

Low Temperature District Energy Systems

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15 October 2011

Part of the BRE Trust

Scope

- About district heating
- About *low temperature* district heating
- Research for low temperature district heating

District Heating – local networks

- Pipe networks carrying heat from one/few sources to many users
- Sources may comprise: heat from CHP, waste incineration, industrial sites, renewable energy sources
- Benefit derives from **fuel flexibility**, and **aggregation of disparate loads**
- Enabling heat that would otherwise be wasted to be re-used
- District heating schemes are already energy systems that make use of heat that would otherwise be wasted...
- *but* lower temperature networks are able to make use of heat from a *wider* range of sources.

Benefits of district heating

- DH networks allow almost any source of heat to be used
 - Commonly linked to CHP which is (apart from biomass CHP) fossil based, but DH also uses heat from municipal and industrial waste...
 - ...as well as renewables: biomass (NB limited supply chain), geothermal, solar thermal
- By using low grade heat, higher grade sources can be reserved for other purposes
- DH confers **flexibility to future energy choices**: migrating towards lower carbon solutions that also *strengthen energy independence* and can play important role in system integration with smart electrical grids.

District Heating – Global Perspective

- Each DH network has its own characteristics; exemplar schemes to consider replicating exhibit a wide range of approaches
<http://www.districtenergyaward.org/index/awards2011>
- Recommended policy actions depend on nature of DH market (consolidation, expansion, refurbishment, new development)
<http://www.ecoheat4.eu/en/>
- Diversity of schemes makes it difficult to judge global environmental benefit, but Werner (2008) estimates 4% of global carbon savings
<http://www.iea-dhc.org/index.php>
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What is low temperature district heating?

- The first district heating schemes used steam
- Then there were hot water distribution systems
- Most current systems are medium temperature hot water systems
- Currently 'low temperature' (district heating) often implies 90° C or perhaps as low as 70° C supply
- But potentially we can use 50° C supply (and perhaps lower).

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Why develop low temperature district heating?

- Buildings require 20° C, this is a very low quality heat, so we can potentially 'get away with' a very low quality supply
 - By using very low quality heat supply, higher quality sources can be reserved for other purposes
- This also **extends the range of heat sources** that can be used...
- Including '**recycling**' of local waste heat... as well as **renewables**: biomass (NB limited supply chain), geothermal, solar thermal
- More *flexibility* with future energy choices: migrating towards **lower carbon solutions** that also strengthen **energy independence**.

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DH futures: low temperature systems for new-build

- Under floor and/or in-wall heating systems
- Energy efficient building design: high levels of insulation
- Range of usable heat sources could *more easily include* renewables like solar thermal, geothermal
- Lower temperature supply means lower pipe heat losses
- Even lower pipe losses if new twin-pipe system is installed
- However, care is required to ensure that the low demands from connected buildings still adds up to a viable business case

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DH futures: low temperature systems and smart grids

- Even the buildings themselves can at times work as energy producer, at other times as energy consumer
- Thermal storage may be integrated to help with the balancing between supply and demand
- Optimal balance between greater fabric insulation that reduces *quantity* of energy supply required, temperature of supply that defines *quality* of energy required, and role for thermal storage
- Real time interaction between many supply sources and many demands: this is why low temperature systems can benefit from the district heating scheme becoming a smart thermal grid.

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Low temperature exemplar: Lystrup

- New-build pilot schemes in Denmark are operating at 50° supply, 20° return
- Comprises energy-efficient new-build dwellings with underfloor and inwall heating pipes
- Systems have small water volume to avoid legionella problem
- http://www.districtenergyaward.org/download/awards2011/New_scheme_Denmark_Lystrup.pdf

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Low temperature district heating: issues that need to be addressed

- Can low temperature district heating systems (50° C supply or lower) function effectively in practice?
- How low is possible to go?
- Consider the requirements for both space heating and hot water
- How should the potential issue of legionella be addressed?
- Is it necessary to adapt the design of sub-stations?
- Can low temperature district heating systems also be used to heat the existing building stock?

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Who's looking at low temperature district heating?

- IEA District Heating & Cooling research programme: completed projects have examined district heating for new-build developments; current projects include '4th Generation District Heating' and 'Low Temperature District Heating and Smart Networks' at <http://www.iea-dhc.org>
- *Special offer currently available for countries wishing to join the IEA-DHC programme – contact wiltshirer@bre.co.uk*