

Contribution of Solar Heating and Cooling to a 100% Renewable Energy System

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The heating and cooling sector plays a crucial role within the worldwide primary energy supply. Heat used in the building sector and in industry accounted for more than 50% of the world's final energy consumption in 2011.

It is very likely in the near future that due to their limited availability, fossil fuels will become too expensive to be used for hot water preparation or for heating and cooling of buildings or industrial processes. The necessity to reduce the consumption of fossil fuels for energy requirements in buildings and industrial processes will lead to energy efficiency measures and energy savings in general. However, these measures alone will not be sufficient.

The proportion of CO₂-neutral heating systems using biomass and in some regions geothermal will rise significantly in the future. The existing biomass and geothermal potential, however, will not be sufficient to cover the entire heating and cooling demands, especially, since biomass will also be used to cover the requirements of the transport and electricity generation sectors.

Applications

Several solar heating technologies are already relatively mature such as domestic hot water heating and swimming pool heating. Solar supported district heating and low-temperature industrial applications (> 250°C) in the several MW-scales are in the advanced demonstration stage and close to commercialization. Currently the biggest solar thermal district heating system is in operation in Denmark and has a capacity of 25MW_{th}.

The solar thermal system at the copper mine "Gabriela Mistral" in Chile is one of a series of industrial process heat plants. This system produces heat for the electro winning process and has an installed capacity of 26 MW_{th} (39,300 m² collector area). It was commissioned in 2013 and represents currently the biggest industrial process heat application.

Other applications, such as solar air conditioning and cooling as well as solar space heating require further development to achieve cost effectiveness, market entry and widespread uptake.

Main markets and installed capacity

By the end of 2012, the solar thermal collector capacity in operation worldwide equaled 283GW_{th}, corresponding to 405 million square meters. Of this, 26.3% comprised of flat-plate collectors (FPC) and 64.7% evacuated tube collectors (ETC), 8.4% unglazed water collectors and 0.6% glazed and unglazed air collectors.

The vast majority of the total capacity in operation was installed in China (189.4 GW_{th}) and Europe (45 GW_{th}), which together accounted for 83% of the total installed.

Long term potential

The IEA Technology Roadmap Solar Heating and Cooling envisages development and deployment of solar heating and cooling by 2050 to produce 16.5 EJ solar heating annually, some 10% of total final energy use for heat, and 1.5 EJ solar cooling, nearly 17% of total energy use for cooling by that time, following the IEA Energy Technology Perspectives 2012 2D scenario (2DS).¹

¹ In 2009, worldwide final energy for heat was 173 EJ (IEA, 2012). In the IEA Energy Technology Perspectives 2012 2DS final energy for heat is projected to be 198 EJ in 2050 (IEA, *ibid.*).