

Don't Blow Your Money Away

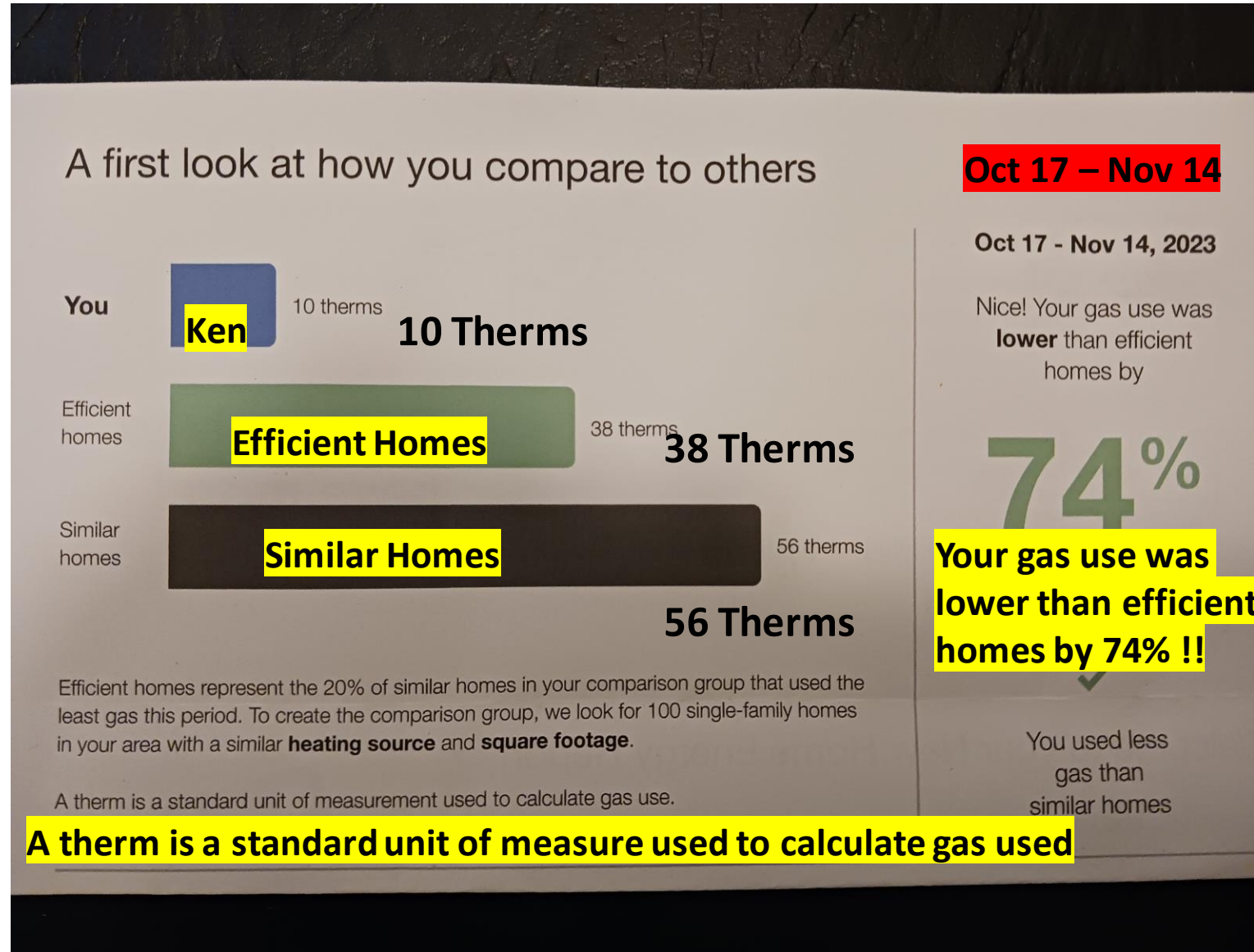
A workshop presented by

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CUMC Sanctuary

12 December 2023

A Concrete Example of Money Saved by Following the Steps and Advice of this Workshop



My Professional Resume

- **Three degrees in meteorology: B.S. ('73), M.S. ('75), PhD. ('78) @ Penn State**
- **44 years as a working meteorologist (1973-2017)**
 - 6 years as teaching & research assistant in the Graduate School of Penn State University
 - 4 years active duty in the U.S. Air Force (Offutt AFB, Omaha, NE)
 - 6 years federal civil surface member of Air Force Geophysics Lab (AFGL) in Bedford, MA
 - 20 years as federal civil service member of the National Weather Service (NWS/NOAA)
 - member of NWS Development Division, which creates and improves computer-based weather forecast models (aka Numerical Weather Prediction, or NWP) in D.C.
 - 8 years self employed as a consultant for two companies: AER, CLIMBIZ
- **Concurrent with above positions:**
 - 17 years in the Air Force Reserve (1982-1999)
 - Member of the American Meteorological Society (AMS) from 1973 to present
 - Three years as Associate Editor of the AMS Journal of Hydrometeorology (1999-2002)

Outline of this Workshop Presentation

- **Instructions for creating your personal BGE online account**
 - Energy saving tips, advice & comparisons accessible via your BGE online account
- **Learning two laws of physics**
 - Via pictures from inside my home (pictures speak a thousand words)
- **Energy saving instructions and examples for**
 - Save energy by doubling your **attic insulation**
 - Save energy by “new management” of your **window** blinds, curtains or drapes
 - Save energy by **heating “locally”**, not “globally”
 - Save energy by adjusting and insulating your **water heater**
 - Save energy by taping the joints of your **heating/AC ducts**
 - Save energy by insulating your **hot water pipes**
 - Save energy via changes to your **refrigerator habits**
 - Save energy by insulating your **basement windows** in non-living areas
 - Save energy by utilizing “**free sources**” of heat (winter) or cold (summer)
 - Save energy by staying tuned to and utilizing your **weather forecast**
 - Save energy by **avoiding double heat-up** (or double cool-down)
 - Save energy by properly **utilizing fans** (ceiling fans, floor fans, bathroom exhaust fans)
 - Save energy by making wiser choices in the **clothes and footwear** you wear

Workshop Assignment #1

- **Create your own BGE online account**
 - Go to bge.com
 - this site is for residential customers of BGE
 - Then click the “**Register**” link at top right (to the right of the “Sign In” box)
 - Then click on the blue “**Register Now**” box at bottom center of page
 - This registration process typically takes 3-5 minutes
- During the registration **process you will need handy** the following:
 - Your email address
 - One of the following combinations:
 - Your phone number and the last 4 digits of your SSN **OR**
 - Your **BGE account number** (shown on your monthly bill) **AND**
 - the last 4 digits of your SSN **OR**
 - **Your Zip Code**
 - The bold words in above 3 lines show how to register without giving your SSN
- **Via your personal BGE online account, you will have access to boatloads of A) Energy Savings Tips, B) Comparisons of your gas & electricity usage with nearby similar homes, C) Comparisons of your gas & electricity usage in the current month but from last year, and D) more**

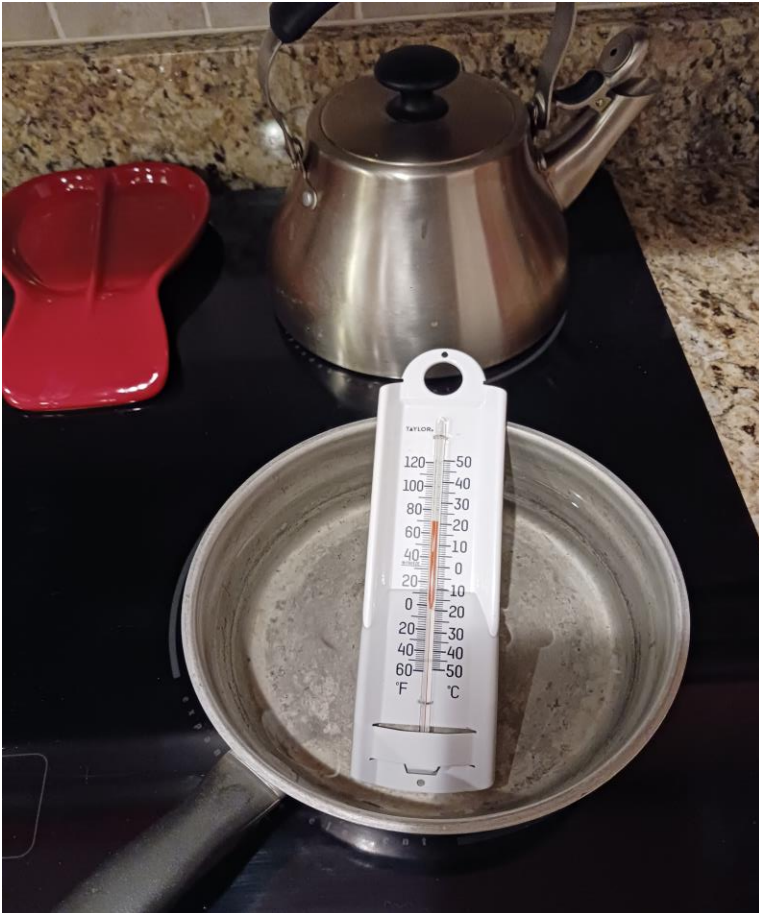
Workshop Assignment #2

You will experience two laws of physics that dominate the heating & cooling of air in your home

- Assignment **#2A: you will do the refrigerator and bare feet test.**
 - Stand close to your main refrigerator in your bare feet and open the refrigerator door
 - Stand close to an unheated closet in your bare feet and open the closet door
- Above exercise illustrates the following **law of physics #1:**
 - **Colder air sinks and warmer air rises**
 - Important -- I did NOT say “cold air sinks and warm air rises”: why?
- Assignment **#2B: you will do the boiling pan of water test.**
 - Boil a pan of water 2 inches deep on your stove, turn off the heat, place a thermometer in the water and write down the water temperature every 5 min for one hour
- Above exercise illustrates the following **law of physics #2:**
 - **An initial temperature difference between two side-by-side materials will decrease exponentially fast to a zero temperature difference**
 - The term “exponentially fast” will be illustrated in the slide after next slide

The Boiling Water Test Illustrated

Assignment #2b



- Bring a pan of 2 inches of water to a boil
- Turn off the heat
- Place suitable thermometer in the hot water
- Observe & record **initial** water temperature & then **every 5 minutes** for a period of **one hour**
 - Does the water temperature decrease much faster in first 15 minutes and then much slower in final 15 minutes?

Energy Saving Tip #1

This is the only expensive tip in this presentation

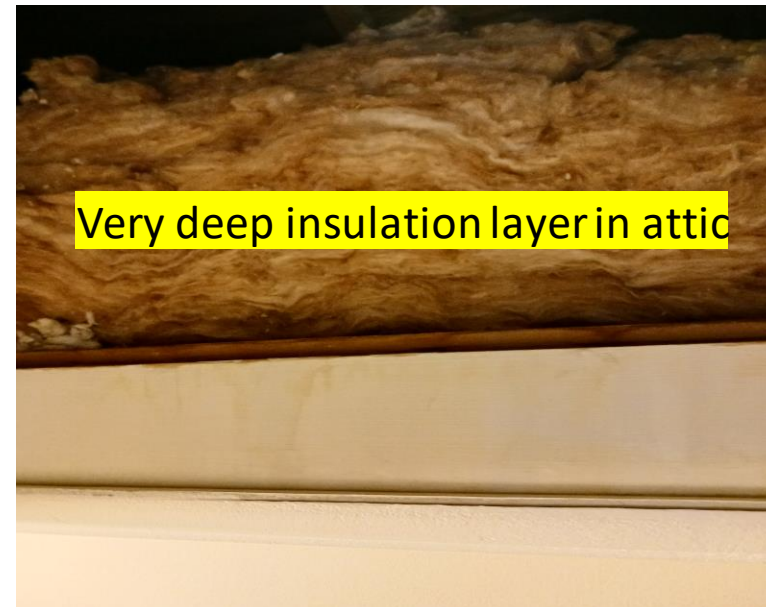
- **Increase the thickness of your attic insulation by 2 to 3 fold.**
 - In around 2002, I had a contractor add a thick layer of insulation on top of the existing insulation.
- **At this time, add a thermostatically controlled attic fan**
 - If your attic doesn't already have one



Attic access door



On/off switch for attic fan in master bedroom



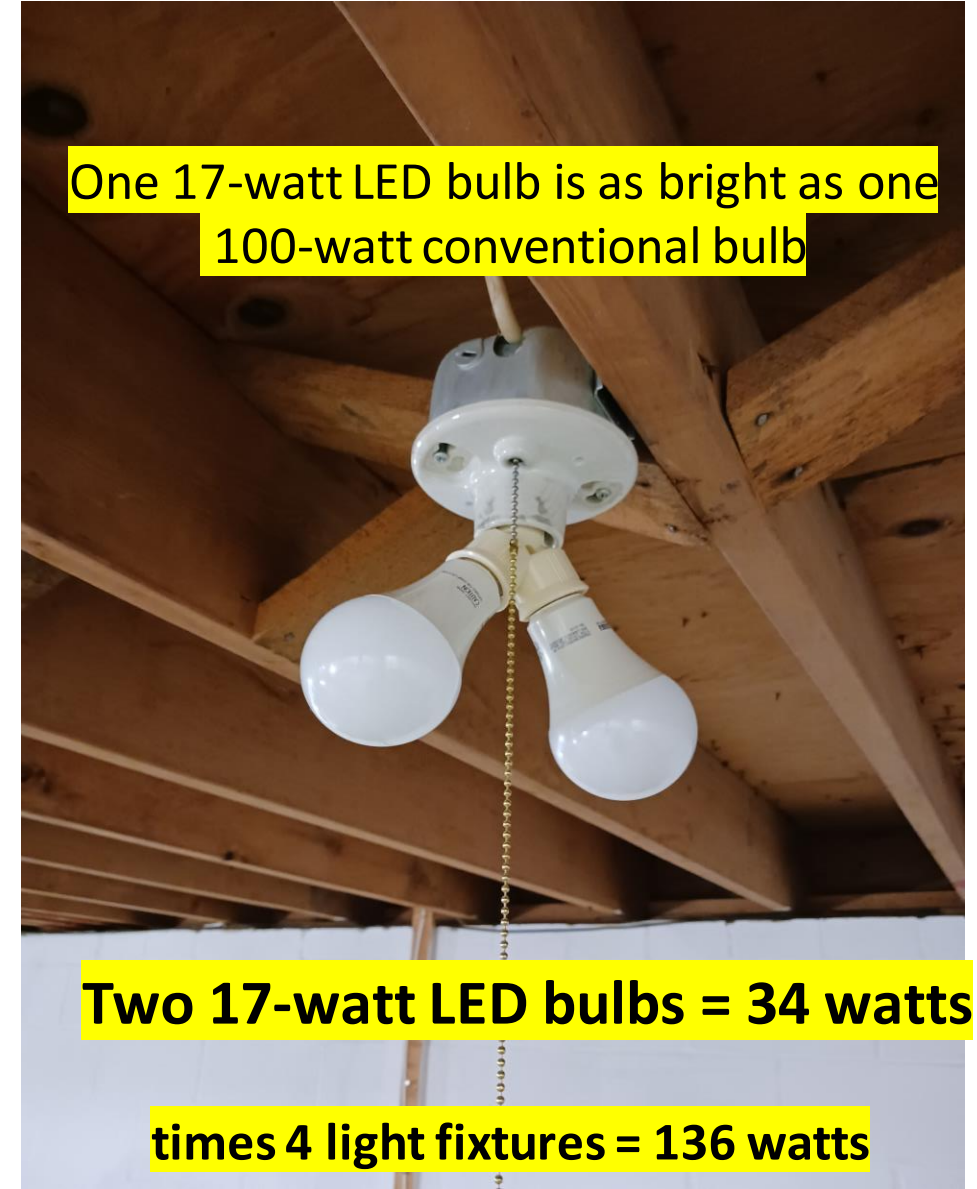
Very deep insulation layer in attic

Energy Saving Tip #2

Replace ALL light bulbs with LED bulbs (even if old bulb is a CFL bulb)



**One 100-watt conventional bulb
times 4 light fixtures = 400 watts**



**One 17-watt LED bulb is as bright as one
100-watt conventional bulb**

**Two 17-watt LED bulbs = 34 watts
times 4 light fixtures = 136 watts**

Energy Saving Tip #3

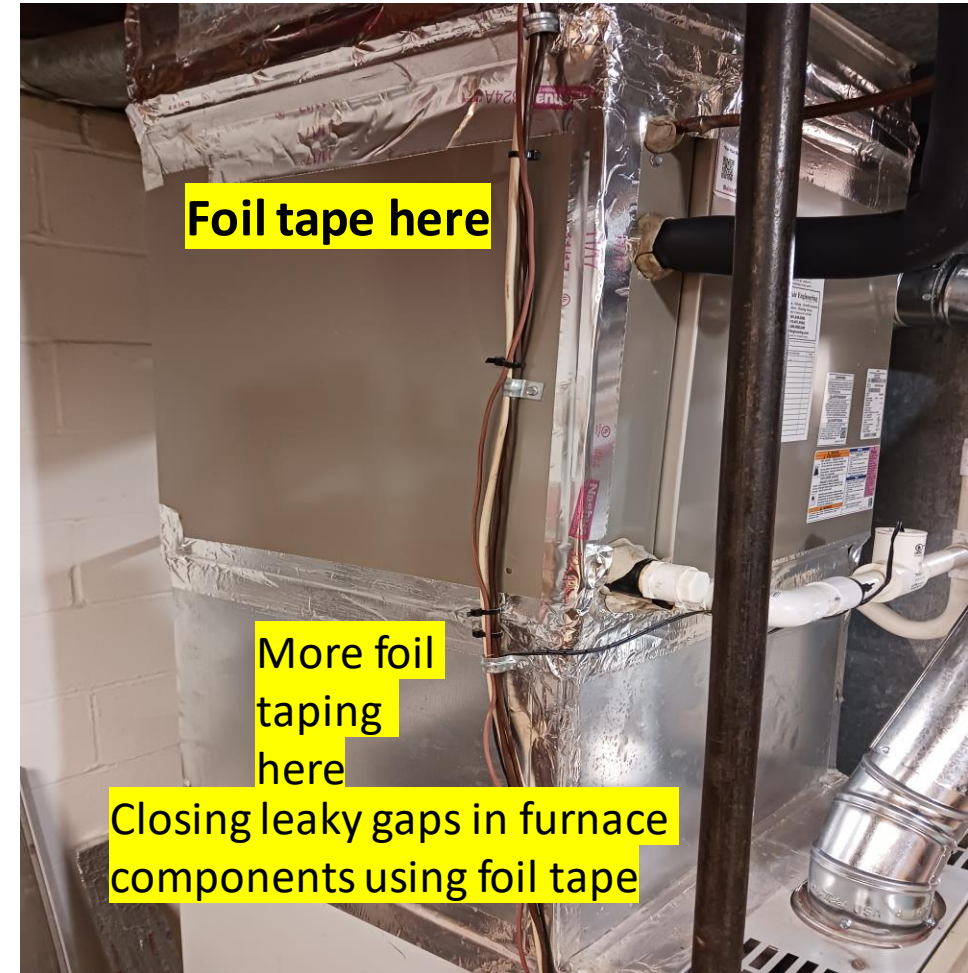
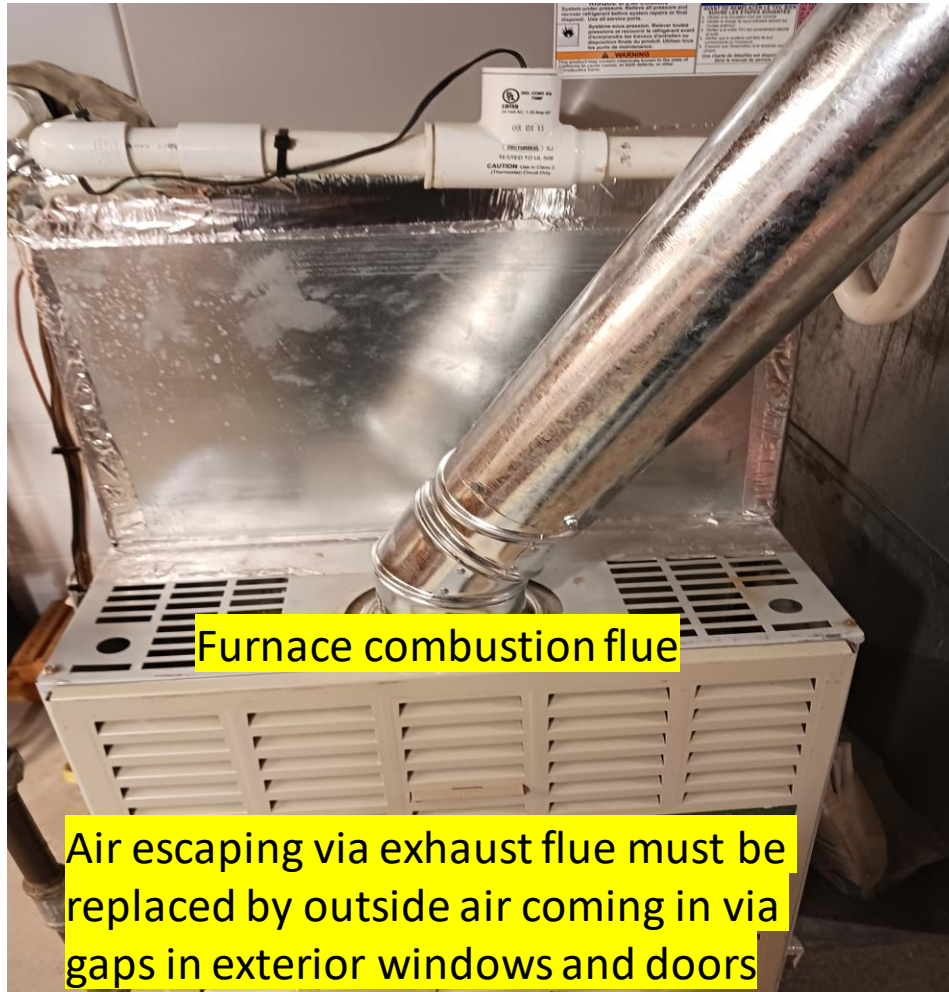
Heat directly “locally” using space heaters, not “globally” using your gas furnace.

- **Directly heat the few rooms you use most**
 - such as family room, kitchen, one or two bedrooms

Do not use your gas furnace to heat your frequently used floorspace (except on very cold days) because:

- **Use “direct” room-specific heat sources**
 - **Electric space heaters**
 - 1500 watt capable
 - **Gas fireplaces**
 - **IF** fireplace chimney has both exhaust flue for combustion gases and intake flue bringing in outside air to feed the fireplace flame
 - Such chimneys don't draw air from the room
 - Gas fireplaces with blower fan are best
- **Close ALL doors of rooms rarely used**
- **Close ALL closet doors (recall physics law #1)**
 - Quickly reclose closet doors after each use
 - Don't dawdle with your open closet
- **Gas furnaces have low efficiency**
 - About 30 percent of furnace heat is lost keeping the air ducts warm
 - About 10 percent is lost through the exhaust flue
 - Air going up the exhaust flue is replaced by cold outside air coming in through leaks around external doors and windows
 - Air ducts leak at their sectional joints
 - Heat registers that are “closed” still leak warm air
- **Improve furnace efficiency by these steps:**
 - Use **foil tape** to cover gaps in heat ducts and between furnace components
 - Insulate any exposed heat ducts
 - Such as ducts exposed in basement ceiling joists

Some pictures to illustrate the advice given in previous slide of Energy Savings **Tip #3**



You ask:

How long in months or years will it take me to recover my costs of implementing several or more of these energy savings tips?

I will address this question near end of this presentation

(Aside from hiring a contractor to add more insulation to your attic)

Utilize **space heaters** & **gas fireplace** as direct heat sources in several rooms in lieu of running furnace as per Energy Savings **Tips #3**



Keeping doors closed for unused rooms **and** closets

Example pictures

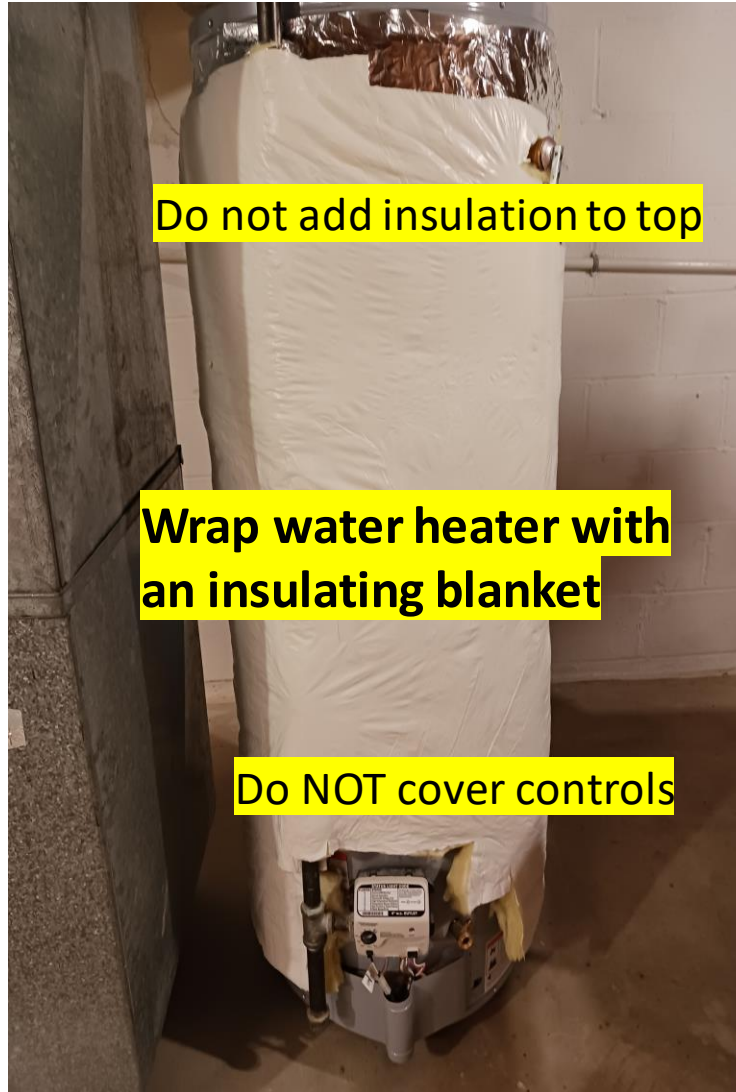


Energy Saving Tip #4

Changes to make your gas water heater run less and consume less gas



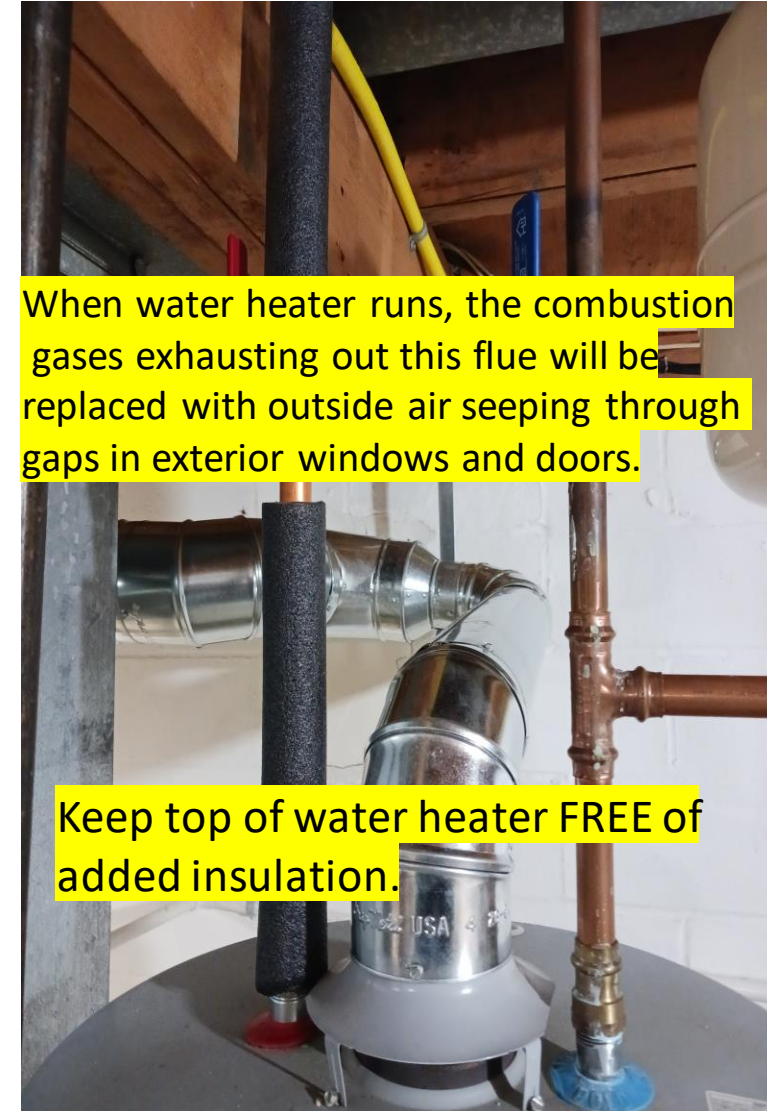
Set thermostat to LOW setting



Do not add insulation to top

Wrap water heater with an insulating blanket

Do NOT cover controls



When water heater runs, the combustion gases exhausting out this flue will be replaced with outside air seeping through gaps in exterior windows and doors.

Keep top of water heater FREE of added insulation.

Energy Saving Tip #5

Better manage window blinds or drapes to reduce heat loss (winter) or heat gain (summer)

- In our living room, we have a large double-wide window **facing south**
- We have other large windows on the **western facing wall** of both our living room and dining room
 - These windows take in a lot of sun in the afternoons (especially in summer)
- Our original curtains in these two rooms were light material and pulled permanently to the side of the windows by restraining straps
 - Are the source of much unwanted heating of first floor in summer
 - Are the source of much cooling in the winter (especially during the long winter nights)
 - Our original living room drapes were of a light material and they were permanently pulled to the sides of the window
- These south facing and north facing windows made the AC run substantially more in summer and the furnace run substantially more in winter
- I agonized over what to do to eliminate the wasteful heating in winter and the wasteful cooling in summer. I oscillated between a number of unsatisfactory solutions (next slide)

Window covering solutions we considered but rejected

- **Darkening window blinds**

- Expensive to implement on four windows in Living Room and Dining Room
- One of the four windows is double wide (think “picture window” size)
- The lines to raise and lower the blinds are susceptible to breakage
- We considered automatic electric blinds with remote control
 - Violated the keep-it-simple mindset
 - Electric motors involved, they can fail (Murphy’s Law: what can go wrong will go wrong)

- **Outdoor awnings**

- Need four of them (one double wide)
- They need to be taken down for winter
 - To avoid collapsing from deep wet snow overloading
 - To avoid undesirable shading of incoming sun in winter

The Solution That Emerged in a **Eureka-type** moment

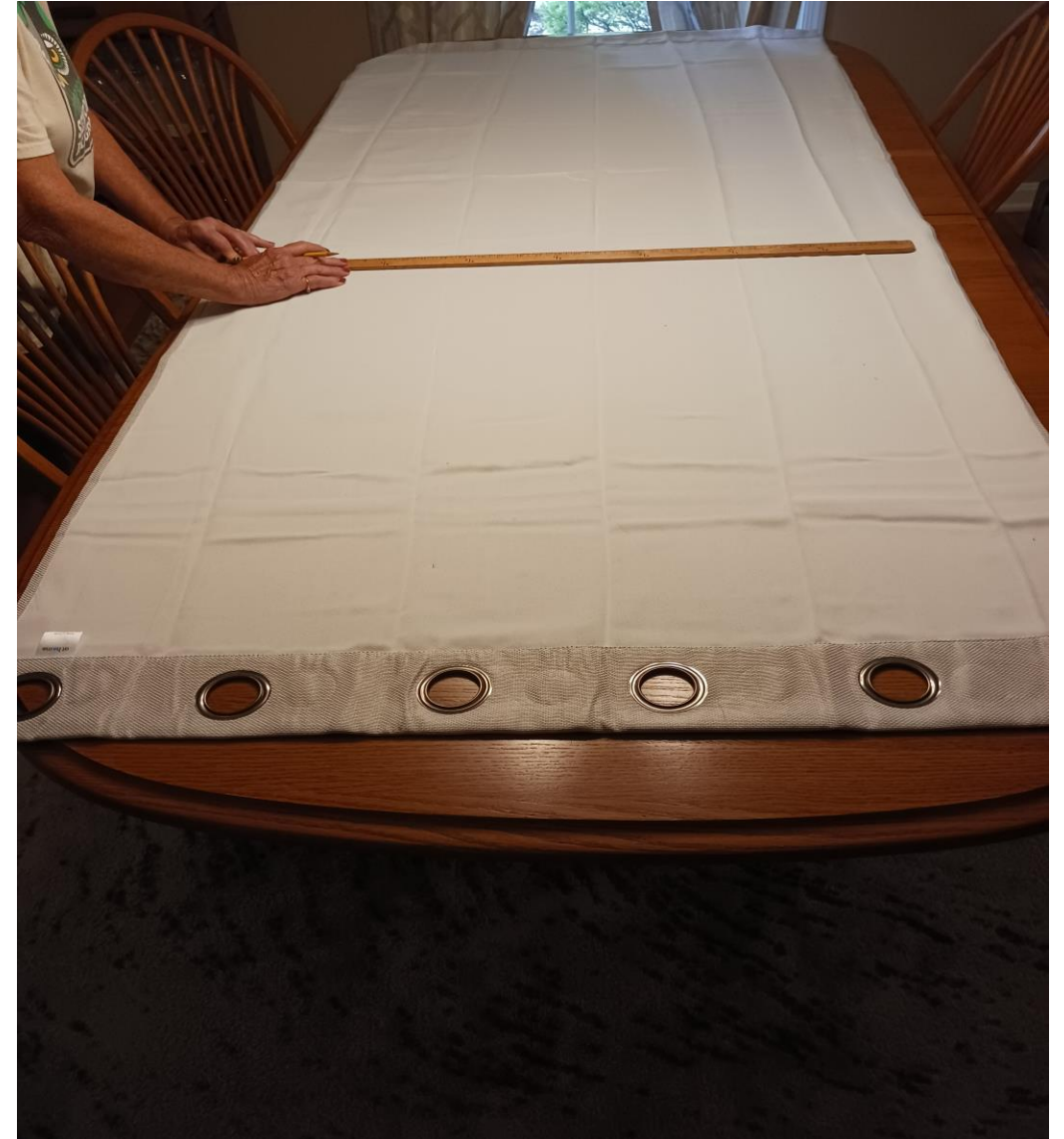
- I was taking a shower and it occurred to me to treat our window drapes in same way as our double shower curtain, namely
 - An inside plastic liner that stays inside the tub
 - An outer decorative fabric curtain
- We discarded our old light-fabric drapes
- We would **NOT** use curtains permanently pulled back by their restraining straps or cords
- We purchased heavy fabric “darkening” decorative drapes
- We purchased light beige “darkening” drapes that go against the glass window and inside the outer decorative drapes
- Pictures on next slide

Picture of the decorative outer darkening drape
Note type of curtain rod which is important to the solution



Picture of the plain-beige outer darkening drape

- My wife Kathy is measuring the plain beige darkening inner drape
- These heavy-fabric darkening drapes were obtained online from J.C. Penneys
- These drapes were not expensive as they were purchased from a mainline store
 - **Not purchased from a specialty window-coverings store**



Managing the new 1st-floor drapes

- **Summer** (for any 1st-floor room not being used)
 - Keep drapes closed at night
 - Keep drapes closed during day
- **Winter** (for any 1st-floor room regardless of being used or unused)
 - Open drapes at sunrise or climb-out-bed time
 - Close drapes at dusk
 - I'm not yet disciplined to do this on time (I often forget & it gets to be bedtime when I do it)
 - I need to set an alarm on my cell phone (and maybe on wrist watch)

Managing our upstairs blinds

- Our upstairs blinds are standard 1-inch vinyl blinds
- Managing our upstairs blinds
 - **Winter**
 - Open in daytime to let in sunshine
 - Close at dusk as “insulation” from outdoor cold
 - **Summer**
 - Close in daytime in unused rooms
 - Close at dusk as “insulation” from outdoor heat
 - Manage sunshine allowed thru blinds via angle of the slats



Energy Savings Tip # 6

Recognize and use FREE sources of heating or cooling

Winter



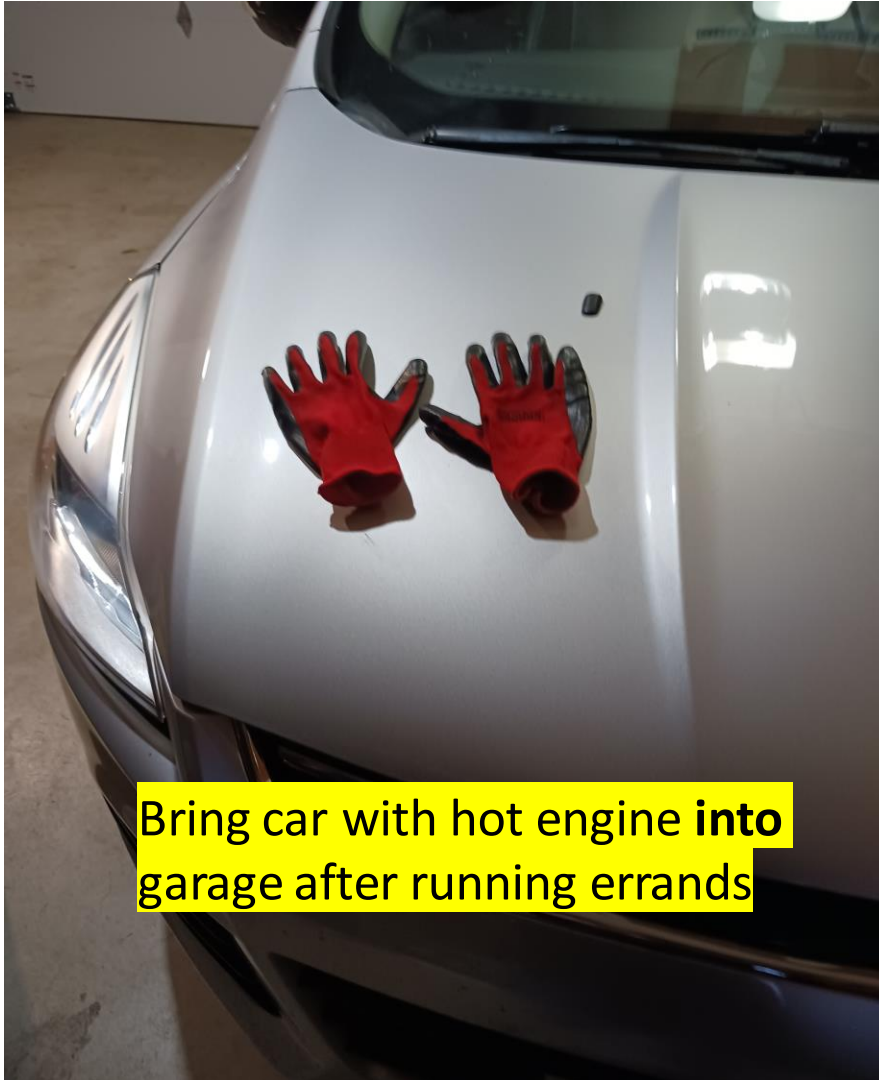
Summer



Energy Savings Tip # 6

Recognize and use FREE sources of heating or cooling (Continued)

Winter



Bring car with hot engine **into** garage after running errands

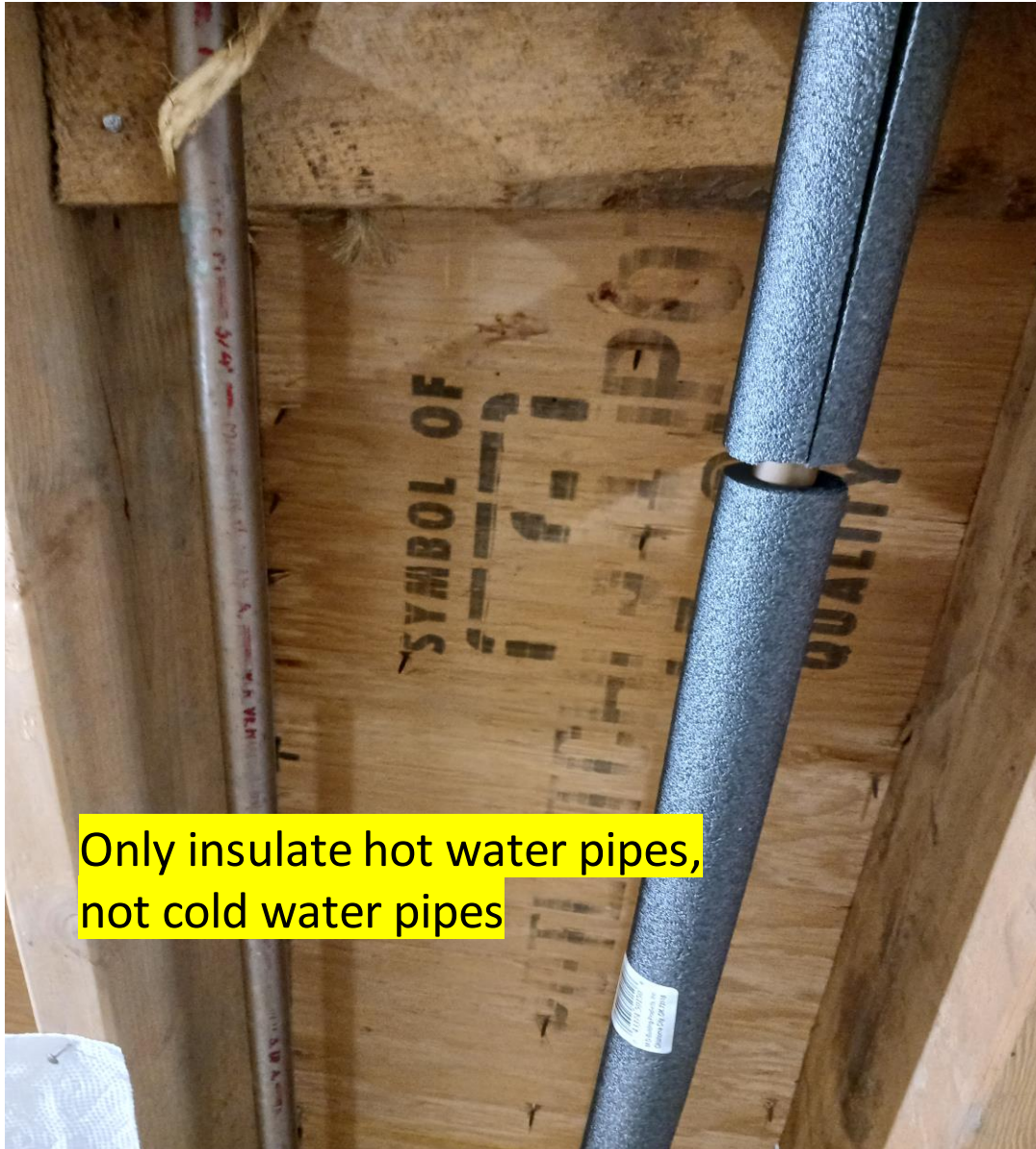
Summer



Leave car with hot engine **outside** of garage after running errands

Energy Savings Tip # 7

Insulate exposed hot water pipes and exposed air ducts



Only insulate hot water pipes,
not cold water pipes



My blanket insulation supply for insulating
exposed HVAC air ducts (yet to be done)

Energy Savings Tip #8

Do not turn on the hot water handle of any of household faucets
(except for taking showers and doing dishes by hand)

Say NO to this handle position (hot water on)

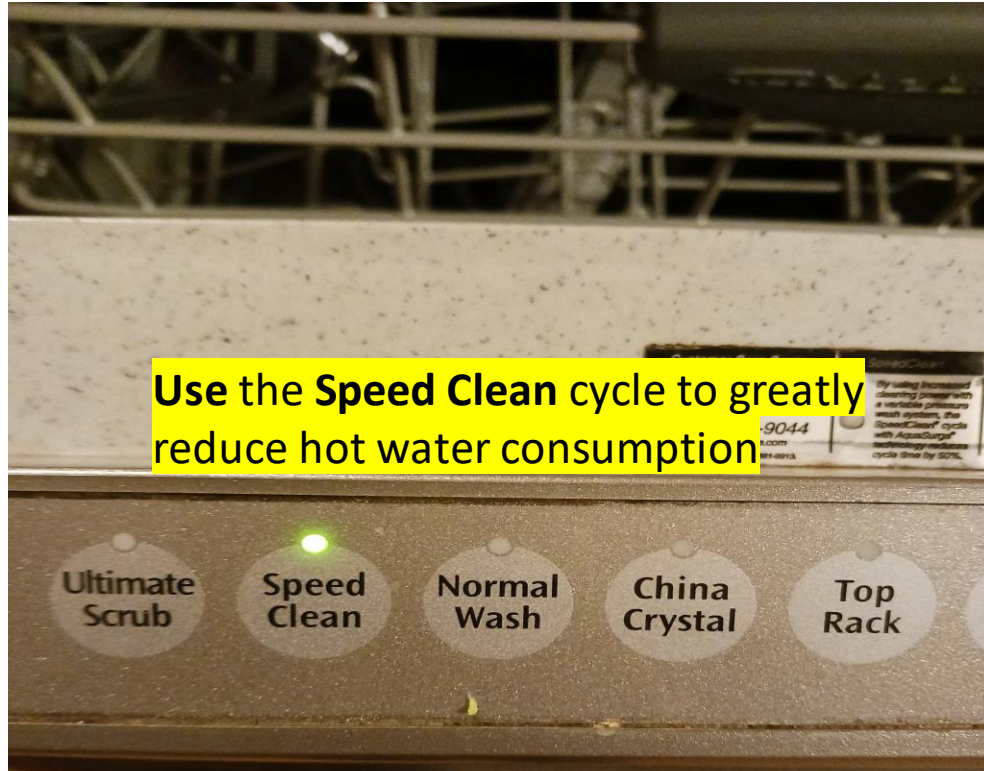


Say yes to this handle position (hot water off)

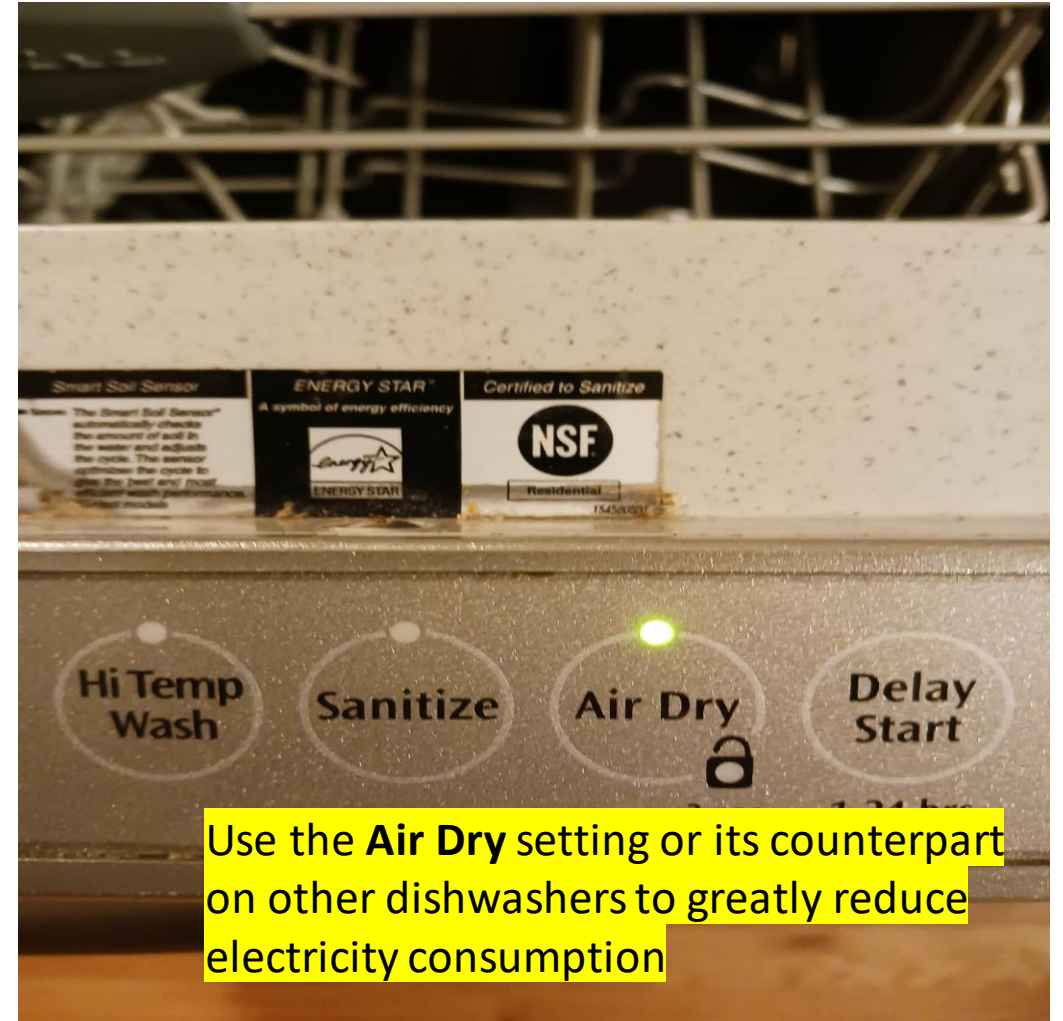


Energy Savings **Tip #9**

Change your dishwasher settings



Never use the **Ultimate Scrub** setting or its counterpart on other dishwashers, as this choice greatly increases both water consumption and electricity consumption.



Before operating dishwasher in speed clean mode, one must pre-rinse dishes, pots, and pans manually using cold water only

Energy Savings Tip #10

Strive to avoid “double” heat-up or “double” cool down

Workshop exercise:

You have newly brewed a hot pot of coffee. You have poured yourself a 10 oz cup of that fresh coffee. You have just retrieved the large and nearly full bottle of creamer from your refrigerator and just now poured your typically generous dollop of creamer into your cup of coffee. This generous pour of creamer has cooled your cup of coffee, so you are going to reheat it in the microwave.

Answer the following two questions:

1 --- What is your best next step in terms of saving the most energy?

2 --- Which of our two laws of physics have you applied to decide on your next step?

The correct answer will demonstrate the “double heating” waste of energy

Return the creamer to the refrigerator to minimize warming it, as motivated by our Physics Law #2.

Not doing so is an illustration of the “double cool-down” waste of energy.



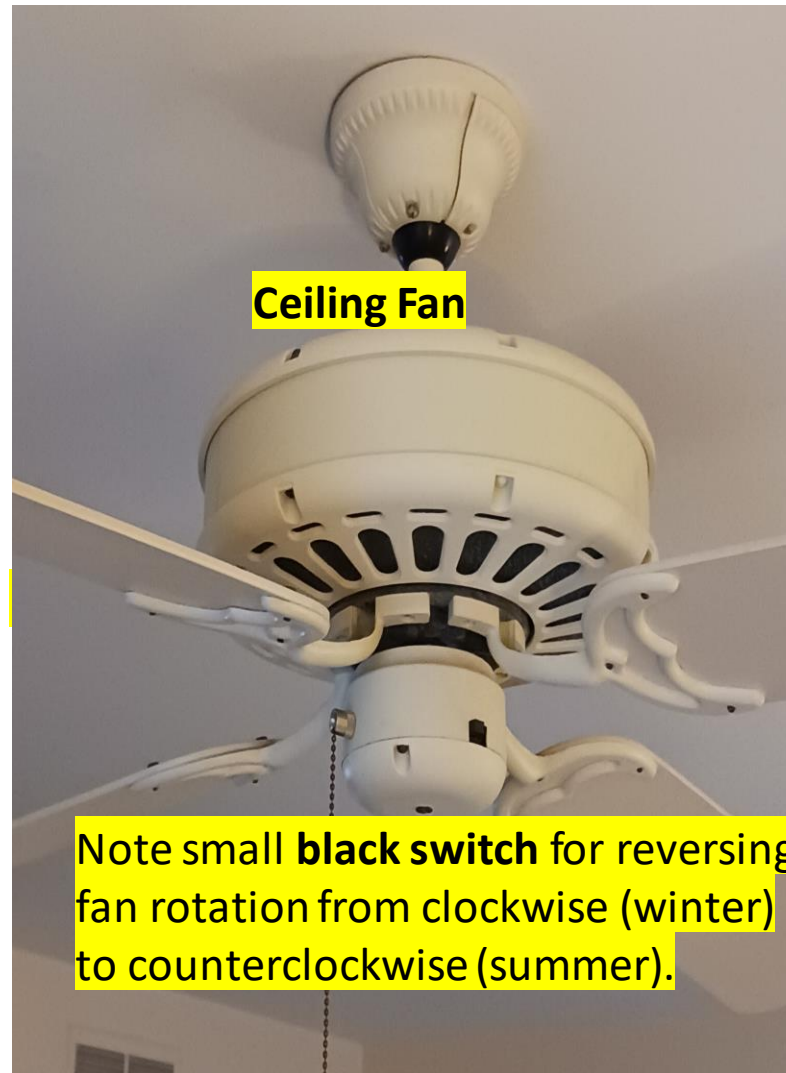
Energy Savings Tip #11

How to best utilize the fans of various types in your home

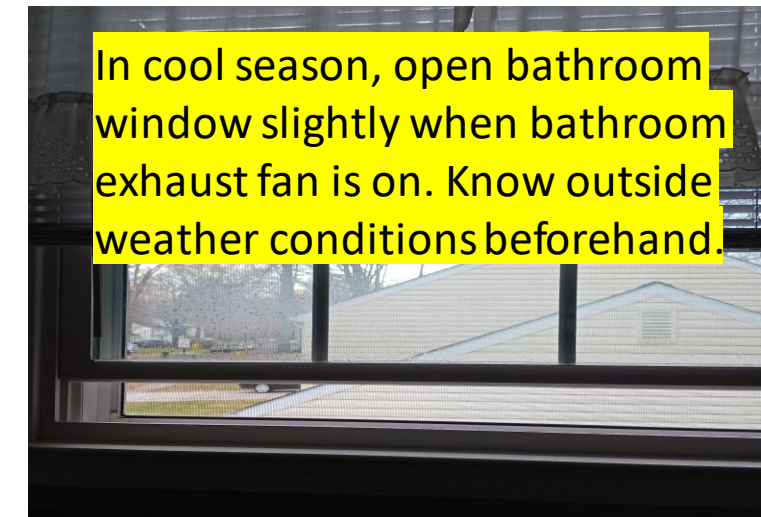
Floor fans



Ceiling Fans



Bathroom exhaust fans



Saving Energy Tip #12

Insulate **basement** windows and ends of ceiling joists in non-living area



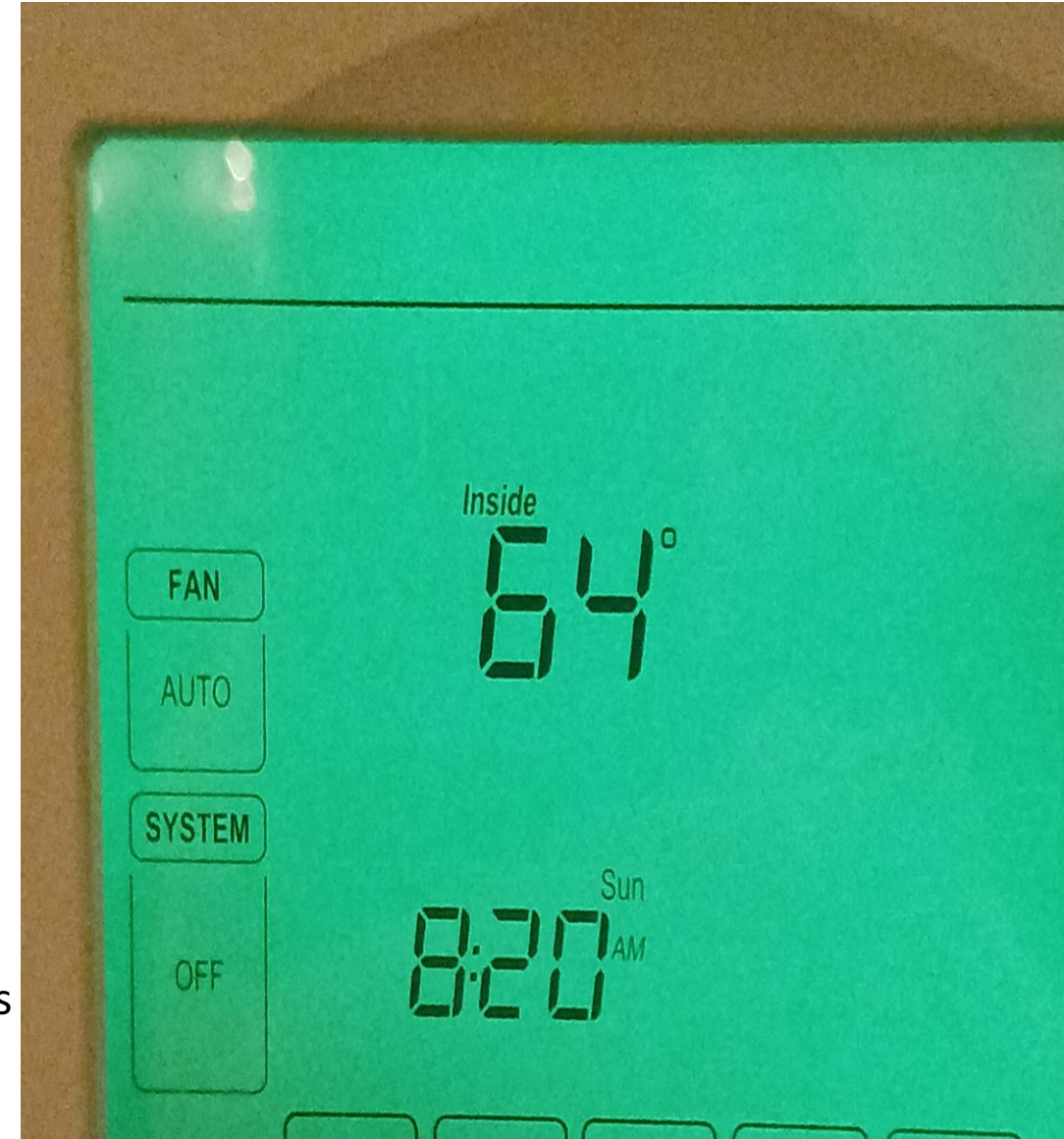
Energy Savings Tip #13

Informed (better) management of your Heat/AC smart thermostat

- **Turn heat mode off (i.e. turn off gas furnace)**
 - If electric space heaters maintain comfortable temperature
 - Use gas fireplace if electric space heaters inadequate
- **When heating with gas furnace, set target temperature to 66 F**
- **The furnace/AC fan has three modes**
 1. **Always ON** (Evens out temperature differences between rooms)
Very useful for split-level floor plans
 2. **Periodic circulation** (cycles to **ON**, then **OFF** in 20-min intervals)
 1. No heating or cooling
 2. Evens out temperature across all rooms that have open heat/AC registers
 3. **Auto mode**: furnace/AC fan turns on when either furnace or A/C comes on in response to thermostat target temperature

The challenge in split-level homes in A/C season:

- **Physics Law #1** is relentless: cooler air sinks / warmer air rises
 - >>> Lower level is often too cold and upper level too warm
 - >>> The fan mode of **always on** is good strategy



Indoor Air Temperature is an incomplete indicator of your indoor comfort (but first some definitions)

- **Mean radiant temperature:**
 - This is the average temperature of **all the surfaces that surround us**
 - ceiling, walls, floor, big screen TV, kitchen cabinets
- **Operative temperature:**
 - consider this an indoor “feel-like” temperature
 - It is the **average of** the mean radiant temperature and the average air temperature
- **The comfort level you feel while inside your home is that of the operative temperature**
- Residential architects define a set of operative temperature “species” that also take into account such things as indoor air movement (fans), indoor humidity, the clothing and footgear you wear

A picture of me in my typical indoor winter clothing

- **I have 3 layers on my torso**
 - One layer is a **sleeveless down vest**
 - It's very comfortable because sleeveless
- **I have 2 layers on my arms**
 - by means of a long sleeve undershirt

My footwear(not shown) is thick wool socks inside leather fleece-lined slippers

AND I'm holding a warm alcohol-free beverage



You ask:

How long in months or years will it take me to recover my costs of implementing several or more of these energy savings tips?

I will address this question near end of this presentation

(Aside from hiring a contractor to add more insulation to your attic)

Our climate is changing more rapidly than any time in the past history that we can document through ice-core samples in Greenland or core samples from ocean-bottom sediment

- **From many observations of many types from many countries, it is irrefutable that our climate is warming**
 - warming atmosphere, warming ocean
- **The issue of how much of this climate warming is human-induced from the burning of fossil fuels is not important for my message here**
- **The current warming climate is now self-sustaining and accelerating owing to **NATURAL** positive feedback mechanisms**
 - The pervasive melting of permafrost in Siberia and Canada is releasing methane
 - Methane is a more effective cause of our warming climate than carbon dioxide
 - More atmospheric warming yields more melting of more permafrost which releases more methane which yields more atmospheric warming which yields ever more permafrost melt and methane release **THEN REPEAT**
- A similar positive feedback to our warming atmosphere is the warming climate melts sea-ice, the shrinking of bright sea ice means less sunshine is reflected back to space means the atmosphere warms even more, which causes even faster melt of earth's sea-ice cover **THEN REPEAT**
- **Our earthly human population must reduce its fossil fuel consumption (CO2 and methane) to slow the accelerating climate warming occurring from **non-human natural processes****
- **Take out a hymnal and turn to page 885: and from there let us recite **The World Methodist Social Affirmation****