



**CONCERTED ACTION
ENERGY EFFICIENCY
DIRECTIVE**

Decarbonisation of heating and cooling (Article 14)

Final Report 7.7 Executive summary

Core theme 7 Efficiency in energy supply

Stane Merse, Jozef Stefan Institute, Slovenia

Daniel Fribberg, Swedish Energy Agency, Sweden

Bjarne Juul-Kristensen, Danish Energy Agency, Denmark

Date: 19 April, 2016

1 Summary

This report focuses on the decarbonisation of heating and cooling, a key climate and energy policy goal (Article 14 of the Energy Efficiency Directive (EED)). The key topics within this area of focus are:

- **EU heating and cooling strategy:** official communication, its contribution to Energy Union goals, etc.
- **Waste heat utilisation experiences in the CELSIUS project:** technical solutions for waste heat utilisation, prices and business models, end-user aspects, other project findings.
- **Large heat pumps - emerging technology for the supply of efficient heating and cooling:** technical and economic aspects of large heat pumps, practical examples, etc.
- **Comprehensive assessment (CA) results:** presentations on **The Netherlands'** experience in implementation of Article 14 and on the methodology and approach for assessing the potential for CHP in the **Czech Republic**.
- **Regional plans for heating and cooling from renewable energy (RES H/C SPREAD project):** methodology for data collection and development of regional GIS-based maps of heating and cooling supply, Cost Benefit Analysis (CBA) methodology and results, support measures, implementation process, etc.

This report summarises the experiences of 24 Member States (MS) in implementing the comprehensive assessment and in waste heat utilisation. The experiences of Member States were gathered through a survey and discussions at the 7th CA EED Plenary meeting at The Hague in March 2016.

Responses and discussions indicated significant diversity in the current status of and support instruments for waste heat utilisation, and significant potential for improvement. Furthermore, the discussions concluded that more focus needs to be put on low-carbon heating and cooling solutions, rather than just renewable solutions, and that there is huge untapped potential in utilising waste heat.

2 Recommendations and conclusions

2.1 Survey on the status and MS experiences of implementation of the CA and waste heat utilisation

The survey highlighted that more than 50% of responding MS have implemented the CA with several positive effects reported. In particular, respondents reported that their view on the potential for district heating and cooling (DHC) and combined heat and power (CHP) had been revised as a result of the new data and insight derived from the CA.

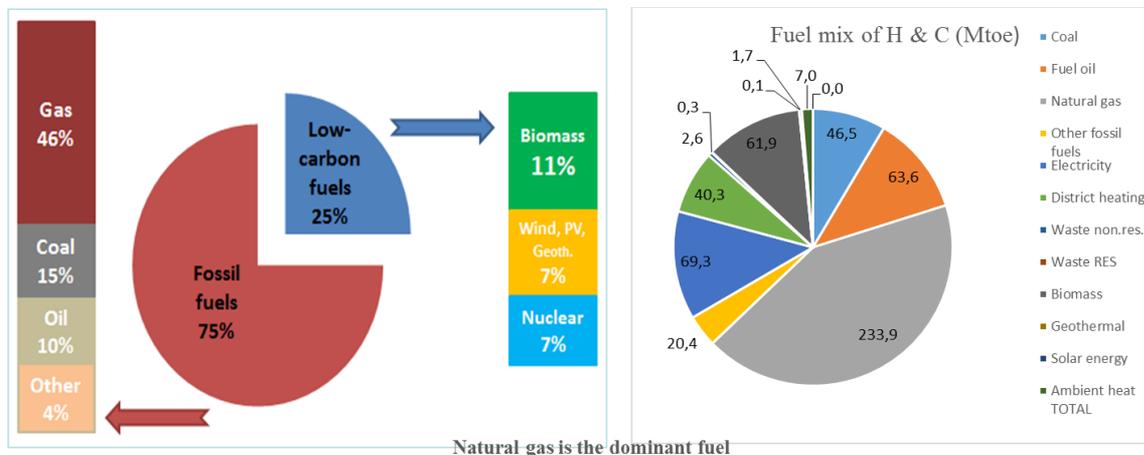
Although close to 50% of responding countries agreed that the CA had contributed to the **development** of clearer policy priorities for heating and cooling, only 38% agreed that the CA had contributed to the **approval** of new policy measures or to the change of existing measures. This indicates that CA implementation has had a limited influence on policy and / or market conditions in most in MS so far.

CA implementation has also contributed to a better assessment of the potential for utilisation of waste heat. The highest potential identified was within industry. Potential was also found, to a lesser extent, in power generation and services. MS responses indicated that the waste heat market is becoming active in the majority of MS and 36% of respondents stated that use of waste heat is considered an eligible measure under their energy efficiency obligation schemes (Article 7). The survey also confirmed the importance of giving waste heat utilisation the same status as renewable energy, with 53% of respondents stating that it should be treated the same as renewable energy.

2.2 EU Heating and Cooling Strategy

In February 2016, the European Commission published its first ever plan to tackle the massive amount of energy used to heat and cool Europe's buildings (Figure 1) and how it can be integrated into EU energy policies. It aims to raise awareness of the key issues and facts, as well as ways to increase the uptake of efficient, low carbon heating and cooling in EU.

Figure 1: Primary energy (structure and volume) for heating and cooling, 2012



Different tools and solutions are proposed for addressing different sectors (buildings, industry, DHC, CHP, thermal storage and linking heating and cooling with electricity). Follow-up actions will be taken forward by ongoing legislative reviews (EED, Energy Performance in Buildings Directive, Renewable Energy Directive, Eco-design Directive, etc.).

Waste heat utilisation is one of the important new areas which could make a significant contribution to the decarbonisation of heating and cooling of buildings, with current waste heat from industry exceeding the energy needs of existing buildings.

More information is available in the [DG ENERGY presentation](#).

3 Practical Examples

The practical examples seen across MS in this area could have significant positive influence on the whole process of Article 14 implementation.

3.1 Smart City heating and cooling in Europe - experiences within CELSIUS project

The CELSIUS project collaborates across the entire spectrum of planning, implementing and optimising new and existing smart infrastructure solutions for heating and cooling. The CELSIUS project is targeting Gothenburg, London, Rotterdam, Cologne and Genoa. The focus of the project is to support these cities in becoming more energy efficient by promoting the role of district heating in making use of the excess heat that always exits within city limits. Examples include:

- **Residual heat from the London Underground mid-tunnel ventilation** shaft is used for the district heating system
- **Heat from sewage water** is now used for the DH system in six schools in Cologne
- **Cold water from the river** is fed into the district cooling network in Gothenburg, reducing the use of harmful cooling agents, electricity and cooling towers or compressors
- **Heat hub storage** is used to increase the effectiveness of the waste heat transportation and buffering capacity in Rotterdam
- **Short term thermal storage** is used to enable energy balancing and integration of waste heat use in Islington, London
- **District heating for ships** in Gothenburg harbour; this is the first regular service for heat supply to ships that are connected to the DH network instead of burning bunker oils while in the harbour

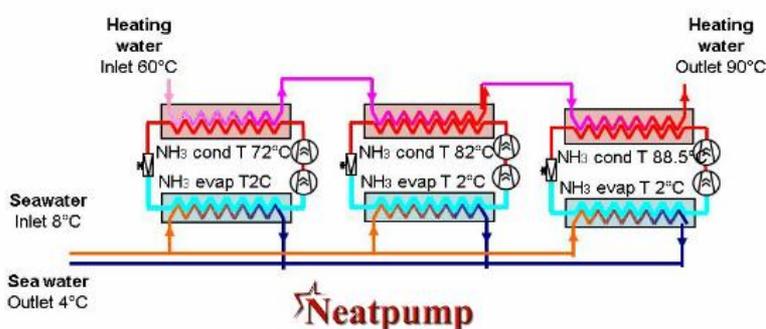
- **District heating to household appliances** - dishwashers, washing machines and dryers use the DH instead of electricity for the heating demands of the machines, reducing electricity consumption by 70-80%.

The CELSIUS project offers expert support through specialist workshops, expert groups and demonstrators, and has also developed a social toolbox and technical toolbox. For more information, please visit the project web page celsiuscity.eu.

3.2 Large heat pumps - emerging technology for efficient heating and cooling supply

Heat pumps are cheap heating solutions compared to oil, gas and biofuels. Large heat pumps coupled with thermal networks (heating and cooling) allow far greater efficiency, whilst also being configured to run in tune with supplies of renewable electricity. In the context of growing demand for cooling and increasing production from intermittent renewable electricity sources, larger heat pumps can bring new quality and benefits to existing and new heating and cooling technologies. The heat pumps cited in this example from Drammen in Norway use natural, low global warming working fluids and achieve an efficiency of 305% even at 90°C heat from an 8°C fjord or river.

Figure 2: 14 MW high temperature heat pump using seawater for DH system in Drammen, Norway



Heat pumps are becoming a competitive source of heating and cooling compared to other sustainable alternatives. Limited sustainable biomass resource cannot cover all of the EU's heating needs. The challenge of using waste heat is that it has to be at the right place, at the right time and at the right temperature.

More information is available in the [Large heat pumps presentation](#).

3.3 The Netherlands heating policy and Article 14 of the EED

The Netherlands has very high natural gas use for heating. Reducing natural gas consumption is one of the main challenges of their heating policy, which aims to be nearly climate neutral by 2050. The replacement of natural gas to heat buildings, by 2050, will be achieved by reducing energy demand (insulation), use of heat pumps and through district heating networks which use residual heat, geothermal heat and biogas/biomass. Implementation has presented the following questions and challenges:

- How to secure the support of consumers who are accustomed to using gas
- People have to be convinced that it's a solution for the future
- DHC systems must be effective in the long term (30 - 40 years) - the energy system is changing and must guarantee sustainability for the future
- There must be an appropriate business case against cheap natural gas
- For the market model to function (monopoly - open network), long term partnerships are necessary
- **EED Art. 14 implementation:**
 - Many measures were already part of the Dutch policy framework (temporary regulation specifically for Articles 8 and 14).

- **National CBA** is mostly ready although further work is under way (heat map is available at www.warmteatlas.nl, extension to an energy atlas is foreseen)
- **CBA for installations** is part of the licensing process linked to environment regulation and obligatory for installations larger than 20 MW. A quick scan scheme is available to check when full CBA is necessary for installation (not necessary for CHP units with low spark spread price or back-up boilers).
- **Potential for high efficiency CHP:** all existing CHP is using natural gas and is high efficiency but not profitable at the moment due to low electricity prices.

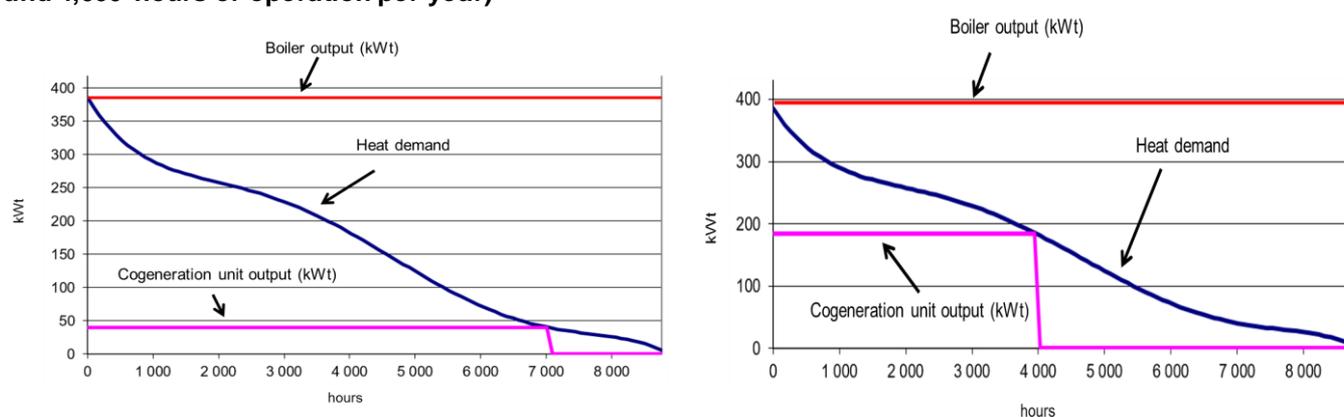
More information is available in [NL presentation](#).

3.4 Methodology and approach to defining CHP potential in the Czech Republic

In the Czech Republic, key CHP potential exists in the replacement of existing heat-only boilers. From 34,000 boilers, 15,500 potential new CHP units have been identified.

To address uncertainties about the real operational mode of the new CHP units, high and low operating scenarios (7,000 and 4,000 operating hours per year respectively) were considered. This estimated the range of CHP potential between 328 MWe and 1,078 MWe (3,677 to 11,287 units) and total electricity generation between 2.3 and 4.1 TWh.

Figure 3. CHP potential assessment approach for existing heat only boilers – high and low scenario (7,000 and 4,000 hours of operation per year)



More information is available in the Czech Republic [presentation](#).

3.5 Regional plans for heating and cooling from renewable energy of the RES H/C SPREAD project

The IEE funded project “RES Heating and Cooling - Strategic Actions Development” (RES H/C SPREAD) develops plans for heating and cooling from renewable sources in six pilot regions in Austria, Bulgaria, Greece, Italy, Latvia, and Spain.

The project involves:

- Data collection and development of regional GIS-based maps of heating and cooling supply (DHC, CHP, biomass, geothermal, etc.) and current and future demand, to enable the identification of opportunities for renewable energy utilisation.
- Cost-benefit analysis of projects and programmes for heating and cooling from renewables.
- Development and adoption of measures promoting sustainable heating and cooling applications, identified through cost-benefit analysis.

Linking national and local levels is of high importance for regional planning as different authorities (local, regional and/or national) are responsible for energy planning in different MS. This is why the established country governance committee (CGC), consisting of local, regional, and national authorities and market players in each participating MS, significantly contributed to the successful planning process and final implementation.

More information is available in the Bulgarian [presentation](#) and at the [RES H/C SPREAD project web page](#).

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

Legal Disclaimer

The sole responsibility for the content of this report lies with the authors. It does not necessarily reflect the opinion of the European Union or the Member States. Neither EASME nor the European Commission are responsible for any use that may be made of the information contained therein.

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



CONCERTED ACTION
**ENERGY EFFICIENCY
DIRECTIVE**



Co-funded by
the Intelligent Energy Europe Programme
of the European Union