Cooling technologies

SUMMARY

The objective of the project was to find out the current state-of-the-art of cooling technologies and to evaluate their availability in Finland. The study was based on the newest research results and on the newest reported pilot cases. The study included also a simple questionnaire study allocated to some big property owners and technology suppliers.

In the short run (time perspective less than 5 years) there are no signs of big changes in the present technology and it takes longer for the new technologies like for example magnetic or thermoelastic cooling to break into the cooling markets of buildings. Compressor technologies will in near future still play important role in cooling applications. Development of compressor technologies is mainly driven by the demand of environmentally sound refrigerants. Also new automation and control applications as well as technical solutions like magnetic bearings will contribute to improved efficiencies and higher cooling capacities of compressor technologies. It is expected that cooling capacities per unit will double and the achievable condensing temperatures will be higher than 100 °C. Thermally driven cooling technologies which include absorption, adsorption and desiccant cooling technologies has developed during the last years especially concerning the temperature levels of the driving heat source. Applicable temperature levels for adsorption technology are as low as 65 - 70 °C and 75 - 80 °C for absorption technology. The cooling efficiencies of the adsorption and absorption technologies are still very poor (around 0,55 - 0,75) and the investment costs high which implies that these technologies will not become common in cooling buildings in near future in Finland. There are some signs of mass production of solar cooling applications based on thermally driven technologies which would decrease the investment costs and make these technologies more attractive. Free cooling technologies will play even more important role in cooling solutions in the future. Free cooling technologies utilise the cooling potential of outside air, sea, lake, river, ground water, etc.

District cooling solutions will gain popularity in urban areas. Production of cooling energy will in near future be based on existing technologies in Finland like heat pumps (compressors), free cooling, and tri-generation. Tri-generation means combined heating, cooling and electricity production where cooling includes often absorption technology. The main advantages of the district cooling compared to the building-specific solutions are environment friendliness, lower maintenance needs and often higher energy efficiency. In new district cooling networks it is possible to utilise distributed cooling generation like existing available cooling capacities of ice rinks, markets and industry. In the long run there are signs of the development of the so called 4th generation of smart district heating systems (4DHG). 4DHG combines all energy networks (heating cooling, electricity) and optimise the total system by utilising for example low temperature technologies and developed control and automation solutions (smart grids).

Full report:
Laitinen A., Rämä M., Airaksinen M., 2016, Jäähdytyksen teknologiset ratkaisut, VTT-CR-05415-16