



District Heating and Cooling including the integration of CHP

A New Future for District Energy Systems

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Scope (1)

- IEA-DHC: who we are
- IEA-DHC: what we do
- IEA-DHC: our future plans.



Scope (2)

- DHC: already a mature technology delivering carbon savings and fuel flexibility...
- ... faces new opportunities, new challenges, SO...
- DHC Futures: **lower temperatures** delivers more possibilities (*more carbon savings, greater fuel flexibility*)
- DHC Futures: **renewables and thermal storage** to play greater role – more cross-cutting between the IEA Implementing Agreements (Thanks to ECBCS for the invite to speak here!)
- DHC Futures: **network innovation: pipe material, configuration, installation; optimised operation**
- DHC Futures: determining comparative benefits, devising smarter integrations!



District Heating and Cooling IA: who we are

- One of the implementing agreements operating under the auspices of the IEA
- It carries out a programme of internationally based research and development....
- and has a policy voice through its links to the IEA Secretariat
- It is also one of 7 building-related programmes that regularly communicate.



District Heating and Cooling: what it is

- A pipe network connecting many consumers to centralised energy supply
- Consumer demands aggregate to a smooth overall demand
- Centralised energy technologies can be more easily maintained
- DHC networks connect a large thermal load so that heat from thermal power generation (CHP), municipal waste incineration can be used
- DHC is an enabling technology for many low and zero carbon technologies
- DHC enables rapid integration of newly available sources of waste heat and/or new technologies
- DHC assists local and national security of supply
- DHC schemes tend to grow demonstrating their business case
- DHC schemes migrate towards zero carbon solutions
- New systems are emerging using lower temperature heat.



The DHC/CHP Implementing Agreement Mission Statement

To conduct highly effective Research and Development as well as policy analysis of District Heating and Cooling systems (including the integration of CHP) with low environmental impact through international collaboration.



Benefits of participating in the DHC IA

- Value for money: each country benefits from research value for a small fraction of its cost
- Collaboration with industry through in-country consultation
- Part of the IEA 'family' of building-related research programmes
- Sharing knowledge with participant countries where
 - *the DHC market is well-developed*
 - *DHC is established but refurbishment is the key issue*
 - *DHC penetration is small*
- Links with policy community via IEA Secretariat



IEA-DHC: how it works

- Cost sharing agreement
- Three year 'Annexes' of research projects
- Areas of interest selected following **in-country consultation**
- Competitive bidding process
- Functions like an international consultancy able to tap into the experts in each participating country
- Executive Committee steers project selection and monitors project progress to completion
- Each country participates in each project through international Expert Group (1 delegate/country)
- Dissemination at international conference.



Annex VII projects (completed 2005)

- To inform **policy** and decision-makers
 - A comparison of distributed and large-scale CHP/DH
- Better **supply/demand** management
 - Two-step decision and optimization model for centralized or decentralized thermal storage in DHC systems
 - Dynamic heat storage optimization and demand side management
- Better **distribution** network operation
 - Strategies to manage heat losses technique and economy
 - How standards and insulation properties influence the competitiveness of district energy
 - Improvement of operational temperature differences in district heating systems
 - Biofouling and Microbiologically influenced corrosion in District Heating Networks



Annex VIII projects (completed 2008)

- Improved **distribution network**
 - Cost benefits and long term behaviour of a new all plastic piping system
 - New materials and constructions for improving the quality and lifetime off district heating pipes including joints – thermal, mechanical and environmental performance
- Better integration of efficient **supply**
 - Improved cogeneration and heat utilisation in district heating networks
- Connected **buildings** and their services
 - Assessing the actual annual energy efficiency of building scale cooling systems
 - District heating distribution in areas with low heat demand density



Example project: District heating in areas with low heat demand density

- Analysis that outlines techniques and measures that can reduce costs for heat distribution in areas of low heat demand density
- More careful planning required than for traditional district heating
- Practical considerations include consideration of
 - Low pressure and low temperature systems
 - Reduced pipe dimensions
 - New types of pipe systems e.g. twin pipes
- Outcome: Concludes that areas with heat density 10 kWh/m² year may in future be economically served by district heating – much lower value than traditionally accepted.



Ongoing Annex IX 2008 - 2011

- To inform **policy** and decision makers
 - The potential for increased primary energy efficiency and reduced CO₂ emissions through DHC
 - Policies and barriers to DHC outside EU countries link with EU IEE project that focuses on EU countries
- Future **buildings**
 - District heating for energy efficient building areas
- Integration of efficient **supply technologies** - **renewables**
 - Interaction between district energy and future buildings that have storage and intermittent surplus energy
 - Distributed solar systems interfaced to a district heating system that has seasonal storage

END-OF-ANNEX SEMINAR: JUNE 2011: DETAILS AT WEBSITE



Towards Annex X – priorities

- Integration of many heat sources including renewables
- Lower temperature networks
- Energy and carbon savings – comparative benefits
- Reducing cost of network installation and operation
- Demand management & thermal storage



Annex X priority: Integrating renewable and low carbon supply technologies

- including biomass, solar thermal, heat pumps, geothermal, CHP, and locally available 'waste' heat
- design issues
- compatibility of different technologies
- resource availability
- impact of scale on economic viability.



Annex X priority: Low temperature district heating

- impact on heat losses
- provision of DHW at no legionella risk
- integration with low heat demand buildings e.g. PassivHaus
- integration and control with existing building stock
- effect on sub-stations
- achieving high dT , low return temperature.



Annex X priority – Energy and carbon savings from DHC systems

- future heating/cooling demands: climate change, new regulations, energy efficiency in buildings
- carbon savings from DHC systems, compared with (a) alternatives serving typical building mix (b) serving PassivHaus buildings
- developing primary energy factors for calculation of primary energy use.



Annex X priority – Reduce installation & operation costs and increase service life

- more efficient pipe-laying techniques for plastic and steel, including no-dig
- emphasis on retrofit with more effective connection to dwellings
- innovative materials and construction (testing, standardisation, certification)
- improved maintenance strategies
- metering and metering software
- optimal sequencing of multiple energy sources.



Annex X – Demand management and thermal storage

- DHC with thermal storage as a flexible energy option to integrate with future electricity grid scenarios
- seasonal thermal storage for DHC
- benefits to local electricity grid through demand reduction or demand response
- demand-side control including attention to tariffs
- use of heat driven chillers, CHP and/or advanced controls with district cooling to enable electricity demand management.



Our work is not finished!

- DHC:
 - facilitates low carbon technologies
 - can deliver very large carbon emission and primary energy reductions
 - is a market ready proven technology
 - has barriers confronting it
 - needs to find ways to reduce cost



Further information

Project reports, programme brochure and current activities at:

www.iea-dhc.org

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