

Heat pump trends

Heat pumps are one of the fastest growing domestic technologies. They use renewable energy, are energy efficient and have a predicted product life time of 25 to 50 years. True, their first procurement is more expensive. But considering rising crude oil and energy prices, the investment pays off in 10-12 years, allowing savings of 30-70% on heating and 20-50% on cooling costs over conventional systems.

It is estimated that a 30% market penetration of heat pumps in retrofit heating markets could allow for global greenhouse gas emissions reductions of up to 8% thanks to the energy efficiency of heat pumps. Heat pumps are used in heating, ventilation and air conditioners as well as more recently in water heaters and dryers. In general heat pumps are used for upgrading low-temperature free heat from renewable sources (air, water, ground, waste heat) to useful temperatures.

Climate change, global warming and energy crises will motivate more and more stringent regulations and drive governments to subsidise technologies that promise to help reduce emissions while tapping into renewable energies. The Canadian government does so with up to \$4,500 subsidies for single homes implementing energy saving projects that reduce energy-related greenhouse gases and air pollution

Tight spots

Heat pump compressors and evaporator fans in air-conditioning systems absorb a good part of electrical power which is often still increased due to neglected maintenance. Refrigerant leakage remains high and is a real problem if HFCs are used which have a very high global warming potential. Leakages are a system failure and have of course to be avoided as much as possible, however the use of natural refrigerants such as CO₂ can diminish the environmental impact of the leakage to almost zero.

Another difficulty with heat pumps is that the temperature difference should be kept quite low for heat pumps to work efficiently. Lower ambient temperatures, for example, decrease heating capacity, while higher ambient temperatures decrease cooling capacity.

However, the technology advances fast and examples of successfully installed and operated heat pumps are abundant.

Heat pumps in Canada

Canada has concentrated on improving design and control in low, medium and high-temperature heat pumps used for industrial drying (hardwoods, softwoods, food products) to provide safe and efficient operations and to accelerate industrial implementation. In supermarkets, heat pumps are employed as heat recovery devices as well as in combined space and domestic hot water heating systems. A conscious effort to overcome market and technical barriers for ground-source heat pumps and the promotion of heat pumps as ideal solution for low and net zero energy houses

have helped to establish heat pump technology in cold climates. Heat pumps have also been integrated in the HVAC systems of commercial buildings such as ice rinks and retail stores, as well as into cogeneration units for residential applications.

Currently, Canada puts an emphasis on improved process efficiency in residential, commercial and industrial heating and cooling/air-conditioning and the use of the natural refrigerants CO₂, ammonia and hydrocarbons which can further improve the heat pump efficiency as well as the environmental impact. Concrete projects look at industrial heat pumps for agricultural industries and the efficient integration of ground-source and exhaust air heat recovery heat pumps into commercial/institutional, multi-apartment community buildings and cold storage plants.

Heat pumps in the future

Heat pumps can use electricity coming from renewable sources as well as conventional ones and reduce the end-user's dependency from one particular energy source, giving them a net advantage over wind, biomass and solar energy installations.

A challenge will be the adaption to changing usage patterns: demand for air cooling and dehumidification are expected to rise. Technical specifications of heat pumps will have to conform to new building and living standards as well (e.g. lower demand for heating but higher demand for domestic hot water; comfortably controlled indoor climate in summer and winter) but more importantly will have to be better adjusted to the use of natural refrigerants which - because of their zero ozone depleting and very low global warming potential have to be the refrigerant of choice - require particular safe installation and operation measures.

Need for more information and training

Heat pump technology needs to be better promoted and explained. To policy makers for one who can encourage the uptake of the environmentally friendly technology through subsidies and tax incentives. A good example is the boiler scrappage scheme in the UK, where the government offers £400 to households to help finance the upgrade of their G-rated boilers with “a new boiler or renewable heat unit”. But also to architects and installers, for example, who need to integrate the technology at an early stage in the design of the building or then have the technical know-how to install and service the system.

In a workshop on “Future Cities = Heat Pump Cities?” organised on 23 March 2010 by the European Heat Pump Association (EHPA) in Brussels in the context of the EU Sustainable Energy Weeks and which R744.com attended, Adrian Joyce, the director of the Architects Council of Europe, and Frank Baumeister, director of the installers of Europe (CEETB - European Technical Contractors Committee for the Construction Industry), emphasised both that heat pumps are not well enough understood in their respective professions and that there is a need for the industry to deliver reliable information and training to them as they are the interface between the manufacturers and the end-consumer and their advice often weighs heavy in the consumers' buying decision.