CONCERTED ACTION
ENERGY EFFICIENCY
DIRECTIVE

Smart, efficient and sustainable heating and cooling systems (Article 14)

Executive Summary 7.8

Efficiency in energy supply

Stane Merse, Jozef Stefan Institute, Slovenia
Daniel Fribberg, Swedish Energy Agency, Sweden
Jacob Byskov Kristensen, Danish Energy Agency, Denmark

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1 Summary

The discussions at the Bratislava Plenary Meeting focused on a retrospective view of the past Core Theme 7 activities and results. Additional emphasis was also given to the actual investment business cases and the measures for enabling smart, efficient and sustainable heating and cooling systems.

Our work in Bratislava was focused on the following linked key topics:

- **Overview of the past CT7 activities and results -** what have we learned and achieved through the process of preparing the Comprehensive Assessments (CA)? What are the key benefits and necessary next steps?
- **What is the business case for district heating (DH) in different countries – what kind of investments are feasible today and why?** Survey results and presentation of the current status in Poland.
- **Local district energy cases from across Europe - ProgRESsHEAT** project experiences, recommendations and successful factors for efficient heating systems.

This final report summarises the key Bratislava discussion findings and conclusions.

That CA is a starting point, not the end result, was one of the main conclusions from our discussion. CA mainly brought more clarity to current heating and cooling demand and the future role of district heating and cooling (DHC) and heat supply in Member States (MS): benefits were smaller in more experienced DHC countries and in Mediterranean MS less appropriate for DH. Large potential was assessed – especially socio-economic – but only limited policy and measures have been triggered. CA could have an important role in linking different energy and climate policy goals and directives (EED and Directives on Renewable Energy Sources (RES) and Energy Performance in Buildings (EPB)) and could significantly contribute to the National Energy and Climate Plans in the future. MS have different experiences with mapping of heating and cooling demand, and all are facing a huge data availability challenge. In some MS, it was recognised as powerful tool for planning that could be used more on a local and regional level, especially in MS with limited DHC experience.

MS were asked to complete a survey on DH market perspectives. The results highlighted the huge interest of MS in this topic (26 MS responded or 90% respond rate) and showed the competitiveness of DH compared to other heating alternatives, despite difficult market conditions being reported by more than half of responding MS. The availability of different support instruments, where EU funds are of high importance, is crucial in overcoming the current gap in investment resources due to the limited or low profitability of DH systems, similar to the power sector. Investor appetite appears to be low with only 6 MS reporting that investors find DH an interesting opportunity. In terms of technology, in almost all MS who responded to this question (14/15), the most interesting investment opportunity cited was renewable DH. Investments in CHP fuelled by natural gas are still considered interesting for investors in more than half of responding MS (53%), followed by investment opportunities for using energy from waste in DH (47%)), waste heat utilisation investments (40%) and investment in large heat pumps and electrical boilers applications (33%). New investment opportunities in coal-based CHP exist in one MS. The most important influencing factor for investment in DH cited by respondents was the level of support for RES and CHP heat and electricity generation, with fuel (natural gas) and electricity market prices considered as the next most influencing factor contributing to the low profitability of CHP and increased risk for new investments.

Investments that ensure a high utilisation rate of installed capacity, connection of new large scale consumers and investment which increase utilisation rate of existing DH systems are feasible today in DH systems in some MS. Only with good communication and cooperation between heat producer and heat distributor can the greatest benefits of DHC be achieved. CA has assessed huge CHP potential where stable economic and legal frameworks and clear supporting mechanism are essential for further DHC and CHP development

High efficiency, sustainable energy sources and high connection rates are key attributes for the efficient green district energy solutions that are cheapest for both society and individuals. Long term policy targets, use of proper planning tools (geographical data essential), proper regulation and access to cheap long term financing or subsidies are key success factors demonstrated by the **ProgRESsHEAT** project experiences.

2 Recommendations/Conclusions

2.1 Discussions

Discussions on a series of core questions were very well received: What have learned and achieved through the process of preparing the Comprehensive assessments (CA)? What are the key benefits and necessary next steps?

The key conclusions were:

- **Benefits of the CA highly depends on the regulatory system and the current level of knowledge in MS:**
  - Countries with highly expanded DHC and a more liberal approach to the regulation of DHC find a smaller need for a geographically detailed CA as most of the market actors already have the necessary information though this is not publicly available. CHP potential was considered as limited or declining due to high existing coverage and low electricity prices.
  - In less DH developed countries, the CA provided mainly interesting results for heating whereas a new focus on cooling potential brought new knowledge to the more traditional DH countries as well.
  - The implementation of the CA has highlighted large potential, especially socio-economic. Policy initiatives are now being discussed and though are mainly not yet implemented.
  - **CA is a starting point – not the end result.** CA results will be an important input to the national energy strategies and National Energy and Climate Plans in coming years.
- **MS have different experiences of heat mapping where level of detail and approaches used differ significantly:**
  - Some do not yet see the benefits of heat mapping or how to use it
  - Several consider it as important tool necessary for the local (municipality, regional) energy planning (DHC and natural gas infrastructure, etc.) as well as being applicable for the environmental purposes (mitigation of local air emissions, etc.).
  - Data availability and necessary regular updates are important challenges for the developed tools.
- **MS gains from CT7:**
  - Exchange of MS practices within Article 14 implementation.
  - Good practice presentations – heating and cooling technologies, tools and approaches.
  - Formal and informal Discussion with participants
- **Future expectations:**
  - More technical oriented assistance - bring industry to present technical solutions.
  - Connect CA with EU strategy goals and the EU funding.
  - More attention to district cooling - efficient technologies to convert heating to cooling

2.2 Survey results: What is the business case for DH in different countries?

This survey had the highest response rate of all CT7 surveys, showing the high level of interest in this topic amongst MS and the importance of the state of the market and investment in DH systems for them.

The survey results showed that DH systems are most commonly seen as a “public good”, managed by the public sector where regulation of the DH sector, exists (complete or partial) in 2/3 of the responding MS. From responses to the survey it appears that DH systems are quite competitive compared to other heating technologies. In more than half of responding MS (or even 2/3 if we exclude “not applicable” MS without DH systems), heat prices reflect the actual costs of the DH systems.

Although it is difficult to make general assessment on the profitability of the DH systems from responses to the survey, it appears that DH systems are still quite competitive compared to other heating technologies in more than half of the responding MS (11/26 MS answered Yes: 4 MS with Yes and No) as shown in Error! Reference source not found.. But on the other hand, the survey highlighted a very limited ability of a DH systems to re-invest in their infrastructure, due to limited or low profitability in at least half of the MS with DH (a situation is similar to the power sector). Different support instruments (EU funds) and proper regulation can significantly ease these problems.

Is DH competitive compared to other heating technologies?

Investor appetite appears to be low with only 6 MS reporting that investors find DH an interesting opportunity. In terms of technology, in almost all MS who responded to this question (14/15), the most interesting investment

opportunity cited was renewable DH. Investments in CHP fuelled by natural gas are still considered interesting for investors in more than half of responding MS (53%), followed by investment opportunities for using energy from waste in DH (47%), waste heat utilisation investments (40%) and investment in large heat pumps and electrical boilers applications (33%). New investment opportunities in coal-based CHP exist in one MS.

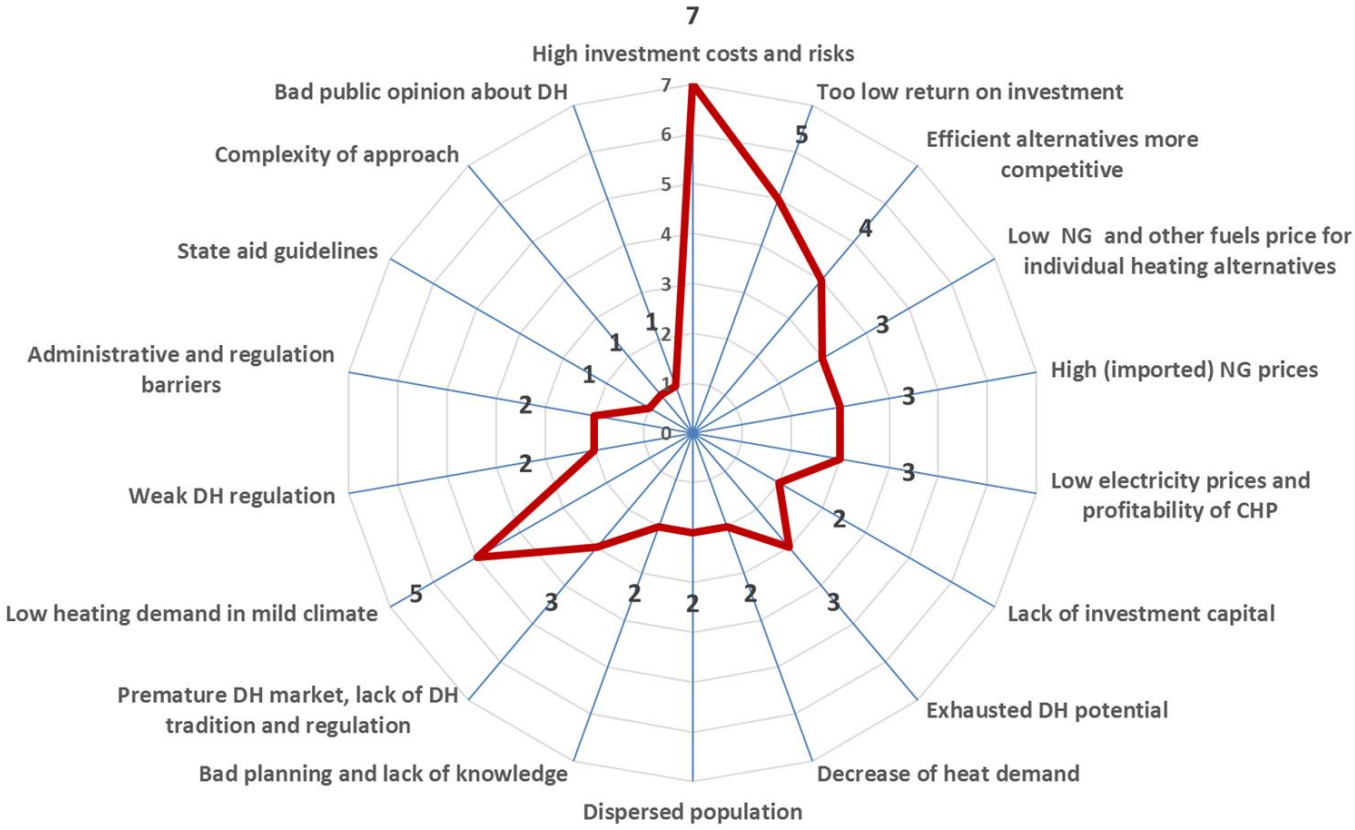
What kind of DH - considering energy source are interesting investment opportunities?

The most important influencing factor for investment in DH cited by respondents was the level of support for RES and CHP heat and electricity generation (mentioned by eight MS), with fuel (natural gas) and electricity market prices considered as the next most influencing factor contributing to the low profitability of CHP and increased risk for new investments.

The survey responses indicate that district cooling technology has not yet been generally recognised with less than one third (29%) of responding MS stating that they have introduced targeted support for this technology and first considerations have been done in some other MS.

As can be seen in **Figure** , that high investment costs and linked risks and low return on investment are key barriers for new investments in DH. Low electricity prices are decreasing the profitability of CHP as an important DH technology. Low fuel costs for efficient individual heating alternatives is an obstacle that is evident in several MS, as well as administrative and regulation barriers. Low heating demand is a reported barrier for DH in MS with mild climate, where a lack of tradition and premature markets are inhibiting the development of DH.

Figure 1: The main barriers for developing DH reported by MSs



2.3 Practical Examples

What is the business case for DH in Poland today?

By Wojciech Bujalski, Warsaw University of Technology, Poland.

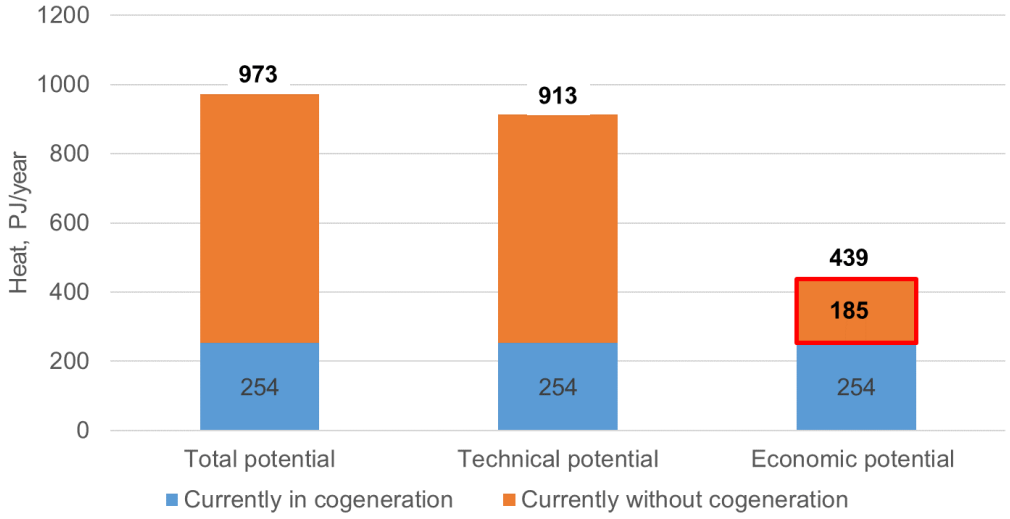
One of the key challenges within the preparation of the CA of the potential for the application of high-efficiency cogeneration and efficient district heating and cooling in Poland was the lack of data, because the current reporting system focusses on electricity statistics. Extensive technical cogeneration potential has been assessed especially for the current heat supply without CHP, although less than 1/3 of it (185 PJ of heat) was assessed as having

economic potential (**Figure 1**). Bigger social benefits, CO_2 reductions and lower investments are key advantages identified of natural gas technologies even though higher support is needed compared to the large-scale coal technologies. Gas turbines and gas engines are economically justified for small scale applications (<20 MWe).

Key challenges and conclusions:

- **The length of the DH network and CHP electricity generation is growing at a stable CHP capacity, where approximately 1,800 MWe of CHP capacity will be decommissioned in the next 15 years** (most of the planned investments are waiting for the confirmation of a support mechanism).
- **Stable economic and legal frameworks and clear supporting mechanism are essential for DHC and CHP development**
- **Cooperation problems between heat producers and heat distributors –** shared responsibilities (efficient generation, investments to the grid for reduction of losses and to enable new connections, etc.). **Only with good communication and cooperation can the greatest benefits of DHC be achieved.**
    - **Modernisation of supply sources in smaller DH systems are necessary due to environmental legislation** (Medium Combustion Plant Directive[1]) - without proper support DH systems will be closed and individual supply options applied (low heat costs from individual gas boilers do not allow increases in the heat price, but the current heat prices don't enable new investments and development of DH systems).
    - **Effective DH grid extension to new areas needs better planning –** first buildings connections are not profitable, but if not connected individual solutions are applied and the area is lost for the DHC.
    - **What kind of investments in DH are feasible today?**
        - Investments that ensure the high utilisation rate of installed capacity.
        - Connection of new large scale consumers.
        - Investments which increase the utilisation rate of existing DH systems (many over scaled):
            - retrofitting programme for heating stations by installation of heat exchangers for domestic hot water (increasing the utilisation rate of existing assets)

Figure 1: Estimation of the cogeneration potential in Poland



Local district energy cases from across Europe - ProgRESsHEAT project experiences

By Marie Münster, DTU Management Engineering, Technical University of Denmark, and Lukas Kranzl,Vienna University of Technology, Institute for Energy Systems and Electric Drives – EEG

[1] Directive (EU) 2015/2193, regulates emissions of SO_2, NO_X and dust into the air - lower emission limit values to be applied from 20 December 2018 for new plants and by 2025 or 2030 for existing plants.

The main objective of the progRESsHEAT project is to support policy makers and public authorities at a local, regional and national level in the development and implementation of integrated strategies and policies to enforce the use of renewable and efficient heating and cooling solutions in their regions.

The main pillar of the strategy development process are local case studies for six municipalities. The goal of these case studies is to develop heating and cooling strategies through a deep analysis of (1) heating and cooling demands with respect to future developments, (2) long-term potentials of renewable energies and waste heat in the regions, (3) barriers and drivers and (4) a model based assessment of policy intervention in scenarios up to 2050 together with the authorities.

For this purpose, we apply a geographic information system (GIS) and map the energy demands based on the modelling of buildings and industry, the potential renewable energy sources (including biomass, solar, geothermal, etc.) as well as waste heat sources and the existing energy production plants locally for each municipality. The district energy system of each municipality is then modelled in a coherent energy system analysis tool (EnergyPRO) which combines the detailed demand side modelling with the geographical overview of the resources and the existing production plants. The costs of providing district energy is then entered into a cost curve tool where the cheapest solution is found, depending on the location and type of building, comparing 1) district energy costs to 2) costs of increased energy efficiency and 3) costs of individual energy solutions. In this way, the most cost effective solutions to increase RES heating and cooling at local level are identified.

Recent results from the local case studies illustrating business cases for district heating in different EU regions were presented with the following key conclusions:

Energy efficient heating and cooling consists of:

- Energy savings (on the demand and/or supply side)
- Individual and central green energy
- Efficient district energy

Efficient green district energy solutions are cheapest for society when ensuring a high connection rate:

- should also be cheapest for individual
- **Interesting identified DH supply options are:** waste heat (appropriate risk mitigation necessary – diversity of supply sources), waste-to-energy, solar heat, heat pumps, sustainable biomass

The following key success factors were stressed:

1. **Strategic local and regional heat/cool planning**
   - **Long term environmental political targets** (necessary both at local and national level)
   - Information campaigns and **cooperation to smoothen transition**
   - **Better geographic data availability** (buildings, waste heat potentials, cooling demands and local renewable resources – essential for the planning quality)
   - **Availability, time and competences to use DH/C planning tools at a local level** (part of progRESsHEAT)
2. **Regulation**
   - **Zoning to avoid double infrastructure** (of respectively DH and natural gas, mandatory connection in DH priority areas?)
   - **Ownership structures** (including equal access to grids)
   - **Mandatory improvements of energy efficiency in buildings and industry? Including:** energy savings in buildings, efficiency improvements in DHC grids, individual or DHC RES use and DHC expansion
3. **Economy**
   - **Access to cheap long term financing or subsidies** (also for upgrading existing grids or investing in new)
   - **Risk taking - in particular in relation to industries** (waste heat)
   - **Increased heat savings in DH areas must be matched by increased DH connection rate** (in opposite DH prices will increase!)
   - **Non profit DH/C?**
   - **Aligned taxes, tariffs and subsidies** (CO_2, fuels, electricity for heat pumps and use of waste heat)

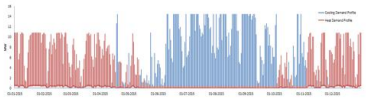
An interesting example of the local district energy system in the commercial centre in Matosinhos Portugal, is shown in **Figure 2**. With larger cooling than heating demand, two promising alternatives have been evaluated:

1. **Centralised supply of waste heat** from near-by refinery and
2. **Decentralised combination** of PV, heat pumps and compressor chillers.

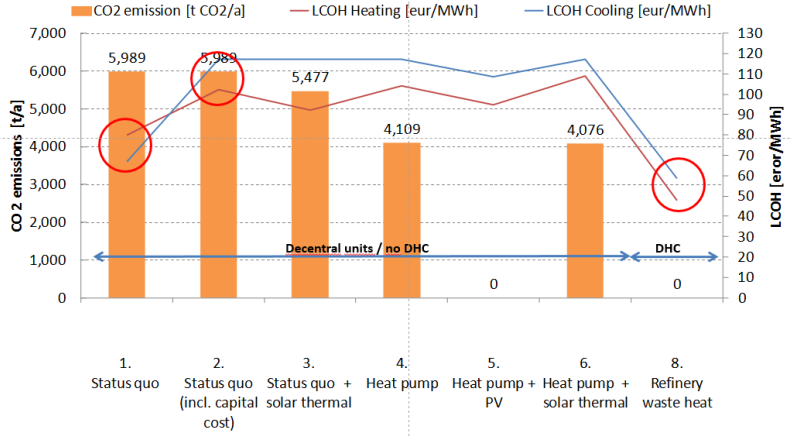
Figure 2: Matosinhos - Portugal local district energy system and proposed solutions description

Matosinhos

- **Focus area**:
  - Shopping mall and large stores
    - Individual gas boilers + compression chillers
    - Demand for cooling three times higher than heating
  - Residential area under construction
  - Refinery as potential excess heat source
  - No DHC infrastructure in the city and surroundings
- **Energy demand in focus area**:
  - Cooling: 28 GWh/a (at right bottom in blue)
  - Heating: 15 GWh/a
- **Scenario analysis focuses on**:
  - Role of solar thermal, PV and HP
  - Economic viability of DHC
  - Connection of refinery for excess heat use
- **Simple socio-economic perspective**:
  - 1.5% discount rate, no taxes, no externalities



Matosinhos - Feasible initiatives: Results for LCOH and CO2



Matosinhos Key success factors

- Using **excess heat from refinery** seems very promising
  - close to city and not yet used
  - Estimated sufficient to supply focus area
  - Can be an opportunity to establish DH grid („door opener“)
  - However:
    - No tradition/ experience with DH in Portugal (only one network in Lisbon)
    - Uncertainty about future perspective of refinery
- **Photovoltaic** can be an option to decarbonize heating & cooling based on decentral **heat pumps** and **compression chillers**
  - High share of cooling -> el demand equally distributed across year
  - Building roofs (plus parking roofs) provide enough space
  - Current estimates with annual net metering (-> explore real time self consumption)
  - Attractive tariffs for HP and PV crucial
- Both options to be explored more in detail in **phase II of the analysis**!

For more information please email
stane.merse@ijs.si

Legal Disclaimer

The Concerted Action for the Energy Efficiency Directive (CA EED) was launched by Intelligent Energy Europe (IEE) in spring 2013 to provide a structured framework for the exchange of information between the 29 Member States during their implementation of the Energy Efficiency Directive (EED).

For further information please visit **www.ca-eed.eu** or contact the CA EED Coordinator Lucinda Maclagan at **lucinda.maclagan@rvo.nl**

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