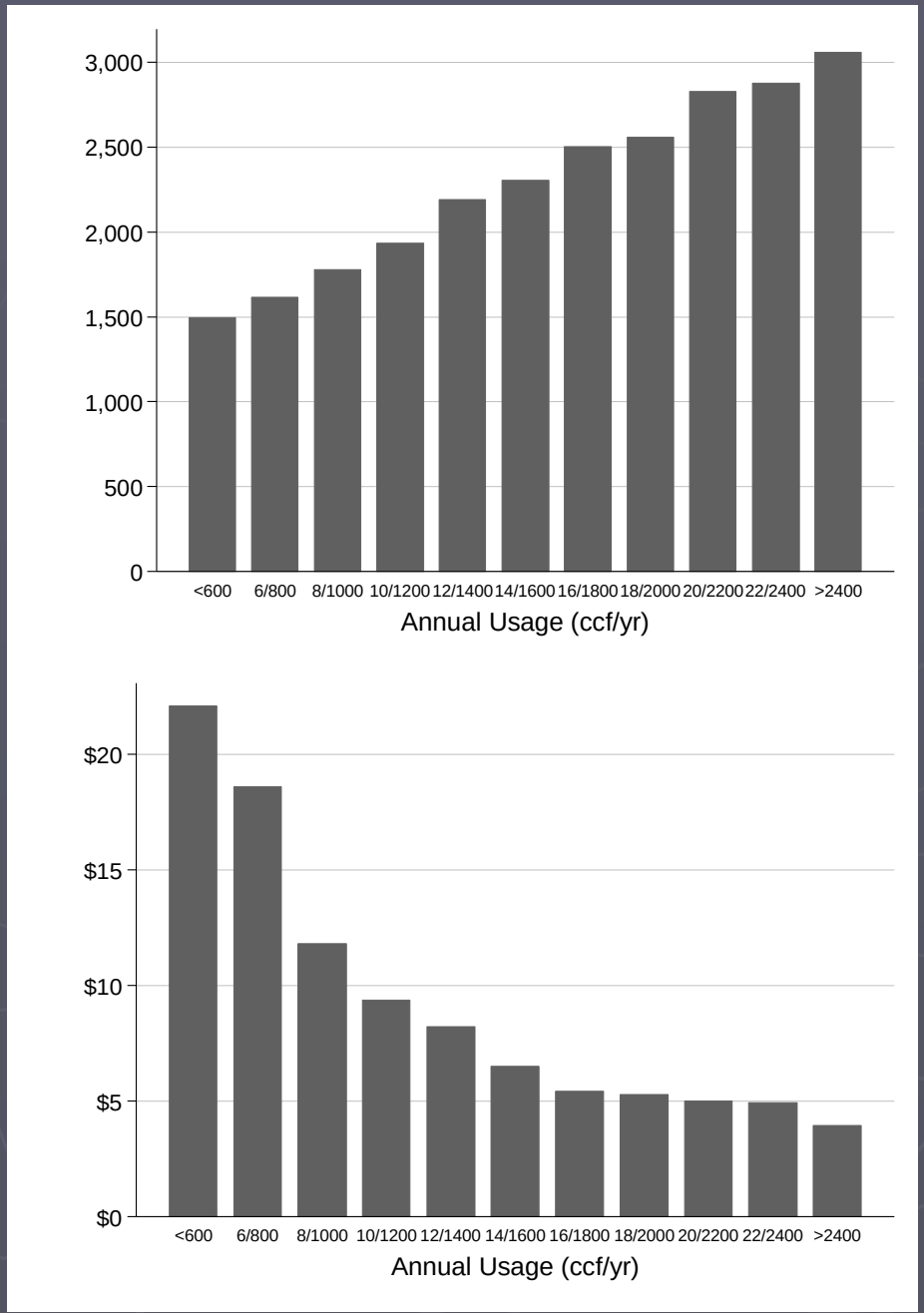


Electric Baseload Program Evaluation Results



Usage & Cost Effectiveness

- Spending increases sharply with usage in diagnostic-based 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: 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: payback <4 years
  - 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
    - 50-100 th/yr savings achievable for low income housing in heating climates
  - Often the largest heating savings available in insulated homes
    - but few people know how – need training
- Hot climate shell measures
  - 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
  - Only cost-effective if usage is high
    - Heating use 1200-1400+ th usually needed for good 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 cooling 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 gal. water vs. old unit
    - depends on hot water and dryer fuels, assumes 1 load/day
  - Cost-effective to replace if...
    - high energy or water costs
    - high laundry usage: 2+ loads/day
  - 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 < 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 ACI conference
  - Use blower door, infra-red, zonal pressures, etc.
  - Problems most common in split levels, kneewalls, cantilevers, porch connections, balloon framing
- Air conditioner commissioning / tune up
  - Must measure charge and air flow
  - Save ~ 5%-12% cooling use – worthwhile if big cooling load
    - std tune-up doesn't help because HVAC contractors don't measure charge or air flow
    - TXV units may not benefit much

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, jalousies
    - Storm windows more cost-effective
- Routine Weatherstripping & Caulking
  - Savings ~ 0-15 th/yr
  - Most leakage is in attic, basement, key junctures
- Floor Insulation?
  - Fairly expensive with lower than expected savings
    - Any savings over typical basements?
    - Crawlspaces: 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 heath/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