

# 113 Causes of High Summer Utility Bills

Since 1981 the City of Tallahassee's energy auditors have been investigating home energy problems. They have kept notes on causes of high summer utility bills. Here's their updated list for Spring 2009.

**1. The air conditioner's thermostat is set too low.....** The recommended summer setting is 78 degrees. Set it 2 or 3 degrees higher when you're away in the day. Recent research in Florida reveals that home cooling costs increase 12% for each degree setting below 80 degrees. ***Your cooling costs can almost double if you set the thermostat at 70 instead of 78 degrees!***

**2. The air conditioner's air filter is clogged.....**Air flow is restricted. When air flow is restricted your HVAC (Heating, Ventilating and Air Conditioning) system runs less efficiently. A clogged filter increases costs, reduces comfort and can lead to costly equipment failures. Ice may form on the air conditioner's evaporator coils, a condition that can precede "slugging" the compressor with liquid refrigerant. The resulting repair bill can exceed \$2,000. Change the air filter religiously! It should be replaced monthly during summer and winter periods of heavy use.

**3. The evaporator coils are clogged with accumulated dust.....**Air flow is restricted. Problems that result are much like those described above for dirty filters. If you have central air conditioning, all the air in your house draws through the air conditioner's filter, then through the cooling (evaporator) coils. Generally the filter doesn't so much clean the air as protect the equipment, in particular the cooling coils. In spite of the filter, the downstream cooling coils gather dust and grime over time. Those coils are not just cold, they're also wet – they're a magnet for dust. Energy efficiency is degraded by about 5% each year as the coils get dirtier! Your costs go up while comfort goes down. Have a service technician check the evaporator coils yearly and clean them if necessary.

**4. The Fan "ON" setting is selected at the air conditioner thermostat.....**It should always be set on "AUTO". Set to cool with the Fan selection at "ON", the fan blows air through the ductwork continuously while the compressor cycles on and off. Moisture removed from the air while the compressor runs is reintroduced to the house when the fan alone runs between compressor cycles. Don't let this happen! Don't set the Fan to "ON" – if you set it that way, the Fan is ALWAYS ON! Instead, always cool with the Fan set on AUTO: Humidity is kept lower, costs are much lower and comfort is higher. If your ducts are leaky (and most are) the Fan "ON" setting is especially costly to you.

**5. The central heat pump is simultaneously cooling and heating .....***and the cooling cost triples!* Overall this is a rare condition, but memorable to all involved because the summer bills get so stunningly high. A variety of thermostat and wiring problems can be the cause. For example, we've found situations where 5,000 watts of supplemental heating strips come on whenever the air distribution fan runs, winter or summer. The auditor detects the problem by running the cooling system alone (other appliances off at the breaker panel) and timing the meter spin to calculate power draw. A 5,000 watt overage is readily detected by this method.

**6. Teenagers.....**are full-sized human beings who don't yet pay the bills themselves but may use extraordinary amounts of electric energy per capita. Small children, by contrast, are low to the floor and relatively comfortable at levels of summer heat that stress many adults. See #84 below.

**7. Central heat strips turn on, off, on, off .....**even when the hallway thermostat is set to OFF. With everything in the house off or unplugged and the water heater switched off at the breaker panel, the meter races, stops, races, stops. Because of a thermostat, control wiring or other wiring problem, the central electric heating strips (10,000 to 20,000 watts) are coming on even though the distribution fan is off and all is silent. Without the fan running, heat from the strips is not distributed; heat builds up around the strips until a high-temperature safety switch is activated, turning them off. They cool. They come on again.....and so on. Another rare problem like #5 above, but costly when it happens.

**8. The thermostat is miscalibrated.....**and so is the thermometer on the thermostat faceplate. The system cools lower than the temperature selected by the resident. For example, the thermostat might be set on 78 degrees, but an accurate thermometer shows that it's actually cooling to 75 degrees. *This is an extremely common situation* – We've found thermostats as much as 10 degrees off. The simplest solution is to rest an accurate thermometer on top of the thermostat, find out how much it's off, and compensate accordingly when you select the desired indoor temperature. *By the way, if you'd like to receive a simple card-sized thermometer that's perfect for this kind of testing, call Energy Services at 891-4YOU (4968).*

**9. The customer has a swimming pool.....**and the pool pump runs 24 hours a day. The high cost of pool pumping is a surprise. Most residential pool pumps are 3/4 horsepower output. Operated all day every summer day, the monthly energy cost is about \$75; operated continuously year around, the annual energy cost is about \$900. *A timer for the pool pump is well worth the installation cost*, and usually pays for itself through energy cost savings within a few months. The National Spa and Pool Institute recommends that the pool be "turned over" (one complete circulation of water) once a day. Full turnover of a typical 20,000 gallon pool, then, requires 4 hours pumping at 85 gallons per minute, 6 hours at 55 gallons per minute or 8 hours at 40 gallons per minute. Most pool pump systems are sized to accomplish a full turnover in 4-6 hours. Pumping year around for 6 hours a day instead of 24 hours a day saves about \$675 a year! Installed cost of a timer is \$100-\$150.

**10. The ceiling lacks adequate insulation.....**Heat from the attic is conducting through to the house below. Improving ceiling insulation is one of the best investments you can make towards lowering your air conditioning costs in summer. The older your home, the more likely its original level of insulation would now be considered inadequate. We still find older homes with no insulation at all. *If you're not sure how much insulation you have, call us for a free home energy audit. City of Tallahassee electric customers can participate in a grant program that pays 80% of the installed cost to add ceiling insulation, up to a maximum City contribution of \$400. Insulation target level in this program: R38 (about 15 inches of blown white fiberglass). If your residence is heated with electric resistance "strip" heat, the insulation target level is R49 (about 20 inches of blown white fiberglass). This program is available to both home owners and renters!*

**11. Humid outdoor air is leaking into the house.....**through cracks around doors and windows, electrical outlets, ducts, vents, recessed lights in the ceiling, or fireplace dampers that don't seal tightly. In Florida homes about 38% of the air conditioner's work (and operating cost) goes to drying out this moist air leaking in from out of doors. Leaks in the ducts that supply cooled air to rooms will make this situation much worse, because the overall house air pressure becomes "negative" with respect to the out of doors whenever the air conditioner is running. In this condition the house sucks in warm, moist air – especially attic air -- whenever the air conditioning system runs. The system runs longer to compensate. Even more warm air is drawn in, which needs to be cooled.....and so forth in a vicious cycle. Costs rise significantly. (By the way, closing bedroom doors when the air conditioner runs can also result in a negative-pressure house that sucks in warm, moist outdoor air. See #66.)

**12. Dogs have pulled air ducts apart beneath the house, cats have bedded for years in the ceiling insulation, possums have tugged open a crawl way where water pipes penetrate the floor and they're living in the hollow wall of the bath tub.....**and so forth. Energy wise, the worst situation is where supply or return air ducts are disconnected in the crawl space under the house. Every summer at least one of our auditors reports finding the family dog comfortably housed in the return air plenum under a customer's home. It costs a lot to cool the outdoors!

**13. The refrigerator that served for twenty years in the kitchen still works, and now it's in the garage.....**And it's a hot garage. Those old refrigerators are not very energy efficient, but they sure last a long time! In a hot garage your ancient Coldspot may run almost continuously. The new refrigerator in your kitchen is probably three or four times as energy efficient as one from 1977. Energy wise, you're much better off organizing all your stored foods into the newer refrigerator and unplugging the old unit. How big a difference in cost can there be? A new, 25 cubic foot high-efficiency refrigerator in the kitchen costs about \$5 or \$6 a month to operate; an old, inefficient unit in a hot garage can cost \$25 to \$50 a month in summer.

**14. The house is equipped with awning or jalousie windows designed for cross ventilation.....**But the house is closed up for air conditioning. Unfortunately, these window types are notoriously leaky. In summer, the air conditioner must toil to dry as well as cool the air, and major air leaks cause major cost increases. (See #11 above)

**15. Hot water leaks.....**from a tub or sink faucet. Here's something we occasionally find: The water heater is located at one end of the house and there's a leaky tub faucet at the far end of the house. The leaking water feels cold. "Minor problem", you think. But even though the water feels cool, it could be hot water that cooled as it was piped the length of the house. An easy test: Tighten down the hot side handle and watch to see if the leak diminishes. Another test: Put a screwdriver tip to the hot water pipe where it exits the water heater, and press the handle end against your ear; the sound of running (hot) water is magnified. A third test: Feel the cold water supply pipe where it enters the water heater; if no hot water has been used in the previous half hour, the cold pipe should feel warm (heat from the water heater conducts to that pipe and warms it). If the cold-water pipe is cold where it approaches the water heater, and you ran no hot water recently, there may be a water leak. That pipe would be cold because cold water is feeding to the tank (and cooling the inlet pipe) to make up for cold or hot water being lost to a leak.

**16. Residents have waterbeds.....**but are not careful to make them up each day. Make up the bed! The more blankets the better. A typical waterbed costs about \$10 a month to heat if it's made up each day with heavy covers that hold its heat. If left uncovered the heating cost can double. Smaller water beds cost less to heat than larger: A queen size bed's heating cost is about 22% less than a king size. Whatever the size, it helps to insulate the bed's edges and bottom with polyethylene foam, polystyrene foam or even layers of corrugated cardboard.

**17. A rooftop power ventilating fan pulls hot air from the attic on summer days.....**However, a). The fan's thermostatic control is set too low (maybe 95 degrees instead of 115 degrees), so the fan runs more than it should; b). There's a lot of air leakage from the house across the ceiling to the attic, or bathroom and dryer vents open into the attic instead of passing through the roof, so that when the rooftop fan pulls air from the attic it also pulls air (expensively cooled air) from the house; and c). The fan motor itself is costly to run, and eats up any potential savings for having cooled the attic. In general, well insulated attics don't need power ventilation. Passive ventilation devices such as high ridge, off-ridge, turtle-back or gable vents, together with low soffit vents, are adequate. The optimum design is usually a ridge vent (internally baffled so that rain doesn't bounce in) and soffit vents at the eaves.

**18. The air conditioning system is not getting enough air returned from the house.....**for a variety of reasons. We've seen return air grills set in the floor that are partly or entirely covered by a rug, for example. In addition to increasing operating costs, inadequate volume of return air back to the indoor HVAC coil is a major factor in shortening the life of central air conditioners. Too little air across the indoor coil can potentially lower the coil temperature to the point that ice forms on the indoor coil. An air conditioner with its indoor coil iced over is in a "destruction mode" (see #2 above).

**19. The HVAC filter is located in a return duct plenum under the house.....**Because it's so hard to get to, it's never changed. And at some time in the past a plastic laundry bag was sucked into the return air system and is plastered against the filter. Almost every energy auditor can tell of finding situations like this.

**20. The HVAC air handler, located in a hallway closet, is pulling return air from the attic as well as the house.....**adding considerably to costs. Sometimes this happens where the resident previously had a gas or fuel oil furnace in a hallway closet. Originally, the furnace pulled its combustion air from the attic through an opening in the closet ceiling. When the resident later switched to a heat pump, the furnace was removed from the closet and replaced with the heat pump's indoor "blower-coil" unit. But the ceiling opening remained. The new closet unit was set up to pull return air through a grill in the closet wall into the closet space, then through a filter mounted in the blower coil unit. But it's pulling air from the attic as well as the house! Most auditors have a story of first finding this problem when, with the air conditioner running, they climbed a ladder, lifted the attic hatch and noticed house air rushing past them into the attic.

**21. The air conditioning equipment and the air delivery system are inefficient.....**for a variety of reasons. First, the equipment may have been inefficient from the start. Central air

conditioners twenty years old or older are likely to have an original efficiency rating of 7.5 SEER (Seasonal Energy Efficiency Ratio) or less, and the efficiency drops even lower with aging. Today, Federal law requires manufacturers to achieve SEER 13.0 or higher for all split-system units, and SEER 9.7 for package units.

What do these SEER ratings imply? You've probably already guessed: If your cooling cost is \$600 a summer with a SEER 7.0 unit, your cost would be \$300 a summer (for the same amount of cooling) with a SEER 14.0 unit.

What other factors affect air conditioning efficiency? The big three are a) dirty coils, which at normal rates of dirt accumulation degrade efficiency by about 5% each year; b) duct leaks, which in most Florida homes account for about 20% of air conditioning energy consumption; and c) improper refrigerant charge. How common are these types of problems? In 1988 a widely cited Arizona study of residential air conditioners found the following:

- 75% of the condenser coils were dirty
- 70% of the units had improper refrigerant charge
- 55% of the evaporator coils were dirty
- 45% had dirty blower wheels
- 35% had significant duct leakage
- 10% had a wrong motor or fan installed

**22. The HVAC refrigerant charge is low.....or it's too high.** Either way degrades efficiency. In 1990 a field study of residential central air conditioners found 27% undercharged and 27% overcharged. Overcharging is worse. The unit's cooling ability goes down while the power draw goes up: The unit runs longer to do the job, and costs more per minute to run. Overcharging also stresses the compressor, with serious consequences for its lifespan. The compressor is the most expensive system component to replace (see # 2 above).

**23. The air conditioner's compressor runs all the time.....**whether the indoor distribution fan runs or not. Rare.

**24. The outdoor condenser is located beneath a wooden deck.....**and air flow is restricted. Normally, whatever heat is removed from the house by an air conditioning system is released to the outdoors from the "condenser" unit--that big metal box in the back yard. Hold your hand in the hot breeze above the propeller fan--it usually blows upward--and you'll get the idea. To work well it needs plenty of clearance from decks, bushes and folded lawn chairs. By the way, that hot air blowing from the outdoor condenser is not hot air from the house. It's outdoor air heated by passage across the hot condenser coils -- it's releasing the heat from inside the house, not the air from inside the house. The cleaner those outdoor coils are, and the easier it is for the heated air to get away from that unit, the better it works. *Cleanliness is critical. Air conditioners and heat pumps only work well if kept clean!*

**25. A resident requires the use of oxygen.....**and unfortunately, the energy cost to run these compressor systems is surprisingly high – about \$49/month for 24/7 use of oxygen.

**26. There's a whole lot of cooking going on.....**Meanwhile the air conditioning runs nonstop to cool the kitchen. To avoid this, a lot of folks cook outside in the summer, eat more fruits and salads, eat later in the evening.....or use a microwave oven! For the same cooking job, a microwave costs far less than half as much to operate as a standard electric oven, and doesn't heat the kitchen.

→ Here's a comparison of costs to cook a meatloaf, from a study by Northeast Utilities (adjusted to our utility rates of 4/1/08):

<u>Oven Type</u>	<u>Cost</u>
Electric oven	29 cents
Electric convection oven	22 cents
Gas oven	20 cents
Electric frying pan	14 cents
Electric toaster oven	15 cents
Electric crockpot	12 cents
Electric microwave oven	6 or 7 cents

**27. There's a dehumidifier running nonstop, draining through a hose to the outdoors.....**and the basement area being "dried" is itself wide open to the outdoors! This is a rare finding, but let's look a little more closely at dehumidifiers. They remove water from the air. So does your air conditioner. But a dehumidifier heats the room in which it sits, just as your refrigerator does! Nevertheless, for some homes it's a good weapon in the battle against mildew. Have you noticed how dehumidifiers all seem to have about the same size pan for water collection, but have widely different capacities for water removal? The capacities are usually expressed as pints of water removed in a 24 hour period at some standard temperature and humidity. A "bigger" dehumidifier, with a larger compressor and higher operating cost per minute of run time, removes water from the air faster, but generally less efficiently. If you're catching the water in the pan underneath, you'll need to empty it more frequently to keep up. If you're draining via a hose, there's no pan emptying necessary. But be sure the area you're attempting to dry isn't open to the outdoors. And be sure the drain hose is routed to empty water away from your house, or into a drain.

**28. Someone's doing a lot of clothes drying every day.....**during the heat of the day, with a dryer located in an air conditioned utility room, and the dryer is vented to the outdoors. A clothes dryer has a powerful fan that whips air (house air in the case above) past the damp clothes at the rate of 150 to 200 cubic feet per minute (cfm). In a 1,500 square foot house with eight-foot ceilings, a 200 cfm dryer can empty one houseload of air every 60 minutes of operation. In summer, that's a lot of expensively cooled house air being heated by the dryer and blown out. Just as bad, that's a lot of lost house air that must be replaced by hot, damp outside air leaking in fast wherever it can: Through kitchen and bathroom vents, fireplace vents and dampers, around windows and doors, through recessed ceiling light fixtures, through electric plug and lightswitch plates, etc. For all the above reasons, it's best to locate the dryer in an uncooled utility room or garage.

**29. The water heater's thermostat malfunctions, the tank overheats, tank pressure builds, the pressure-and-temperature relief valve opens to release a flood of very hot**

**water**.....under the house, where no one sees it. An actual case. Yes, the bills were high! In another similar case, in a student apartment we found the pressure/temperature relief pipe sending scalding water from the under-the-counter water heater to a connection with the drain pipe beneath the kitchen sink. A steamy hot mist was rising from the sink drainhole; the electric usage had recently doubled. A third case: The pressure-and-temperature valve simply failed, for unknown reason. In all three cases, hot water flowed from the water heater 24 hours/day, leading to high electric cost, high water cost, high sewer cost. In most single family detached homes, the pressure/temperature relief line from the water heater emerges as a little down-spout low on the back side of the house or garage. If you find hot water plunging from that spout, call a plumber.

**30. We experience a dry period, maybe in May or June.....**and water bills rise, the result of desperate lawn watering. Home lawns are often over-watered. At normal pressure, a 5/8" garden hose delivers about 10 gallons per minute. Thirty minutes of unneeded watering wastes 300 gallons of water! Water waste costs you money and does not improve the health of your lawn. A few tips: a). The best lawn watering time is a windless, morning period. Avoid watering on windy days. b). Wait longer times between waterings. Grass roots will grow deeper, less watering will be needed. c). Remove weeds before they get large. They steal precious water from desirable plants. d). Mow regularly, removing only 1/3 of the grass length. Clippings can remain on the lawn. They help retain moisture.

**31. The resident's City Energy Loan payment on the utility bill makes the total bill in summer higher than it was the previous summer.....**when they still had their old, inefficient equipment. Ouch. The truth is, new air conditioning equipment almost never pays for itself through energy savings in less than five years. Since the term on our Energy Loans is five years, and 80% of our loans are for HVAC equipment, almost all loan program participants are, on average, saving less each month than the monthly loan payment amount. On the other hand, from year six on out, they're doing great. It's been debated that we might extend our term to seven or ten years. Because the amount of money we have to work with is limited, it seems best to turn it around in five years and let more people take advantage of the program. If you'd like to register an opinion or comment one way or the other about this, call Bob Seaton at 891-6130. We appreciate your feedback.

**32. The resident is equipped with a so-called "combination appliance" that uses a powerful gas water heater to heat the home or apartment in winter, as well as heating the water** .....but in summer it keeps on sending heat to the house! Not so rare; it happens as a result of faulty valves, good valves installed incorrectly, or faulty electronic controls. Summertime electric and gas costs both increase; the electric air conditioning (cooling) cost typically doubles. For the energy auditor, higher than expected summer gas cost is often the telling clue.

**33. Leaky supply-air or return-air plenums.....**greatly increase the cost of air conditioning. Using blower-door technology to test Florida homes for duct leakage, almost all systems are found to be significantly leaky. The most common sites of air leakage are the supply-air and return-air plenums, which are the air collecting boxes on the upstream and downstream sides of the blower-coil unit that distributes air around the house. In the supply plenum, air pressure is

greatest; in the return plenum, air suction is greatest. Any leakage from these boxes is exaggerated by the extremes of positive or negative air pressure close to the fan. In the distribution system as a whole, if supply-air leakage predominates, the air pressure in the rooms of the house becomes negative with respect to the outdoors. If return-air leakage predominates, the air pressure in the rooms of the house becomes positive with respect to the outdoors. *A negatively pressured house sucks in warm, moist outdoor air, burdening the air conditioner; a positively pressured house pushes out expensively cooled indoor air, losing it to the outdoors.* Usually mere duct tape is inadequate to repair these high pressure plenum leaks--it quickly loses its grip. Repairs that last a lifetime use a horrible gluey paste called mastic, typically having a high content of embedded fiberglass fabric, high flexibility when dried, and high tolerance for variations in temperature. If you intend to apply mastic, wear old clothes!

**34. Doors need weather-stripping.....**to prevent significant air leakage. The crack around all four edges of a standard door is 20 feet long. If the crack is 1/12" wide, the total "hole" size is 20 square inches, roughly the equivalent of a softball-sized hole in the door! If the house is negatively pressured whenever the air conditioner runs because of supply duct leakage (see # 33), that size hole admits a lot of warm, moist air for the air conditioner to cool and dry. A wide variety of weather-stripping materials are available at local hardware stores and home supply centers. You'll often find good instructions there too, either from staff or from how-to booklets.

**35. Windows and doors need caulking.....**to prevent air leakage, for the same reasons discussed above. This is do-it-yourself work. Caulk is cheap, applying it is easy, but it takes time. Caulk the cracks around window and door frames; cracks where masonry walls meet wood siding or trim; wall penetrations by pipes, meter box, dryer vent or exhaust vents, etc. Some all-purpose caulks are silicon, silicon-acrylic and siliconized acrylic latex.

**36. Gardening and landscaping activities increase water use.....**maybe more than expected. See # 30 above.

**37. Some of the worst water leaks are at toilets.....**where you can lose 100 gallons a day and never know it. Listen carefully for the faint, high whine of a toilet leak. Find out if tightening the water supply shutoff beneath the tank will stop the noise. Or, put some food coloring in the toilet tank. If the color appears in the bowl without flushing, you have a leak. Have you ever seen a "hung" toilet, where the mechanism catches in mid-flush and water rushes continuously out the drain? If you ever discover a toilet in your home that occasionally hangs, don't put off having it repaired. It can flush hundreds of dollars worth of water while you're on vacation.

**38. Windows on the southwest or west side are fully exposed to the setting sun.....** In newer Florida homes, sun entering the windows accounts for about 20% of the air conditioning load. In older homes, it can be as much as 30%. Use interior shades, drapes or blinds to reduce heat gain across the windows by about 20%. External shade (trees, awnings, sun screens) works even better. Some newer, high tech windows have special tints or films that reduce the amount of heat transmitted across the window into the house. Most window manufacturers now offer high-tech windows with low-E coatings. A low-E coating is a microscopically thin, virtually invisible, metal or metallic oxide layer deposited on a window. In a double paned window the



coated surface may be either the outer side of the inner glass or the inner side of the outer glass. In Florida the latter design works better. The coating acts to suppress radiative heat movement across the window by reflecting heat back into the home during cold weather and back to the outdoors during warm weather.

**39. The refrigerator door won't stay shut.....** Take note: Your refrigerator cools the food by removing heat from within and releasing that heat to the kitchen. The longer it runs, the more it heats the kitchen. So make sure the door shuts tightly. And arrange items in the refrigerator for quick removal and return.

**40. In some older apartments and townhomes, the air conditioner's indoor component (the blower coil that distributes air to rooms) is located in a small closet, right over the electric water heater.....**which in summer heats the passing air on its way to the AC cooling coils and fan. It helps to lower the water heater's two thermostats to the lowest appropriate temperature (usually 115 degrees, or 125 degrees if the resident uses a dishwasher) and insulate the water heater as well as the hot and cold pipes atop the water heater.

**41. The refrigerator door won't seal when it's shut, the door is askew or the gasket is damaged.....**and cold air is being lost to the kitchen. Years ago our standard advice was: Properly align the door on its hinges and/or replace the gasket. Then we learned that replacement gaskets cost \$50 to \$80, are hard to find for some older models and are not assured to fit well as replacements. If your refrigerator is 10 or 15 years old and in poor condition, you're probably best off to replace it with new one rather than undertake gasket repairs. After January 1, 1993, new refrigerators are three times (or more) as energy efficient as similar sized units 10 years older. And refrigerators manufactured after 2001 are 30% more efficient than those of 1993. A new, 25 cubic foot energy efficient refrigerator costs \$5 or \$6 a month to operate. An old one could cost 5 to 10 times as much to operate if it's located in a hot garage (see # 13 above). If you're shopping for a new refrigerator, consider purchasing an energy efficient model that bears the "Energy Star" sticker – and get a \$75 rebate from the City of Tallahassee!

**42. The HVAC system has moisture in the refrigerant.....**and efficiency is reduced 5-15%. Worse yet, it's probably heading for an expensive compressor failure.

**43. The HVAC system draws warm, moist outdoor air through an unsealed PVC pipe chase that routes refrigerant lines through the slab.** Costs rise as the air conditioner works to cool and dry outdoor air admitted to the system by this and other routes. The best remedy is usually an application of spray expanding foam caulk to seal those airways.

**44. The electric meter was misread.....**high or low. Yes, it happens once in a while. Because the meter registers kilowatt hour usage cumulatively, the billing self-adjusts the next month, but not without some momentary alarm for those concerned. By 2010 the City's new Smart Meters will be radio-signaling their readings, eliminating misreads due to human error.

**45. Relatives come to visit in sunny Florida.....**and the bill goes up.

- 46. Kids come home from college.....and the bill goes up.**
- 47. College students living away from home for the first time move into an off campus house or apartment in August.....and their *second* utility bill has a way of getting high (the *first* billing is often for a partial month). The high bill seems to relate to that whirlwind of initial activity that happens to coincide with brutally hot weather: Moving in, cleaning, parties, friends over, door open, thermostat set too low, etc. See #101 below regarding the so-called “roommate effect”.**
- 48. Schoolchildren are home from school all summer.....and the bill goes up.**
- 49. The clothes dryer vent shoots lint onto the air conditioner’s outdoor condenser coils.....**The AC system, hampered in its ability to release heat, runs longer and longer.
- 50. The dryer vent hose or the outdoor vent flapper is clogged with lint.....and it takes longer and longer to dry a load of clothes. With the vent clogged, the clothes get a hot, damp tumbling, the dryer runs a longer time with poor results, and costs rise.**
- 51. The small pump on a water heating waste-heat-recovery unit runs nonstop.....**whether the air conditioner is running or not. This can get pretty costly, especially if the water heater is a long way from the air conditioner’s outdoor condenser.
- 52. The water heater thermostats are set too high.....**Each 10 degrees downward adjustment cuts water heating energy consumption by 13%. We recommend setting the thermostat(s) at 115-120 degrees. If you have an electric water heater, set both thermostats to the same temperature. If you use a dishwasher that has no booster heater, set your water heater thermostats at 140 degrees. If your dishwasher heats its own water, you can lower your water heater thermostats to 120 or less. In summer, try going another 10 degrees lower.
- 53. The air conditioner’s outdoor condenser sits baking in the sun.....**increasing its operating cost. A north side location for this unit is recommended. It’s possible to shade it with trees, but remember that the condenser needs plenty of “breathing room”.
- 54. The resident has a hot tub.....**and unless careful attention is paid to a tub’s cover, insulation and pumping, the added monthly cost can be \$20 to \$40 or more.
- 55. The pets have special requirements for cooling.....**
- 56. All the lights in the house are on.....**or nearly all. In most homes lighting only accounts for about 6% of the annual electric cost. But lighting costs can mount. Keep up the habit of turning off lights when you leave a room. *Here’s an example described in the March, 2009 issue of National Geographic: “A typical kitchen these days has ten 75-watt spots on all day.”* If you have ten 75 watt lights on for twelve hours a day, the operating cost (at \$.162 per kilowatt hour including taxes) is \$1.46/day, \$43.74/month, \$532.17/year. Some of you may remember the Easy Bake Oven from childhood, which cooked by the heat of incandescent light bulbs. Over 99% of the electric energy provided to incandescent lamps is converted to heat, less than 1% to

light. Switching from incandescent to compact fluorescent lamps reduces heat output from each lamp to about one-fourth the former level. Remember that when you're trying to keep cool in summer! If you're reading by a lamp in a room cooled to 78 degrees, you'll feel a lot cooler sitting under a compact fluorescent lamp.

**57. Outdoor area lights are on all through the day.....**because of a bad photocell.

**58. There's hot water in the toilet!** Six words that mean trouble. Rare but memorable. Call a plumber.

**59. Vines, bushes, tall grass, leaves, litter or lawn chairs cover the air conditioner's outdoor condenser unit.....**so it can't release heat. Cooling costs rise.

**60. The house is very large.....**and so is the cost to cool it. There's more volume to heat and cool. Larger homes have larger energy usage, all things considered.

**61. The garage was converted to a family room.....**without insulating the walls or ceiling. Now it's the hottest room in the house. That's where the TV is located. The family spends the most time there. To make it comfortable, the family turns down the thermostat setting for the whole house. Cooling costs rise. See #93 below.

**62. The family has a refrigerator in the kitchen, an older refrigerator in the pantry, a freezer in the pantry.....**and so forth. Costs rise. If the newest refrigerator was manufactured after July 2001 it's far, far more energy efficient than older refrigerators or freezers. Consolidate stored foods into the newest unit if possible! See # 13 and #41 above.

**63. The air conditioner is way oversized for the house.....***so that it cools powerfully but doesn't run long enough to dry the air.* The result is a cool damp interior, higher costs, and the likelihood of mold and mildew problems. Attempting to improve comfort, the resident lowers the thermostat setting a few degrees and the system runs longer. This dries the air somewhat but overcools it, and "relative humidity" climbs even higher. The house becomes even more uncomfortable. Costs rise. Everyone should know this about air conditioning: *Bigger isn't better. An oversized air conditioner cycles on-and-off frequently, removes less moisture and wastes energy. A system correctly sized for your house will run longer for less cost, dry the air better and give greater comfort than the next bigger size. Correct sizing is a particular concern in Tallahassee where we experience a famously damp climate.*

**64. The fireplace damper is open, or there's no damper at all.....**admitting outdoor air or losing indoor air. Costs rise in either case, especially if there are HVAC duct leaks, and there usually are (see #33 above). One of our energy auditors took an informal survey of his customers, asking those with fireplaces whether their dampers are closed. Among those who thought it was closed, about 50% were wrong: It's open.

**65. Air conditioning supply registers around the house are closed off.....**Take note: *If you have a central air conditioner or heat pump, don't close off room vents.* When you close vents, the house becomes negatively pressured with respect to the out of doors, so that warm, moist outdoor air is pulled in (see #33). Additionally, airflow across the HVAC evaporator coil is

reduced, which lowers system's energy efficiency and cooling capacity. The system runs longer. Costs rise. Don't close off room vents. Twenty-five years ago a lot of energy efficiency brochures and booklets advised closing off room vents but now we know better. Leave 'em all open.

**66. Bedroom doors are closed, with no way for air supplied to the rooms to circulate back to the air conditioner .....**Each closed-off bedroom becomes positively pressured while all other rooms become negatively pressured with respect to the outdoors. The result is exaggerated air leakage to the outdoors from positively pressured closed rooms, and from the outdoors into the negatively pressured house areas. Air leakage occurs through bathroom vents, fireplace vents and dampers; around windows and doors; through recessed ceiling light fixtures; around attic hatches or pull-down attic doors; through electric plug and light-switch plates, etc. The result: Longer run-times are needed for the air conditioner to keep the house cool and dry. Costs rise.

**67. An air conditioning supply duct leads to the garage.....**where it simply wastes cool air to the "outdoors".

**68. The air conditioning system's return air grill is situated low on a wall and blocked by a chair, or it's at floor-level and covered by a rug.....**resulting in restricted return air flow and all the attendant problems (see #2 and #18).

**69. A small pool or spa is situated literally inside the house.....**Rare, but unforgettable. The baby-grand piano needed constant re-tuning. Why not have a swimming pool inside the house? Because of the phenomenal moisture problems that result, not to mention high air conditioning costs. Remember, the air conditioner works to remove moisture as well as remove heat. Even in normal circumstances about 38% of the air conditioner's work (and operating cost) is devoted to moisture removal.

**70. The customer is attempting to cool the entire house with a variety of old, inefficient window air conditioners.....**Here's a topic that deserves a closer look. Our energy auditors have all observed that customers with window air conditioners usually have significantly lower bills than those with central cooling systems. Yes, *lower*. Why? Because only one or two rooms are being cooled some of the time, not the whole house all of the time. However, if four or five old window units are operating all summer to cool the whole house, then costs get high. Older window units often have energy efficiency ratings down around 5 EER; newer central systems are at least twice as energy efficient as that.

**71. In the hallway ceiling there's a large whole-house fan with incompletely closed louvers.....**It provides a major path for air leakage to or from the attic. If you have one of these big fans and never use it, you'd do well to seal it to reduce air leakage and cover it from above with blankets of insulation. And make sure it can't be turned on!

**72. The air conditioner's thermostat is near some source of heat.....**like a floor lamp. This fools your thermostat. It senses heat and calls for the air conditioner to run.....and run, and

run.....Remember, small thermostat adjustments make a big difference to your cost. If your system cools to 73 degrees instead of 78, your cooling cost can increase by 60%.

**73. The hallway wall behind the thermostat is hot.....**because the air-conditioner's distribution fan pulls air down from the attic through that wall cavity, whenever the air conditioner runs. This tricks the thermostat into calling for more and more cooling (compare # 72). Finding the pathway of air leakage and sealing it cures the problem. Usually this involves stuffing paper-backed insulation and/or spray expanding caulk at the top of the wall cavities that open into the attic.

**74. The area where residents sit down to eat is heated by morning or afternoon sun streaming through a sliding glass door.....**and the entire house is cooled to a lower temperature in order to achieve acceptable comfort levels at that spot. Common. Costly.

**75. Old casement or awning style windows are deformed out of alignment and will not seal shut.....**allowing warm moist air to leak in, or expensively cooled air to leak out.

**76. The house lacks shade on the east or west sides, or a mobile home sits fully exposed to the sun.....***Shade trees can reduce air conditioning costs by up to 30%, and higher if it's a mobile home.*

**77. Summer maternity.....**usually brings with it a heightened concern for thermal comfort. Just ask any woman who's endured a summer pregnancy in Tallahassee. Lower-than-normal thermostat settings are generally needed.

**78. Lots of hot water diaper washing.....**increases costs for a period of two or three years.

**79. A shade tree was removed.....**and air conditioning costs increased by up to 30% compared to last year. Shade is important!

**80. Air conditioning ductwork in a hot attic is poorly insulated.....**Attic heat transfers to the cool air moving through the ducts. The AC system runs longer to cool the house. Costs rise.

**81. The air conditioner's return air plenum box constructed of sheetrock is uninsulated and leaky and sits in a hot garage.....**A fairly common finding.

**82. All the components of the air conditioning distribution system, including the air handler, supply ducts and a long return duct, are located in a hot attic.....**Lots of older homes have their air conditioning systems configured this way. The equipment and its air ducts gain heat from the attic. AC equipment runs longer to cool the house. Costs are higher.

**83. Windows lack inside shading devices (shades, drapes or blinds), or the devices are not consistently operated.....**Venetian blinds and other shading devices are tremendously important. Use them to block heat entry on summer days.

**84. The resident doesn't pay the utility bill.....**Someone else pays, maybe a parent living elsewhere. Predictably, this leads to high electric usage and high bills.

**85. A room or wing or extension was added to the house, or a garage or porch was enclosed.....**and the overall cooling costs go up. Larger homes cost more to heat and cool. See #60.

**86. The air conditioner's thermostat mounted on the hallway wall is not level.....**Behind an old-style thermostat's cover plate its operation usually involves one or two mercury-containing glass bulbs that tip left or right as the temperature adjustment lever is moved. When you adjust the lever "downward", calling for cooling, the bulb tilts and a small blob of mercury rolls over to make an electrical connection. *If the thermostat is off-level the mercury roll-over is affected, and the thermostat's calibration can be thrown off.* For example, maybe you've set the lever to 78 degrees, but because the thermostat isn't level the system cools to 75 degrees. Cooling costs rise by 24% to 36%. See #1 above. *(Leveling the thermostat is fairly easy using adjustment screws behind the faceplate, but if you're at all uncertain about it, have it leveled when your unit is next serviced.)*

**87. Bad meter.....**This is often the first thing a customer suspects to be the cause of high bills, but it's about the last thing an experienced energy auditor expects to find. Electric meters usually run very slightly slower as they get older, if they change at all. When an electric meter fails, it doesn't speed up, it stops.

**88. Bathroom power vents are left running.....**sending expensively cooled air to the out of doors. Run these bathroom fans only as long as needed to clear that one room of its moisture. If the bathroom is 10 feet by 12 feet with an 8 foot ceiling, it holds 960 cubic feet of air. Most bathroom fans remove about 50 cubic feet of air per minute. In the above example, nineteen minutes of fan operation sends out one roomful of air.

**89. The residents left town for a summer vacation and were expecting the next utility bill to be low.....**but the bill was high because they left the air conditioner set at 78 degrees during their absence, the weather was hot, and the AC ran a lot. For many folks, the usual practice is to set the air conditioner's thermostat up to 83 or 84 degrees when away. The system runs occasionally, lowers humidity a little, and lowers costs a lot. Findings by the Florida Solar Energy Center offer up a clever strategy utilizing a programmable thermostat: Set the AC system to cool to 71 degrees for one hour a night, from 3 a.m. to 4 a.m. In older leakier homes, cool for two hours, from 3 a.m. to 5 a.m. The AC runs efficiently in the cool of the night, costs are low, and humidity is kept low. The challenge will be programming the thermostat, a task that will be easy for some teenagers and difficult for many adults.

**90. Windows and doors are left open while the air conditioner runs.....**

**91. While the family is away during weekdays, a laundry maid or housekeeper is at work around the house.....**and she (or he) drops the thermostat to the low 70's.

**92. The cats always nap on a particular spot in the middle of the kitchen floor.....**because a hot water leak under the slab is warming that spot. You'll hate it if this happens. Repairs usually involve major excavation to reach the broken pipe.

**93. House type #93 has a package-unit central air conditioner at one end, long supply and long return ductwork beneath the house and a garage converted to an un-insulated TV/family room at the farthest distance from the air conditioner. A couple of ducts are added to the air distribution system to supply cool air to the family room.....**This is a recipe for high bills in summer, but even higher in winter. The ductwork has the longest possible run both ways, to cool the room that gets the most evening use. The walls and ceiling of this former garage lack insulation. The air conditioner's delivery fan is probably not powerful enough to handle the additional area, and the add-on ducts result in an imbalanced system that no longer delivers the requisite 400 cubic feet per minute of air (per ton of cooling capacity) across the air conditioner's evaporator coils. It all adds up to high cooling and even higher heating costs.

**94. The air conditioning components are mis-matched.....** For example, a new "high efficiency" outdoor unit (the condenser) is mis-matched to the original 15-year-old indoor unit (the indoor fan-and-evaporator-coil.) And the original copper refrigerant lines connect the outdoor and indoor units. The result: Low efficiency, high operating costs. *A new outdoor condenser matched with an old indoor fan/coil may cool the house, but it does not likely achieve anywhere near the rated efficiency stickered on the new condenser's outdoor cabinet.*

**95. A newly added room is hot, so the thermostat setting for the whole house is lowered.....**meanwhile, in the attic, the air supply duct to the new room is laid out and connected to the "boot" above the register, but was never connected into the main system. No cooled air is delivered to the new room. Instead, hot air enters from the attic. Surprisingly, our energy auditors have repeatedly found unconnected air ducts in attics.

**96. The ductwork "boots" behind the registers are loose, or ducts under the house have fallen away from the register boots.....**and the system is cooling the crawlspace under the house. A good tip: When you shine a flashlight down into a floor register, you shouldn't see the earth under the house!

**97. Flex duct in the attic is kinked, pinched, folded or flattened, restricting air supply to particular rooms.....**and the thermostat setting for the whole house is lowered to compensate. This kind of problem is especially significant if the rooms having insufficient air supply are the kitchen or family room. *This is a common problem!*

**98. The air delivery system includes some length of panned floor joists which are leaky.....** The spaces between floor joists are sometimes modified for use as return air ducts. This cavity is made into a duct by attaching sheet metal over the bottom of the joists and by capping the ends of the joist cavity. A leaky panned floor joist draws in air from the crawl space or basement. To remedy, seal using mastic.

**99. Plumbing/pumping reversed on a large solar water heating system.** Water heated electrically in 80 gallon basement storage tanks, then pumped backwards through the system to cool at the rooftop, and returned to re-heat in basement tanks. Continual circulation. Highest bills ever. Infamous case on Beverly Court.

**100. Office in the home.....**Here’s the power draw of some selected home office accessories:

<u>Equipment Type</u>	<u>Power Draw (Watts)</u>	
	<u>Idle</u>	<u>Active</u>
Copier	6	400
Personal computer	62	62
Video Monitor	62	62
Laser printer	80	200
Fax machine	14	30
Totals	222	752

How much this costs depends on activity levels. Suppose the copier, printer and fax machine are idle 23 hours and active 1 hour each day: Together with computer and monitor (let’s say they are active 24 hours/day), operating cost at current rates including taxes (June 2008) is about \$28.70/month.

**101. “The roommate effect”.....**Happens to college students in off-campus housing. Each roommate has a different level of thermal comfort and a different level of concern for energy conservation in general. The energy practices of the least concerned and least conserving individual often become the norm for all roommates.

**102. Southwest sun exposure floods the home with radiant heat in the Fall.....**Some homes have southwest windows that are well shaded by overhangs through the middle of the summer, when the sun passes overhead. But in the Fall, afternoon sunlight (radiant heat) pours in as the sun’s path passes lower in the sky. Air conditioning costs may soar unexpectedly in late September and October. Typical expression: “It’s hotter in here in October than it was in August”.

**103. A floor register was closed by accident, and the cooling temperature for the entire house was lowered in order to feel cool enough in that one room, or cool enough in one particular chair in that room.....**Floor registers are easily kicked shut. If you’re not cool enough in a room that was always ok last summer, check to make sure the air registers are still open.

**104. All the ceiling fans run all day when no one’s around.....** Only run fans when you’re there to feel the breeze. Fans assist “evaporative cooling” from your skin. They don’t cool the house. They don’t cool a room. They don’t even cool the furniture. They only cool your skin. In a vacant room, the fan’s breeze has no benefit and energy is wasted.

**105. The ceiling fans run backward, breezing upward.** They should breeze downward, so you feel the breeze. Otherwise it’s wasted energy. *Another common finding!*



**106. A package-unit central air conditioner was connected to a mobile home's existing furnace ductwork.** In summer, cool air that breezes from the furnace feeds to a nearby return-air grill. Cools poorly. Distributes air poorly. High operating costs. Similar to # 107.

**107. A stand-alone AC fan-coil box under the house was tapped into supply and return ductwork that originally distributed heated air from an old oil furnace.** With no directional damper, the air can recirculate in the ductwork without much affect on the house above. In summer, AC runs a long time to accomplish a little cooling. Very high operating costs.

**108. The garage was enclosed and is now cooled with a window-unit air conditioner....**but the garage walls and ceiling were never insulated. Cooling costs are high. Similar to #61.

**109. "The Takeback Effect".....**Also known in certain public service agencies as "The Conservation Effect". There's an occasional but well-documented human tendency to follow-up home energy efficiency improvements with lowered summer thermostat settings that "take back" the potential energy savings. An example: The homeowner who upgrades his windows, then cools in summer to iceberg levels and experiences his highest-ever electric bills.

**110. Plasma TVs and other digital electronic equipment in the home.....**An emerging concern that first gained national recognition in the fall of 2005. Big plasma TVs can use 100% to 200% more electric power than standard small screen TVs. In 1996, these didn't exist. Projections for the US show 53% of us with digital TVs by 2008. Nationally, TV annual energy use is expected to climb to 70 billion kwh by 2009, 50% higher than in 2005. Altogether, TVs, DVDs, computers, chargers and other home electronics can account for as much as 10% of a family's annual electric bill. And they produce a lot of heat, adding to summer air conditioning costs.

**111. The central air conditioning system has a second, unknown filter that never gets changed.** Here's how it can happen: A homeowner finds a filter-backed grill mounted in the hallway ceiling or low on an interior wall. The grill is hinged. It's easily opened. It's obviously designed to hold a filter, and air is pulled through it. So someone puts a filter in it – not realizing there's already an air filter in the air handler a few feet away. It's hard on the system to pull air through two filters like this, where one filter is downstream of the other. And the situation is made much worse if one of the filters (the one in the air handler) is out of sight, unknown, never changed, and clogged shut with dust. The result: Airflow is restricted, operating costs rise, and equipment can be damaged. One filter is enough!

**112. Water heater's lower element burned out.....**Electric water heaters typically have two heating elements, upper and lower. The lower element works longest, and tends to burn out first. The result: Only the top one-third of the tank is heated. The water is just as hot as it was before, but it quickly runs out. If left that way, operating costs actually go down. But if the upper element's thermostat is dialed to a much higher temperature to compensate, operating costs go up.

**113. Double-wide mobile home has a critical air leak at the duct crossover.....** A double-wide mobile home is wheeled to its site in two halves, with air conditioning ductwork already factory-installed under each half. When the halves are joined on site, a critical cross-connection is then made to join the ductwork underneath. If that crossover connection subsequently falls loose, enormous amounts of heated or cooled air will escape to the out-of-doors. Equipment runs longer attempting to cool the residence. Operating costs skyrocket.

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