

Alternative Heating Sources

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Introduction

How high must heating oil prices climb before consumers demand change? The sharp rise in interest for alternative heating methods would suggest that we have reached that point. The time to look for smarter, cleaner ways to heat homes is now. There is now a growing ecological understanding amongst the population, fossil fuels are limited and therefore will become more and more expensive. The German government wants to increase the amount of renewable energy from 6%, up to 20% in 2020. Therefore, in the future there will be a greater demand for alternative (renewable) energy sources, which means that the source renews itself within a short period of time or at least not causing more depletion of the reserves by using it as a fuel.

Current situation

In Germany, the most common heating sources are oil and gas condensing boilers as well as district heating in residential trade and industry. The current oil prices are just temporary. As the prices of fuel and gas increase during both the medium and long term, it is important to be aware of alternatives when deciding to change an existing fossil heating source or when planning a new building.

Alternatives

Replacement of old condensing boiler

The easiest way is just to change the old condensing boilers and install new ones. Most of the older ones are inefficient. This means that there is great potential to save fuel.

Heat pump

Most heat pump technology moves heat from a low temperature heat source to a higher temperature level. The two main types of heat pumps are compression heat pumps and absorption heat pumps. Compression heat pumps always operate on mechanical

energy via electricity, while absorption heat pumps may also run on heat as an energy source via electricity or fossil fuels. In Germany, the heat pump is the most commonly used alternative to conventional heating sources, having a market share of 10% in new buildings. In the following paragraphs, the three most important sources of heat pumps are described:

Air-source heat pumps

Air source heat pumps are relatively easily constructed, and hence inexpensive to install. Therefore, they are the most widely used type of heat pump because they use the warmth of the surrounding air. They have limitations due to their dependence on the outside air as the heat source during changeable conditions; therefore, there can exist a need for an additional condensing boiler. The temperature discrepancy during periods of extreme cold or warmth leads to lower efficiency. On cold winter days it is normally more economical to switch off the air heat pump and to operate an additional condensing boiler.

Geothermal heat pump

Geothermal heat pumps typically have greater efficiency than air-source heat pumps. The reason is because they draw heat from the earth which is at a relatively constant temperature all year round at below a depth of approximately 50 to 90 meters. Geothermal probes in the earth absorb the heat with a constant temperature, which means that the temperature differential is lower than from the air. Hence there is no dependency regarding outside conditions and therefore leads to better efficiency. Another advantage is that normally no additional condensing boiler is needed. Generally, a geothermal heat pump is the most expensive but also the most efficient kind of heat pump.

Ground water heat pump

Special geothermal heat pumps are the groundwater heat pump types that use solar power saved in the ground water. There is typically, little seasonal variation and little difference in temperature (on average a constant temperature of 10 degree Celsius). The trade-off for the improved performance is that a ground-source heat pump is more expensive to install than an air-source heat pump, this is due to the need for digging wells or trenches in which to place the pipes that carry a heat exchange fluid. In comparison, groundwater heat pumps are generally more economical than heat pumps using heat from the soil.

Biomass

The most important biomass resource in Germany is wood because of the short transportation distances between the source of the wood and end user. Normally it is not possible to store firewood, but a reservoir of wood pellets or chips is possible.

This provides the same comfort as gas or oil due to using an automatic filling process of the energy source in the condensing boiler. To minimize the risk of price fluctuation, a long-term supplier contract can be made. The main advantage is that wood is much cheaper than fossil heating sources and is a renewable resource. The pellet prices over recent years have been stable and will continue to be stable despite an increasingly higher demand. One advantage that should not be underestimated is that biomass heating has a positive impact on a buildings energy passport, every house owner has to show this to potential tenants in Germany since 2009. Furthermore, with increasing oil and corresponding gas prices, it will become more and more attractive to change to biomass as an ecological and economical resource.

Cogeneration of heat and power

Cogeneration (heat and power plant) is the use of a heat engine or a power station to simultaneously generate electricity and useful heat. Cogeneration is the thermodynamically efficient use of fuel or other energy sources. In the separate production of electricity some energy is lost in the form of wasted heat. Heat and power plants also use the thermal energy effectively as local heat. Compared with single gas heating or central power plant, a higher efficiency (up to 90 percent higher) is obtained by using the generated energy and heat directly, without suffering remarkable losses. A cogeneration plant must be operated for a certain number of hours per year to run economically. One disadvantage is that it has to be combined with a condensing boiler when peak capacity is needed. There are different types of energy sources for cogeneration. Conventional sources are gas and oil and in the near future, fuel cell cogeneration with hydrogen will be possible.

Solar heat

In Germany, 95% of all solar heating panels are installed on the rooftops of one and two family houses. Hence there is a high potential for using solar energy heating on multi-family dwellings because they meet 50% of the total heat requirement in residential buildings. In 2007 there was a dramatic decrease in new solar heat installations by 37%. Some possible reasons were the increase in the value added tax and the interim decrease of fuel prices. Nevertheless, solar heating is the most accepted renewable energy form in Germany. The roofs need to fulfill different criteria for installing solar heating panels. Therefore, solar heat is only property related realizable unlike geothermal energy, also there is a need for space to house buffer storage. It is not economical if long distances to the end user have to be covered resulting in high energy losses. The current standard

solar panels can supply only 10 to 20 % of the heating requirement per year of a house; therefore an additional heating source such as pellet heating could be a good combination. At the moment it is not economical to install solar heating because of the long amortization periods of between 15 to 20 years. Despite this, in the coming years there will be growing demand for solar heating as an alternative heating source, especially when the price of heating oil rises.

Correlation between heating and refurbishment

Most of the renewable energy sources cannot be used just on their own. Therefore, in many cases houses have two heating systems to cover the entire demand of the heating energy. That is why it is helpful to understand heating as an interaction between heating source, façade, windows, and controlled room ventilation for example. For heating sources such as heat pumps it is necessary that the houses are fitted with large heating surfaces such as floor heating. In most cases existing heating surfaces in old buildings must be replaced or enlarged when switching to heat pumps. Most of the time, it is necessary to reduce the heat demand by insulating the façade and changing windows. Otherwise house owners run the risk of over sizing the heating systems with correspondingly higher initial and operating costs. Controlled mechanical room ventilation can dramatically reduce the risk of mildew, and recover heat that normally would be wasted by uncontrolled ventilation via windows. If the windows are changed and the façade is insulated to reduce heating costs, problems with mildew in older buildings could appear. In many cases this has nothing to do with none or false ventilation by tenants, but rather caused by false window installation by the craftsmen. A German court recently judged that house owners are primarily responsible for the ventilation, and not the tenants. A reasonable action for house owners could be to install a controlled room ventilation system with vents in the façade, in order to minimize the risk of mildew and to save the building structure. It is best to achieve an integrated combination of heating, insulation and ventilation.

Finance

There are several options for getting financial assistance for new heating. A lot of programs are provided by the Federal Republic of Germany, the German States or the municipalities. It is important to know that in most cases there is no restriction of taking advantage of more than one source of aid for the same measure. In the following the most commonly used financial aids offered by German institutions are briefly described:

Grants

The Federal Office of Economics and Export Control (bafa) provides grants for example for biomass condensing boilers, heat pumps. The current requirements can be read under www.bafa.de.

Low interest loans

The German bank “*KfW Förderbank*” provides low interest loans for ecological and environmentally friendly heating technology, under the condition that certain requirements are met. Due to the new energy saving regulation (EnEV 2009) there is tougher criteria for getting low interest loans. Detailed information and current interest rates in combination with the different promotional loan programs can be found at the link below.

www.kfw.foerderbank.de.

Contracting

If a house owner is not in the financial position to finance the investment in new heating by themselves, they have the option of making a contract with an investor that will finance the measures, but under the condition that the house owner pays for example a higher than market energy price to the investor over a period of approx 15 years (with margin), and after that period, the investment will go over to the owner.

Conclusion

- Fossil resources are limited and will become more and more expensive; this will be an opportunity for renewable heating sources.
- An integrated combination between heating, insulation and ventilation in buildings should be aspired to.
- Possible alternatives are the replacement of old condensing boilers, heat pumps, biomass, cogeneration, solar heating.
- There are some programs for grants and low interest loans provided by German institutions for investing in ecological heating sources.