7th International Conference on Smart Energy Systems
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#SESAAU2021

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LOW TEMPERATURE DISTRICT HEATING AS A PROVEN AND MARKET READY TECHNOLOGY

– CASE STUDIES OF IEA DHC ANNEX TS2

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Fraunhofer IEE

Implementation of low temperature district heating systems

=> The purpose of IEA DHC Annex TS2 is to facilitate the wider *implementation* of 4GDH systems.

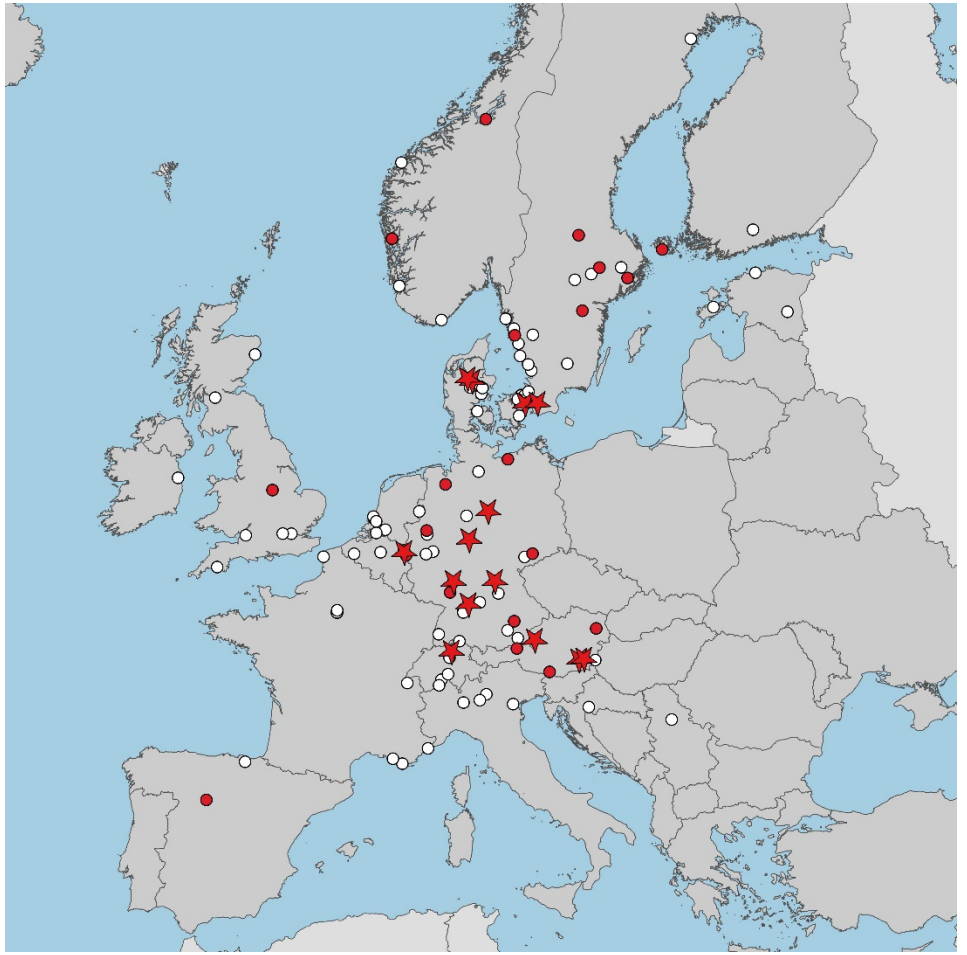
- Participating countries:
  Austria, Denmark, Germany, Norway, Sweden, and United Kingdom.
- Observing partners from
  Ireland and Korea

Coordination by Halmstad University/Sweden: Kristina Lygnerud & Swen Werner

Demonstration projects from Annex TS2

- Identified case studies
- 12 Cases are described in detail and presented ★
- 25 Cases more are analyzed in project ●
- 165 Cases are identified and listed ○

- The presented cases are from:
  Austria, Denmark, Germany,
  Sweden, Switzerland and The Netherlands



Demonstration projects from Annex TS2

Six different classes of demonstrators have been identified:

- realised demonstration project on **existing** or conversion areas with an **existing** heating network

- realised demonstration project on **existing** or conversion areas with a **new** heating network

- realised demonstration projects on **new** constructed areas with a **new** heating network

- realised demonstration projects on the single **building** scale

- **simulation** and design studies on areas

- demonstrators on a **laboratory** scale

Woergl (Austria)

⇒ Realised new construction

Low temperature secondary network for 20 affordable row houses (60/40)

- Innovative pre-fabricated piping systems
- Heat supply form industrial biomass plant and from 3 heat pumps
- Direct connection of the heating system

Benjamin Franklin in Mannheim (Germany)

⇒ New construction and existing buildings

Smart thermal subgrid

- Integration of renewable heat (ca. 20%) from heat pumps / PV systems (ca. 25.000 m²) in addition to the classic district heating supply
- Heat pumps are operated with 100% PV power
- Utilization of surplus electricity in summer time for the operation of cooling machines
- Smart control of subgrids
- Modular expansion

Copenhagen Fredriksberg (Denmark)

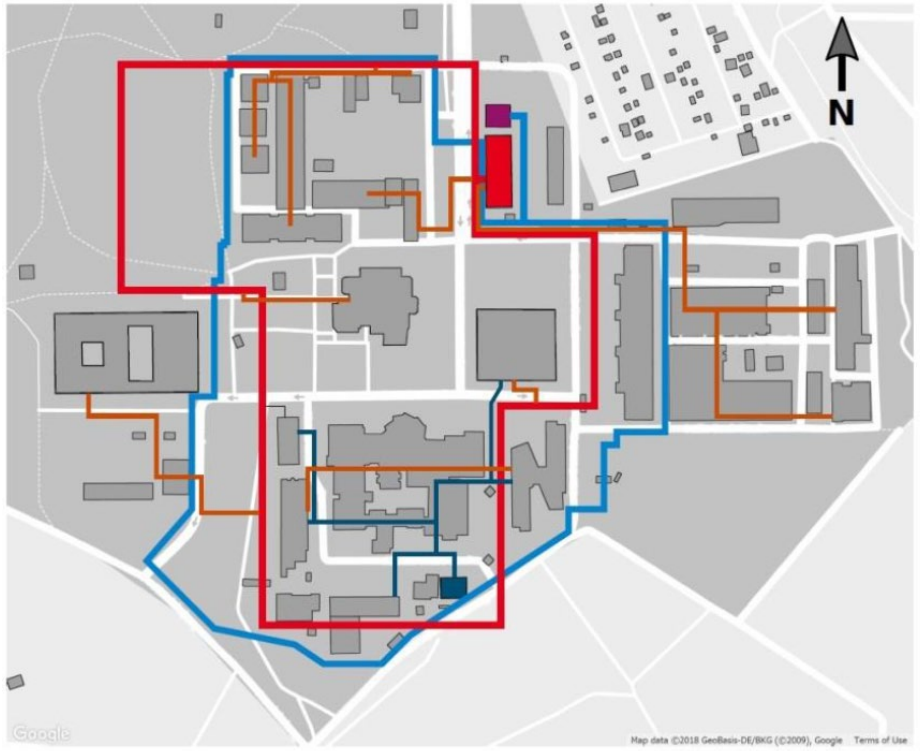
⇒ Building scale

Return temperature optimization in cities

- Central substation including weather compensation
- Online control of substation
- Radiators are equipped with smart electronic thermostats and return pipe temperature sensor
- Optimization of operation and monitoring

Darmstadt „Lichtwiese“ (Germany)

⇒ Simulation study



Energy efficient campus Lichtwiese

- Heating and cooling network
- Based on monitoring a virtual model / digital twin has been up
- Strategy developed to reduce network temperatures
- Waste heat utilization from high performance computer center

Sigtuna (Sweden)

⇒ Realised new construction

Low temperature neighborhood
(60°C supply)

- Solar heating parking (1000m² collector)
- Electric heat pumps with geothermal source

Lagarde District in Bamberg (Germany)

⇒ New construction and existing buildings

Source: SW Bamberg and architects

Innovative energy supply

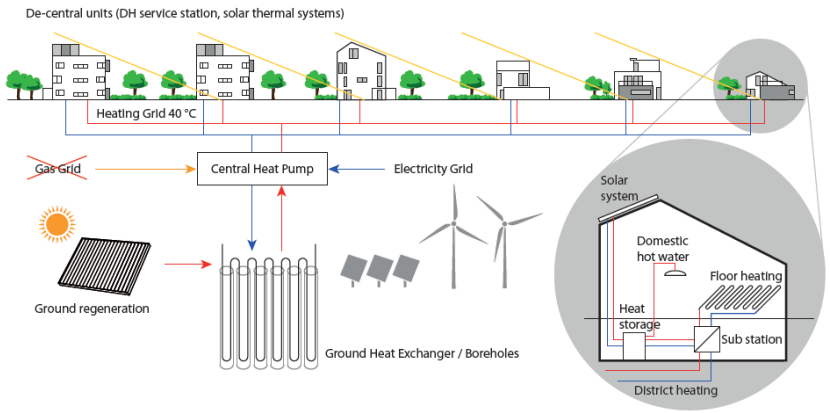
- Ultra-low temperature heating network (10°C) and conventional grid
- Different ground collectors, DH pipes and fresh water as heat source
- Heat pump on building level
- High temperature cooling for offices
- Sector coupling / e-mobility / PV

Kassel „Zum Feldlager“ (Germany)

⇒ Simulation study

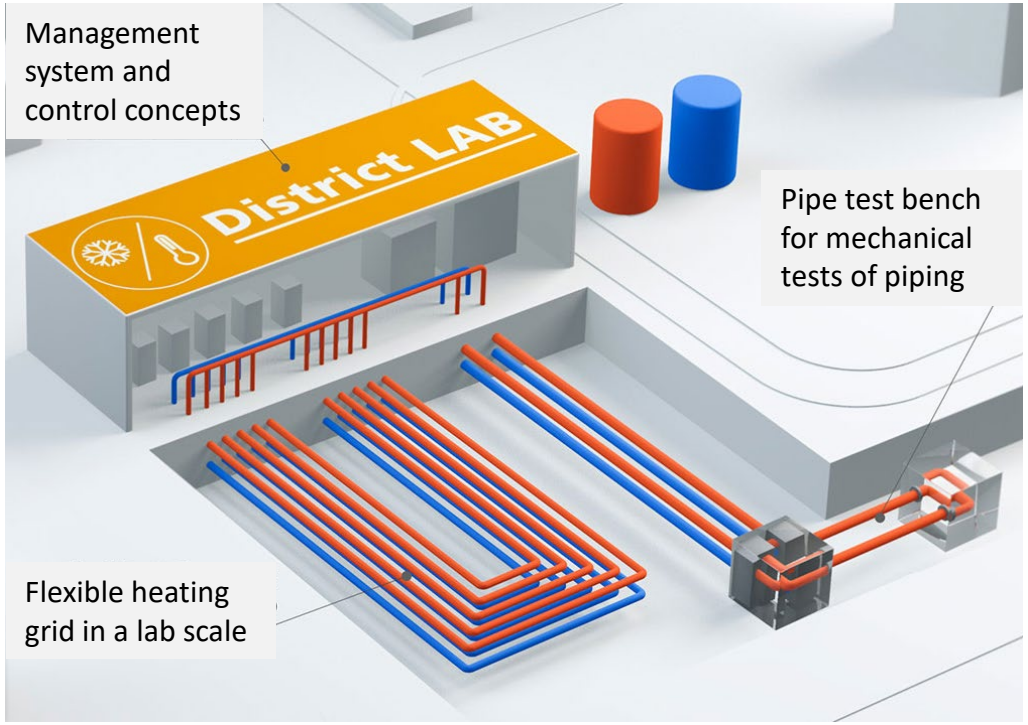
Geo-solar district heating

- Low temperature DH (40°C) with ground coupled HP and solar collectors
- Decentral DHW-preparation
- Solution for new housing areas
- Financing models



District Lab (Germany)

⇒ laboratory scale



New Experimental Facility for Innovative District Heating Systems

- Flexible heating grid in a lab scale
- Management system and control concepts
- Pipe test bench for mechanical tests of piping

Major conclusions from the case studies

Technical

- large variety of cases and system configuration show flexibility in implementation and realization
- For the integration of multiple heat sources digitalization is needed

Regulatory boundary conditions

- Are not beneficial in all regarded countries
- Realization of cross sectoral energy systems are not foreseen

Ownership issues

- Systems owned by the municipality or cooperative get more customer support

Business

- Ownership issue important because of longer pay back times. Some cases show up to 10% lower costs.

Summary

"In summary, the cases give the **evidence that low temperature district heating is a proven and market ready** heat supply technology and works **under various boundary conditions**. Furthermore, experiences from the cases show a good support for a needed implementation of **digitalization measures to secure a good operation** under the new boundary conditions, such as integration of fluctuating renewable or waste heat sources or changed network (bidirectional) operation."

IEA DHC Annex TS2

IEA DHC|CHP

Interested in more cases?

Visit

http://publica.fraunhofer.de/dokumente/N-640204.html

and get the final report of the IEA DHC Annex TS2

Technology Collaboration Programme
by iea

IEA DHC Annex TS 4:
Digitalization of District Heating and Cooling:

Optimized Operation and Maintenance of District Heating and Cooling Systems via Digital Process Management

Next Industry Workshop

(in cooperation with IEA DHC Annex TS3 on hybrid Energy Systems)

on 03. November 2021

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THANK YOU FOR YOUR ATTENTION

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