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Smart Energy Systems and 4th Generation District Heating



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District heating and cooling are here to stay, but the district heating technology has to change. It has to adjust to the requirements of a future smart energy development. Therefore, research is essential, but not only research in university laboratories. Demonstration projects and innovation and collaboration between industry and universities are important, not only in terms of technical improvements, but also institutional and organizational aspects.

On 25-26 August 2015, Aalborg University and the 4DH Research Centre hosted the first International Conference on Smart Energy Systems and 4th Generation District Heating in Copenhagen/Denmark. The conference applied to everyone with an interest in energy systems and district heating and cooling and included more than 70 presentations from both industrial and academia.

District heating and cooling are essential to a cost-efficient implementation of the European Energy Union Strategy. First, because district heating offers a way of decreasing the cost of heating Europe, while creating jobs and avoiding imports of natural gas. District cooling has similar benefits. These benefits are documented in the Heat Roadmap Europe studies. Next, because district heating and cooling offer cost-efficient thermal storage options which are essential to the integration

of variable renewable energy sources such as wind and photovoltaic. However, to understand the fully potential of these benefits, one will have to take a smart energy systems approach to the analysis and understanding of the future options of implementing a sustainable energy solution for Europe.

The Smart Energy System concept is essential for 100% renewable energy systems to harvest storage synergies and exploit low value heat sources. The Smart Energy System approach was defined in 2011 as a result of a research project called Coherent Energy and Environmental Analysis (CEESA). The project addressed scenarios with a particular focus on renewable energy in the transport system in a context with limited access to bioenergy. As opposed to, for instance, the smart grid concept, which takes a sole focus on the electricity sector, the smart

energy systems approach includes the entire energy system in its identification of suitable energy infrastructure designs and operation strategies.

Focusing solely on the smart electricity grid often leads to the definition of transmission lines, flexible electricity demands, and electricity storage as the primary means to dealing with the integration of fluctuating renewable sources. However, these measures are neither very effective nor cost-efficient considering the nature of wind power and similar sources. The most effective and least-cost solutions are to be found in the combination of the electricity sector and the heating and cooling sectors and/or the transport sector. Therefore, the combination of electricity, heating, cooling, transport and gas infrastructures plays an important role in the design of cost-efficient future renewable energy systems.

4DH is an international research centre which develops district heating solutions for the future – known as 4th generation district heating technologies and systems. This development is fundamental to the implementation of the national objective of future sustainable energy solutions as well as the European 2020 goals. With lower and more flexible distribution temperatures, 4th generation district heating (4GDH) can utilize renewable energy sources, while meeting the requirements of low-energy buildings and energy conservation measures in the existing building stock.

In its research on low-temperature district heating, the 4DH Research Centre enhances the understanding of supply system design, infrastructure and heat savings. In future energy systems, combinations of low-temperature district heating resources and heat savings represent a promising alternative to individual heating solutions and passive or energy+ buildings. This change in the heating system also requires institutional and organizational changes that address the implementation of new technologies and enable new markets that can provide feasible solutions to society.

District heating and cooling basically provide efficiency to the system. District heating and cooling make it possible to meet heating and cooling demands with lower costs and lower fuel demands. Further, district heating has always changed and has been able to adapt to the developments in energy systems. The next International Conference on Smart Energy Systems and 4th Generation District Heating will be held in 2016 in Aalborg/Denmark. We hope to see even more people then.