Renewable heating systems

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Renewable heat is an application of renewable energy referring to the generation of heat from renewable sources; for example, feeding radiators with water warmed by focused solar radiation rather than by a fossil fuel boiler. Renewable heat technologies include renewable biofuels, solar heating, geothermal heating, heat pumps and heat exchangers. Insulation is almost always an important factor in how renewable heating is implemented.

Solar heating is a style of building construction which uses the energy of summer or winter sunshine to provide an economic supply of primary or supplementary heat to a structure. The heat can be used for both space heating (see solar air heat) and water heating (see solar hot water). Solar heating design is divided into two groups:

Geothermal energy is accessed by drilling water or steam wells in a process similar to drilling for oil. Geothermal energy is an enormous, underused heat and power resource that is clean (emits little or no greenhouse gases), reliable (average system availability of 95%), and homegrown (making populations less dependent on oil).[5]

A heat pump with Interseasonal Heat Transfer combines active solar collection to store surplus summer heat in thermal banks[9] with ground-source heat pumps to extract it for space heating in winter. This reduces the "Lift" needed and doubles the CoP of the heat pump because the pump starts with warmth from the thermal bank in place of cold from the ground.

A heat pump CoP increases as the temperature difference, or "Lift", decreases between heat source and destination. The CoP can be maximized at design time by choosing a heating system requiring only a low final water temperature (e.g., underfloor heating), and by choosing a heat source with a high average temperature (e.g., the ground). Domestic hot water (DHW) and conventional radiators require high water temperatures, affecting the choice of heat pump technology. Low temperature radiators provide an alternative to conventional radiators.

Renewable electricity can be generated by hydropower, solar, wind, geothermal and by burning biomass. In a few countries where renewable electricity is inexpensive, resistance heating is common. In countries like Denmark where electricity is expensive, it is not permitted to install electric heating as the main heat source.[13] Wind turbines have more output at night when there is a small demand for electricity, storage heaters consume this lower cost electricity at night and give off heat during the day.

Burning wood fuel in an open fire is both extremely inefficient (0-20%) and polluting due to low temperature partial combustion. In the same way that a drafty building loses heat through loss of warm air through poor sealing, an open fire is responsible for large heat losses by drawing very large volumes of warm air out of the

building.

Modern wood stove designs allow for more efficient combustion and then heat extraction. In the United States, new wood stoves are certified by the U.S. Environmental Protection Agency (EPA) and burn cleaner and more efficiently (the overall efficiency is 60-80%)[14] and draw smaller volumes of warm air from the building.

Because of the problems with pollution, the Australian Lung Foundation recommends using alternative means for climate control.[17] The American Lung Association "strongly recommends using cleaner, less toxic sources of heat. Converting a wood-burning fireplace or stove to use either natural gas or propane will eliminate exposure to the dangerous toxins wood burning generates including dioxin, arsenic and formaldehyde.[18]

"Renewable" should not be confused with "greenhouse neutral". A recent peer-reviewed paper found that, even if burning firewood from a sustainable supply, methane emissions from a typical Australian wood heater satisfying the current standard cause more global warming than heating the same house with gas. However, because a large proportion of firewood sold in Australia is not from sustainable supplies, Australian households that use wood heating often cause more global warming than heating three similar homes with gas.[19]

Renewable heat goes hand in hand with energy efficiency. Indeed, renewable heating projects depend heavily for their success on energy efficiency; in the case of solar heating to cut reliance on the requirement supplementary heating, in the case of wood fuel heating to cut the cost of wood purchased and volume stored, and in the case of heat pumps to reduce the size and investment in heat pump, heat sink and electricity costs.

Improvements to insulation can cut energy consumption greatly, making a space cheaper to heat and to cool. However existing housing can often be difficult or expensive to improve. Newer buildings can benefit from many of the techniques of superinsulation. Older buildings can benefit from several kinds of improvement: