

POLLUTION FROM ELECTRICAL POWER GENERATION

Teton County, WY has one of the lowest electric power rates in the United States. The low cost of energy makes it hard to justify increased energy efficiency based on dollar cost alone. While energy improvements' made in most states often have a 1-5 year payback, due to our low cost of power the paybacks may take 3-8 years to return their investment, assuming that our power costs do not rise.

Reducing the pollution from energy consumption is a different matter. Any improvements made to a home will have an instant effect on the quality of our air. Increasing the energy efficiency of a building by 30% over the minimum building code, or improving an existing building by 30%, will have a dramatic impact on what we put into the air. If all homes in the United States were 30% more efficient, that would prevent about 324 million Tons or 648,000,000,000 pounds of CO₂ from being released into the atmosphere each year. In areas with high heating or cooling energy use, this would be an average reduction of about 20,000 pounds of CO₂ per year per home.

From 1950 to 1999, the annual world consumption of power rose from less than 1 trillion KWH (Kilowatt Hours) to over 14 trillion KWH and is continuing to grow. The US leads the world in per capita use of energy. In 2005, the United States emitted 2.6 BILLION Tons of Carbon Dioxide (CO₂), 3.9 million tons of Nitrogen Oxide (NO_x), 10.6 million Tons of Sulfur Dioxide (SO₂), 83.5 million Tons of Nitrous Oxide (N₂O), 110 million Pounds of Methane (CH₄) and created 1.3 million Tons of Ozone.

The effects of pollution come in many forms. Coal, oil and gas which is used for 72 % of electricity production impacts the land, causes secondary pollution sources, reduces wildlife habitat and creates long term scars on the land. Nuclear power, which is used for 19% of electrical production, creates hazardous wastes that will be with us for thousands of years. Hydropower, while producing no emissions, restricts our rivers and is a limited resource. Wind and solar have small environmental impacts. Biomass fuels consume water and fertilizer and are limited in what they can produce without taking away from agricultural land and affecting our food supply. Altogether, wind, solar geothermal, hydro, biomass and other alternate energies produce about 9% of our electric. As our hunger for more energy grows, the concern over the ever-increasing levels of pollution becoming more alarming.

US Home Heating and cooling accounts for about 49% of homes energy consumption, water heating is about 11%. Lighting is about 10%, computers and electronics about 8%, appliance about 8%, refrigerator about 7% and misc is about 7%. This amount varies by lifestyles, home size and the climate where the home is located.

Miscellaneous

Watts: Most appliances are listed in watts. Power consumption is listed as Kilowatt Hours, (KWH) which is the watts multiplied by the length of time the appliances is running. A 100-watt light bulb running for 10 hours is 1,000 watts of power used, or 1-kilowatt hour.

A heating furnace may be labeled as using 15,000 watts and if it ran for 6 hours it would use 90,000 watts of power or 90 Kilowatt Hours (78KWH). The furnace could release up 32 pounds per hour of CO₂ or 192 pounds over the 6-hour period of CO₂, which is about \$135 worth of electricity per month in Teton County.

1 gallon of propane equals 27 Kilowatt Hours. (KWH)

A 100 watt light bulb running 24 hours uses 2.4 KWH, or ~ .1 gallon of propane

One Kilowatt of power produced from coal emits 2.1 pounds of CO₂ into the air.

A 100 watt light bulb running 24 hours uses 2.4 KWH, and consumes about .8 pounds of coal, which produces 5 pounds of CO₂.

Many heaters are rated in BTU's or British Thermal Units. 1 Kilowatt = 3,412 BTU's.

In 2005, the US consumed 238 barrels of oil every second

Carbon Offsets. One way to help offset a carbon footprint is to purchase carbon offsets. By purchasing a carbon offset, one is paying for other companies to provide clean energy or offsetting technology to reduce the world's overall pollution. While this is good, it is much better to reduce the carbon footprint rather than paying companies to use other technologies. In a sense, a carbon offset is a license to pollute while doing nothing about the underlying problem.

In extreme climates, an average home's heating or cooling usage can be about 2,000 KWH per month. Currently in Teton County, WY, this is equal to a \$120 per month heating bill. This is equal to emitting 4,200 pounds of CO₂. Increasing the energy efficiency of the home by 30% would reduce the CO₂ emissions by 1,200 pounds per month or 14,400 pounds per year.

The Federal Clean Air Act lists almost 200 air pollutants, which are deemed as hazardous as targets for clean up. These include items such as dioxins, benzenes, mercury and chromium. Mercury is of great concern as it is volatile and can travel long distances before being deposited.

CO₂: Carbon Dioxide or CO₂ is the major greenhouse trapping gas. CO₂ allows energy from the sun to pass through the earth's atmosphere, where the CO₂ traps some of the sun's energy as heat. As the levels of CO₂ increase, more heat is trapped, raising the earth's temperature.

Methane: Methane, on a pound to pound basis, has over 20 times the heat trapping capacity of CO₂.

Ozone: Ozone is also known as smog. Ozone is created by a chemical reaction from **NOX** – Nitrogen Oxide, VOC's and sunlight. Stratospheric ozone provides us with protection from ultraviolet radiation while low atmosphere or tropospheric ozone is harmful to human health. Ozone is also known as smog.

Mercury: Mercury is emitted as an elementary vapor. However it quickly changes to methyl mercury when it settles into water. The methyl mercury is then absorbed by plants and transferred up the food chain into humans.

Acid Rain: Acid rain is caused by the combination of **SO₂** – Sulfur Dioxide, **NOX** – Nitrogen Oxide and moisture. Acid rain is responsible for increasing the acidity of water, affecting fish. Acid rain is a suspected cause of vegetation die off.

Water Pollution: One of the side effects of electric power generation is water pollution. This can be caused in several ways. Boilers require purging and cleaning to get rid of impurities. The pollutants from this include nickel, copper, iron and other chemicals used in the cleaning process. Coal pile water run off due to water leeching through coal stockpiles can leech out toxins, which can get into bodies of water or leech into the aquifer.

Coal: Coal, when burned, produces Carbon Dioxide, Sulfur Dioxide, Nitrogen Oxide, Methane and Mercury. The pollution emitted to produce 1 MWH (1,000 Kilowatt Hours) is 2,249 pounds of Carbon Dioxide, 13 pounds of Sulfur Dioxide and 6 pounds of Nitrogen Oxide. The amount of mercury released is dependent on the quality of the coal. Coal burning power plants emit one third of all mercury pollution. Large amounts of water are often used to remove impurities from the coal. Water run-off through coal stockpiles can pollute the water.

Oil: Oil, when burned, produces Carbon Dioxide, Sulfur Dioxide, Nitrogen Oxide and Mercury. The pollution emitted to produce 1 MWH (1,000 Kilowatt Hours) is 1,672 pounds of Carbon Dioxide, 12 pounds of Sulfur Dioxide and 4 pounds of Nitrogen Oxide. The water and other chemicals used for oil production add more contaminants into our environment.

Natural Gas: The burning of natural gas produces carbon dioxide and nitrogen oxides, but at a lesser rate than the burning of coal. Methane, which is a primary component of natural gas, can be leaked into the air during production and transportation and any gas that is not burned completely will emit methane. The average emission rate from gas-fired generation to produce 1 MWh (1,000 Kilowatt hours) is 1135 pounds of Carbon Dioxide, 1.7 pounds of nitrogen oxide and .1 pound of Sulfur Dioxide.

Nuclear Energy: Nuclear power plants do not emit Carbon Dioxide, Sulfur Dioxide, Nitrogen Oxide, Methane or Mercury. The safe and long-term storage of left over radioactive waste has not been solved.

Hydro: Hydroelectric, while emitting no pollutions into the atmosphere, change our river systems, limits natural fisheries and other river associated wildlife. Hydroelectric is a limited resource with not much opportunity for adding future capacity to our electrical needs.

Solar, and Wind: These forms of energy produce no green house gasses. Currently, they are the energy sources that least impact the earth. Unfortunately, for the near future, they are limited on the amount of electrical generation they can produce.

Geothermal, Biomass, Tidal, Landfill gasses, and Other Forms of Power Generation: There are other niche areas for power generation. Many of these are in their infancy or are not currently practical on a large scale.