

District heating & cooling: environmental technology for the 21st century

Robin Wiltshire

Chair IEA-DHC

IEA Bioenergy workshop, Baden, 19 October 2017

What is the IEA District Heating & Cooling TCP?

- IEA-DHC was established in 1983
- Established as a cost-shared TCP that carries out research projects in three-year 'annexes' which comprise 4 – 6 projects
- Also initiated task-sharing in 2011
- Current members are: Austria, Canada, Denmark, Finland, France, Germany, Korea, Norway, Sweden, UK, USA
- Potential new members: China, Belgium... Switzerland?

IEA-DHC: what it does

- Cost-shared projects carried out in three-year ‘annexes’ which comprise 4 – 6 projects chosen by competitive bidding
- Task-shared projects emerging alongside the cost-share programme
- Approximately 80% of projects are technically focused’; 20% policy focused
- Research topics cover all aspects of DHC technology focusing on reducing cost and improving performance: eg pipe materials, installation techniques, system optimisation, pro-active maintenance, thermal storage, integrating renewables
- Reports are produced for all projects and are available at the website: www.iea-dhc.org

Mission statement

Through international collaboration to conduct highly effective Research and Development as well as Policy Analysis to increase the market penetration of District Heating and Cooling systems with low environmental impact.

Key to this is:

Improving efficiency and economy

Annex XI (2014 -7) Projects (Cost-shared)

- Transformation roadmap from high to low temperature district heating systems
 - Plan 4DE: Reducing greenhouse gas emissions and energy consumption by optimising urban form for district energy
 - Smart use as the missing link in district energy development
 - Structured for success: governance models and strategic decision making processes for deploying thermal grids
- *All projects reports now at website!*

Transformation roadmap from high to low temperature district heating system

- This project builds on the Annex X project looking at 4th Generation (very low temperature) district heating networks for new build.
- It focuses on the potential for lowering temperatures for existing heat networks.
- It provides an overview of the steps required to transform existing district heating networks for the future.
- The intended outcome is future improved competitiveness of district heating networks.

Transformation roadmap from high to low temperature district heating system

- Case for reducing return temperatures incontrovertible.
- Even in Sweden: current average return temperature 47°C; potential optimised return temperature 32°C.
- Case for reducing supply temperatures when serving older existing buildings more contentious.
- So: reduce return temperature first; reduce supply temperature if/when appropriate.

Plan4DE: Reducing greenhouse gas emissions and energy consumption by optimising urban form for district energy

- The way in which cities and towns develop has a major influence on energy consumption
- Current land-use decisions by urban planners therefore influence the potential for and effectiveness of future district heating networks
- Urban planners seldom consider district energy due to lack of knowledge and tools
- This project aims to create a tool that will enable planners to consider the impacts of land-use plans on the feasibility of district energy.

Plan4DE: Reducing greenhouse gas emissions and energy consumption by optimising urban form for district energy

- Project team has delivered several webinars, and took part in COP21 in Paris 2015
- Planning tool has been developed and is being trialled.
- It calculates total heat demands and densities, and corresponding DH system costs. This enables planners to very quickly determine the implications of any built form for DH potential, and understand the impact of changing building or district densities.
- ‘One of the surprising conclusions is that district energy is more cost effective than individual heating when considered from a lifecycle cost perspective... in neighbourhoods where we would not have expected this to be the case.’

Structured for success: Governance models and strategic decision making processes for deploying thermal grids

- A major barrier to DH system deployment remains complexity around identifying appropriate governance models.
- This project reviews a range of governance models and strategic decision making processes that have led to successful, financially viable district energy systems
- This research provides civic leaders, planning staff, economic development officials, utilities, infrastructure investors, and other interested parties with critical information and case study examples to align the governance and business models with their district energy project goals and objectives.

Smart use as the missing link in district energy development: a user-centred approach to system management

- There are only a few studies on how people interact with district heating systems, but they indicate people find it difficult to use the controls effectively
- This project develops an intuitive, smart and predictive home energy management interface to assist district heating system end-users
- The interface is designed to empower end-users and to help them become more aware of the benefits of district energy
- It will also help them to use energy more efficiently.

Annex XII (2017-20) – successful proposals

- 1. Effects of Loads on Asset Management of the 4th Generation District Heating Networks
- 2. MEMPHIS - Methodology to evaluate and map the potential of waste heat from industry, service sector and sewage water by using internationally available open data
- 3. Integrated Cost-effective Large-scale Thermal Energy Storage for Smart District Heating and Cooling
- 4. Stepwise transition strategy and impact assessment for future district heating systems.

Low Temperature District Heating for Future Energy Systems – DHC's first Task Share

- Amplifies the work of the Annex X 4GDH project and the Annex XI System Transformation project
- Fundamental link between low temperature systems, integration of renewables, thermal storage, heat demands of future buildings...
- Concluding LTDH Guide will be launched soon
- Case studies to demonstrate low temperature district heating as one of the most **cost efficient technology solutions** to achieve 100% renewable and GHG emission free energy
- Follow-up Task Share currently in planning: 'Practical realisation of low temperature DH systems'.

New Task Sharing Initiatives

Practical realisation of low temperature district heating systems

First discussed September 2016; planning and development workshops held 22 March and 14 September 2017 to define scope. Contact:

kristina.lygnerud@hh.se

Hybrid Networks – District heating and cooling networks in an integrated energy system.

Presented to ExCo May 2017; ExCo gives support for definition workshop 21 September 2017 with formal decision November 2017. Contact:

Ralf-Roman.Schmidt@ait.ac.at

Future Annexes

- District energy networks are developed as large infrastructure programmes; requiring strategic view for decades so fits well for countries with 2050 visions for low/ zero carbon futures
- Themes likely to be continued: integration of local secondary and renewable energy sources, smart systems; synergy of infrastructures.

Links with other TCPs

DHC-TCP organised joint workshop May 2016. Relevant tasks in other TCPs include:

- SHC Task 55 'Towards the Integration of Large SHC systems into DH.'
- ECES Task 28 'Distributed Energy Storage for the Integration of Renewable Energies'.
- HPT Task 47 'Large Scale Heat Pumps in DHC Systems'
- EBC Task 64 'LowEx Communities'.

Further information

For more about the DHC-TCP, contact:

Robin Wiltshire (Chair)

Robin.Wiltshire@bre.co.uk

Andrej Jentsch, AGFW (Operating Agent)

IEA-DHC@agfw.de