

## **Reduction in Residential Natural Gas and Electricity Consumption in California through the Use of Natural Gas Room Heaters and Wood Stoves<sup>1</sup>**

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There are approximately 11.5 million households in California. Of those households, 6.9 million use natural gas furnaces as their main space-heating source, 2.9 million use electricity as their main power source for heat and 0.2 use liquefied petroleum gas (LPG). Because many homes use electrical heaters as supplemental heat along with gas furnaces or other heating appliances, electrical heaters are used in a total of 4.1 million households. It should also be noted that when all natural gas heating devices are taken into consideration, natural gas heat is used in a total of 7.9 million households which makes natural gas unquestionably the dominant residential heat source in California.

While the climate of California is generally considered mild and the average household experiences only 1870 Heating Degree Days<sup>2</sup>, due to California's large population, the energy expenditure for residential space heating in California is still large. The average annual energy consumption per household for space heat is 19.5 million Btu which is equivalent to a statewide annual total space-heating energy consumption of 0.22 quadrillion Btu. The annual consumption of electricity for space heat is 5 billion kWh, for natural gas it is 184 billion cubic feet (1.9 billion therms), and for LPG it is 81 million gallons.

Natural gas room heaters and U.S. EPA certified wood stoves can be utilized to reduce electricity and natural gas (and LPG) consumption. Not only is there the obvious benefit to the State of California by conserving valuable and limited supplies of electricity, natural gas, and LPG, but gas or wood room heater use also provides a financial advantage to the home occupant. Numerous studies have demonstrated that wood stoves reduce expense for home occupants as compared to

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<sup>1</sup>Wood stoves, sometimes called wood heaters, are room heaters and are similar in appearance and heat output to natural gas room heaters. Both cordwood burning and wood-based pellet stoves are considered wood heaters and can be certified by the U.S. EPA NSPS certification protocols published in the Code of Federal Regulations.

The information presented in this summary is based on the U.S. Department of Energy, Energy Information Administration 1997 data, the California Energy Commission, California Energy Demand 2000-2010 staff report, and various general residential space heating guideline manuals and technical reports, and marketing surveys.

<sup>2</sup>The term Heating Degree Day (HDD) is used as a measure of household heating demand which is related to climate. The higher the HDD, the higher the heating demand. For perspective the average HDD for households in California is 1870, which compares to 5,579 for New York, 503 for Florida and 4368 for the national average.

electrical, natural gas or LPG heat sources. In addition, the age of the typical heating appliance in California (Approximately 40% of the heating equipment in use in California is older than 20 years.) suggests that most of the natural gas furnaces in use are older, less efficient vented units and their replacement in all or part with gas-fueled room heaters will reduce natural gas usage and commensurate costs for the home occupant. Cost savings to the home occupant will, of course, be even more dramatic with the predicted future increases in natural gas and electricity rates.

The opportunity for the use of wood and natural gas room heaters in California is large. Currently, only 0.5 million households use wood stoves and 0.7 million households use natural gas room heaters for all or part of their heating requirements. Not surprisingly, marketing research has shown that elective changes in heating appliances are most likely to occur in owner occupied single family detached households. Approximately 54% of the 11.5 million households in California are owner occupied and 56% are single family detached units. In addition, a type of room heater (either natural gas or wood) that can readily be inserted into a fireplace cavity is called a fireplace insert and is readily installed into existing households with wood burning fireplaces since there is no home remodeling required. There are approximately 3 million households in California with wood burning fireplaces currently without inserts. In regards to natural gas room heaters, 8.1 million households currently have some form of natural gas heating or use some other gas appliance and hence are already connected to natural gas lines, which will obviously facilitate natural gas room heater installation. Not surprisingly, due to the diverse climatology of the state (HDD's in California range from less than 1000 to more than 7500.), some parts of the state, such as the Sierras and north coast, require much more space heating than others and programs for adding room heaters are more relevant there.

The average heated area per home in California is 1,381 square feet. A typical central furnace can provide 75,000 Btu/hr and generally operates intermittently. A typical wood or gas room heater can easily produce 35,000 Btu/hr and can be operated continuously. When the mild climate experienced by most households in California is taken into consideration, it is clear that the limitation for the replacement of central furnaces or multiple electrical space heaters with room heaters is not the number of Btu per hour that can be delivered, but rather the fact that they are as the name implies room heaters. They rely primarily on room air convective transfer and radiative heat transfer not forced air duct work to distribute heat. Consequently, in most homes the room heater could conservatively heat on the order of 700 square feet. This would typically include the main living area and connected open areas such as a kitchen, dining room and hallways. In addition, room heaters are known to save energy as compared to central heaters since they tend to be used when and where heat is required whereas central furnaces often heat the entire home even when it is not needed. A conservative estimate of the amount of heat output provided by an added room heater (not energy input) in a typical California household is 50% of the total heating needs for the household if it were simply heated by a central furnace. While it is impractical to provide estimates on the range of energy savings possible for all heating scenarios taking into consideration the range of heating demands in California and number of heating appliance types, the energy savings for the average California household by the addition of room heaters to households with the two most common existing main heating appliance types (natural gas central warm-air furnace 41.3%, and electrical central warm-air furnace 12.1%) are shown in the following table.

### Energy Savings through the Use of Room Heaters

Existing Main Space-Heating Equipment <sup>1</sup>	California Households with existing equipment		Room Heater Added	Annual Energy Savings per Household		Annual Energy Savings per 100,000 Households
	Million Households	Percent		Million Btu	Energy Units	Energy Units
Natural Gas Central Warm-Air Furnace	4.7	41.3	wood stove (cordwood or pellet)	11.9	11,560 cubic feet (119 therms)	1.156 billion cubic feet (11.9 million therms)
			natural gas room heater	6.1	5936 cubic feet (61 therms)	594 million cubic feet (6.1 million therms)
Electric Central Warm-Air Furnace	1.4	12.1	wood stove (cordwood or pellet)	2.4	705 kWh	70.5 million kWh (70,500 MWh)

1. The 34% overall efficiency used in the calculations for natural gas central warm air furnace is the product of inherent heater efficiency, energy loss due to duct work, energy loss due to the pilot light, and energy loss due to the high air exchange rate associated with the atmospheric draft vent. The 62% overall efficiency for electric central warm air furnace is the product of energy loss due to duct work and transmission line losses associated with the delivery of power to the residence.