HANDOUT 3 – ENERGY COSTS AND MEASURES

Residential Energy Use in Santa Fe

Your electricity bill measures the energy you use in kilowatt-hours (kWh). The average residential customer in the Santa Fe area uses approximately **6,500 kWh** annually.[1] As only 12% of Santa Fe County residents heat with electricity[2], this average reflects very little usage of electricity for heating. Residential users currently pay between **$0.07** and **$0.08** cents per kWh.[3]

Your natural gas bill measures the energy you use in British thermal units (Btu)[4], or, since a Btu is very small, in therms; a therm is 100,000 Btu. PNM's average residential natural gas customer in New Mexico uses **between 650 and 720 therms** annually—less in years with mild winters, more in colder years.[5] The price of gas varies monthly with supply and demand; PNM buys gas at the market rate and passes the charge through to its customers. In 2006, the cost per therm in Santa Fe varied from **$0.97** in January to **$0.66** in July.

BTU Content of Common Fuels

To compare different fuels, we need to convert the measurements to the same units. In the United States, the British Thermal Unit (Btu), a measure of heat energy, is the most commonly used unit for comparing fuels.

Fossil fuels

1 gallon of heating oil = 139,000 Btu [= 1.39 therms]
1 gallon of propane = 91,000 Btu [= .91 therms]
1 cubic foot (CF) of natural gas = 1,031 Btu (U.S. Average); 817 Btu (in Santa Fe)[6]

Wood

1 cord[7] shortleaf pine, air dried (20% moisture) =19,000,000 Btu [= 190 therms]

Electricity

1 kilowatt-hour (kWh) of electricity = 3,412 Btu [= .034 therms]

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[1] Average use of PNM's residential customers in Santa Fe in 2004 was 6,485 kWh. This was somewhat smaller than the average household use in New Mexico in 2004, 7,719 kWh, probably reflecting less use of air conditioning in Santa Fe than elsewhere in New Mexico.

[2] 2005 Census survey.

[3] Residential rates are 0.067607 per kWh for the first 200 kWh used monthly, and 0.078844 per kWh for all usage above the first 200 kWh. In addition, the total bill includes various other credits, charges, and taxes.

[4] One Btu is the equivalent of the heat needed to raise one pound of water 1 degree Fahrenheit at atmospheric pressure.

[5] Figures are from PNM's annual report for 2004. In Santa Fe, 650 therms equals about 80,000 cubic feet of gas. On gas bills, the conversion from cubic feet to therms is made with a multiplier, which can change monthly, and also differs by location. There are two reasons for this: (1) the amount of energy per cubic foot varies with altitude—just as air is thinner in the mountains, so is gas, which is usually delivered at a pressure just slightly higher than local air pressure; (2) the amount of energy per cubic foot varies with the gas used, and gas delivered by PNM in different parts of New Mexico comes from different sources.

[6] Btu value of 817/CF is a typical value in Santa Fe, but can vary monthly.

[7] A cord is 128 cubic feet (8 x 4 x 4 feet), containing 80 cubic feet of solid wood.

Efficiency of Conversion of Btu Content to Use

The efficiency of the heating appliance is an important factor when determining the cost of a given amount of heat. In general, the efficiency is determined by measuring how well an appliance turns fuel into useful heat. (The condition of the heat distribution or delivery system also affects the overall system efficiency.) The table below provides average efficiencies for

Estimated Average Fuel Conversion Efficiency

Use - Fuel Type - Heating Equipment	Efficiency (%)
Space Heating	
Coal (bituminous)	
Central heating, hand-fired	45
Central heating, stoker-fired	60
Gas	
High efficiency central furnace	97
Minimum efficiency central furnace	78
Typical central boiler	85
Room heater, unvented	99
Room heater, vented	65
Electricity	
Baseboard, resistance	99
Central heating, forced air	97
Central heating, heat pump	200+
Ground source heat pump	300+
Wood & Pellets	
Franklin stoves	30.0 - 40.0
Stoves with circulating fans	40.0 - 70.0
Catalytic stoves	65.0 - 75.0
Pellet stoves	85.0 - 90.0

Calculating and Comparing Costs of Heating

Using local fuel costs, you can compare the cost of heating your house with, say, gas vs. electricity by combining the above information on Btu's of different fuels with the efficiency of the appliances that convert them to heat. The examples below compare the cost of heating with gas with the costs of two different methods of heating with electricity. They points up the importance of the heating appliance selected to the total cost of heating your house. All three examples assume it requires 12,000,000 Btu's to keep your house comfortable in a winter month.

Example 1: Gas Furnace Assume you have a central gas furnace, which is 97% efficient, and thus requires 12,371,134 Btu's from natural gas to supply 12,000,000 Btu's (=12,371,134 x .97) to your house. Assume the average cost of gas (including fees and taxes) is $1.24 per therm. One therm provides 100,000 Btu's; thus you require 123.7 therms (=12,371,134/100,000), which will cost **$153.40** (=123.7*1.24).

Example 2: Electric Furnace Assume you have an electrical furnace which is 97% efficient, and thus requires 12,371,134 Btu's from electricity to supply 12,000,000 Btu's to your house. Assume the average cost of electricity (including charges, credits, fees, and taxes) is $0.087/kWh. One kilowatt-hour provides 3,412 Btu's; thus you require 3,625.77 kWh (=12,371,134/3,412), which will cost **$315.44** (= 3,625.77*.087).

Example 3: Electric Heat Pump Assume you have a heat pump which is 200% efficient; this is possible because "efficiency" is the ratio of the total amount of Btu's applied to heat your house to the Btu's supplied by electricity, but part of the total Btu's used to heat your house comes from the outside air. Thus electricity must supply 6,000,000 Btu's (=12,000,000/2.00) of the total 12,000,000 Btu's heating your house. The average cost of electricity is $0.087/kWh. One kilowatt-hour provides 3,412 Btu's; thus you require 1,758.50 kWh (=6,000,000/3,412), which will cost **$151.99** (= 1,758.50*.087).