INVITATION

5 juillet 2022 dès 8h30

RÉSEAUX DE CHALEUR ET DE FROID
DANS L’UNION EUROPÉENNE
Overview of District Heating and Cooling Markets and Regulatory Frameworks under the Revised Renewable Energy Directive

Quick overview and main results
Tilia’s work for the European Commission
Studies carried out these last years

Link

Link

Link ➔ Presented today!
Context and objectives
A comprehensive survey

- EU binding target of achieving **climate neutrality by 2050**

→ one of the key leviers is the **decarbonisation of the H&C sectors** (50% of the final energy consumption), including through DHC

→ yet, DHC represents only 12% of the EU’s **heating market** (in residential and service sectors)

- Study initiated in January 2020

- Contributes to an **enhanced knowledge of European DHC markets, regulatory frameworks and operational best practices**

- Needed to develop **policies** (RED, EED, EPBD revision), as well as **initiatives and projects**

- Geographical scope: EU27 + UK, Iceland, Norway and Ukraine
# Deliverable structure

## 3 main blocks

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<th>BLOCK C – INTEGRATION OF RES AND WASTE ENERGY SOURCES</th>
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<td>• Measuring and reporting</td>
<td>• Technical and operational requirements for RES</td>
</tr>
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<td>• DHC system type</td>
<td>• Pricing regimes</td>
<td>• Technical and operational requirements for waste energies</td>
</tr>
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<td>• DHC size</td>
<td>• Support schemes</td>
<td>• Connection to DHC systems by third party suppliers</td>
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<td>• Regulatory framework for TPA</td>
<td>• Case study analysis</td>
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<td>• Contractual modalities for TPA</td>
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<td>• Overall regulatory framework</td>
<td>• National building regulations</td>
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<td>• Detailed analysis of case studies</td>
</tr>
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<td></td>
<td>• Additional technical details</td>
</tr>
</tbody>
</table>

## Main body (≈ 280 pages)

- Methodology
- Cross-analysis over the 31 countries

## Annexes 1 and 2 (≈ 150 pages)

- Detailed country factsheets
- National regulatory authorities

## Annexes 3 to 5 (≈ 70 pages)

- Statistical sources
- Focus on the selected 10 countries
- City case studies illustrating urban planning

## Annexes 6 and 7 (≈ 150 pages)

- Methodology for case studies
- Detailed analysis of case studies
- Additional technical details
Market analysis
Cross analysis

Interactive tool with DHC statistics on Power BI: https://irees.de/2021/10/18/district-heating-and-cooling-trend-interactive-report/

Renewable and waste energy breakdown by country

Substantial amount of the building stock is not ready for 4GDH

Energy and technology mix
Market structure
Consumer perception

<table>
<thead>
<tr>
<th>Country</th>
<th>Type</th>
<th>Distribution type</th>
<th>Distribution by energy sources</th>
<th>Consumer perceptions</th>
<th>Regulation regarding big players</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>O 20</td>
<td>mainly public owned</td>
<td>Industrial excess heat, heat pumps incl. elec., solar thermal, geothermal, biomass, biofuels and renewable waste</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Belgium</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Norway</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Greece</td>
<td>1 cook</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Croatia</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Denmark</td>
<td>1 small</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Austria</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Ownership of the DH networks

- Mainly public ownership and operation
- Mainly private ownership and operation
- Mainly PPP
- Mix between public and private ownership, PPP and customers cooperative

Size of cities served by DH and geographical concentration

- DHC networks are distributed in the country from small cities to metropolis
- DHC networks are present only in a few cities

Industrial excess heat
Heat pumps incl elec.
Solar thermal
Geothermal
Biomass, biofuels and renewable waste
Total share of renewables in district heating supply

Substantial amount of the building stock is not ready for 4GDH

Energy and technology mix
Market structure
Consumer perception
Market analysis

Country fact-sheets

Annex 1: Country fact sheets

Table 1: Size of the cities served by DHC and geographical concentration

<table>
<thead>
<tr>
<th>City</th>
<th>Size of the cities served by DHC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>Large DHC networks (around 2,500 connections) are usually owned by municipalities or energy utility companies. Medium and smaller systems (around 400 connections) are in private hands. (Europe, ca. 10,000 systems) are owned by communities. Cities served by DHC systems are in Vienna and Lower Austria. DHC has expanded from the city to cover hospital needs.</td>
</tr>
</tbody>
</table>

Resources
- Survey with national DHC stakeholders (Association of Gas and District Heating Supply Companies PVV)
- Austrian Heating
-District Heating and Cooling in the European Union: Overview of Markets and Regulatory Frameworks under the Federated Renewable Energy Directive

Figure 1: DHC systems location (source: Austrian Heating)

Table 2: Ownership of the DHC networks

<table>
<thead>
<tr>
<th>City</th>
<th>Type of ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>Large DHC networks (around 2,500 connections) are usually owned by municipalities or energy utility companies. Medium and smaller systems (around 400 connections) are in private hands. (Europe, ca. 10,000 systems) are owned by communities. Cities served by DHC systems are in Vienna and Lower Austria. DHC has expanded from the city to cover hospital needs.</td>
</tr>
</tbody>
</table>

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Table 3: Main suppliers and level of competition

<table>
<thead>
<tr>
<th>Main DHC suppliers</th>
<th>Level of competition</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Wien Energie (Vienna)</td>
<td>Local competition</td>
</tr>
<tr>
<td>- EVN</td>
<td>Local competition</td>
</tr>
</tbody>
</table>

Table 4: Factsheet on regulatory framework, competent authorities and supervision, statistical reporting and sources

<table>
<thead>
<tr>
<th>Regulatory framework, authorities and supervision, statistical reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating networks are governed by the Commercial Code (exception forms land based DHC networks according to Article 2 (1) No. 9 Gaswirtschaftsgesetz).</td>
</tr>
<tr>
<td>Gas law and competition monitoring is carried out by E-Control and ADAC.</td>
</tr>
<tr>
<td>DHC rates are regulated by the Price Act. The Price Act governs the prices of material goods and services. However, the law does not provide for the existence of the free market, whereas it provides for certain possibilities of intervention.</td>
</tr>
<tr>
<td>Any regulation is subject to the local municipal DHC suppliers. There are also corresponding action boards, for instance increases in the networks concerned, the competent authority must be appealed to. This usually consists of representatives of the municipalities involved.</td>
</tr>
<tr>
<td>According to the Netzwerkdienstleistungsgesetz (NDLG), a minimum of 50% and a maximum of 75% of the total energy costs shall be allocated according to individual meters, the remaining (25-50%) to heating areas and the source of supply.</td>
</tr>
<tr>
<td>Smart heat transfer and access usage (heat demand supervision)</td>
</tr>
<tr>
<td>There is no federal regulation providing a legal framework for the connection of consumers.</td>
</tr>
</tbody>
</table>

Resources
- Austrian Heating
- District Heating and Cooling in the European Union: Overview of Markets and Regulatory Frameworks under the Federated Renewable Energy Directive
- Survey with national DHC stakeholders (Association of Gas and District Heating Supply Companies PVV)
Regulatory frameworks
Ownership, support mechanisms, Third Party Access...

Overall analysis

Owner- and operatorship
- 56% No specific regulation
- 25% Regulator or monitoring
- 19% Licences or concession

Prices
- 41% 1. No specific regulation
- 31% 2. Price calculation rule
- 28% 3. Licence or approval of price

Metering
- 51% 1. No specific regulation
- 29% 2. Regulations for heat meter
- 20% 3. Regulations for smart meter

Maps of smart meter roll-out (left), price regulation (center) and TPA regulation (right)

Maps on available incentives to DHC
Regulatory frameworks

Urban planning

### Primary Energy Consumption requirements in near-Zero Emission Buildings, by country

<table>
<thead>
<tr>
<th>Country</th>
<th>References</th>
<th>Maximum PEC for new nZEB [kWh/(m²·y)]</th>
<th>Maximum PEC for renovated nZEB [kWh/(m²·y)]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>residential</td>
<td>non-residential</td>
</tr>
<tr>
<td>Austria</td>
<td>[77]</td>
<td>41 (1)</td>
<td>84 (1)</td>
</tr>
<tr>
<td>Belgium-Brussels</td>
<td>[78]</td>
<td>45 ~90 (2)</td>
<td>~90 (2)</td>
</tr>
<tr>
<td>Belgium-Flanders</td>
<td>[78]</td>
<td>not defined yet</td>
<td>not defined yet</td>
</tr>
<tr>
<td>Belgium-Wallon</td>
<td>[78]</td>
<td>not defined yet</td>
<td>not defined yet</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>[79]</td>
<td>Class A</td>
<td>Class A</td>
</tr>
<tr>
<td>Croatia</td>
<td>[80]</td>
<td>41/33 (3)</td>
<td>-</td>
</tr>
<tr>
<td>Cyprus</td>
<td>Source: own survey with national DHC stakeholders</td>
<td>100 (2)</td>
<td>125 (2)</td>
</tr>
<tr>
<td>Czech Republic*</td>
<td>[81]</td>
<td>not defined yet</td>
<td>not defined yet</td>
</tr>
<tr>
<td>Denmark</td>
<td>[82]</td>
<td>20 (1)</td>
<td>25 (1)</td>
</tr>
<tr>
<td>Estonia*</td>
<td>[83]</td>
<td>100-145 (2)</td>
<td>65-170 (2)</td>
</tr>
<tr>
<td>Finland</td>
<td>[84]</td>
<td>not defined yet</td>
<td>not defined yet</td>
</tr>
<tr>
<td>France</td>
<td>[85]</td>
<td>50 (3)</td>
<td>80 (3)</td>
</tr>
<tr>
<td>Germany*</td>
<td>Source: own survey with national DMC stakeholders</td>
<td>75% (%PE)</td>
<td>75% (%PE)</td>
</tr>
<tr>
<td>Greece</td>
<td>[86]</td>
<td>80 85</td>
<td>95</td>
</tr>
<tr>
<td>Hungary</td>
<td>[87]</td>
<td>100 85-90</td>
<td>100 85-90</td>
</tr>
<tr>
<td>Ireland</td>
<td>[88]</td>
<td>45 50-60% (PE)</td>
<td>125-150</td>
</tr>
</tbody>
</table>

### Impact of urban planning and regulations analysed in 13 city case studies

*Note: *Country codes for the city case studies:
### Extract from the analysis: geothermal energy

#### Table 25: Overview of key technical parameters for geothermal heat production from geothermal aquifer

<table>
<thead>
<tr>
<th>Key parameter</th>
<th>Definition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installed capacity</td>
<td>Maximum power achievable (including heat pumps) at optimized conditions</td>
<td>15 MW for 1 doublet</td>
</tr>
<tr>
<td>Temperature of the resource</td>
<td>Temperature at the wellhead of the geothermal resource</td>
<td>Heating: from 25°C to 90°C and above</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cooling: from 5°C</td>
</tr>
<tr>
<td>Depth of the resource</td>
<td>Depth of the underground reservoir containing the geothermal resource</td>
<td>Heating: from 200 to 3000 m and deeper</td>
</tr>
<tr>
<td>Well flow rate</td>
<td>Flow rate of the fluid extracted from the production well</td>
<td>Cooling: 20 – 200 m</td>
</tr>
<tr>
<td>COP (Coefficient of Performance)</td>
<td>Ratio of heat provided over the electricity needed for heat pumps</td>
<td>3 - 5</td>
</tr>
<tr>
<td>Required floor space</td>
<td>Surface occupied by the facilities per unit of installed capacity</td>
<td>50 m²/MW for the plant plus 100 m²/MW of free space for wells maintenance operations</td>
</tr>
<tr>
<td>Downtime</td>
<td>Period of time for which the facility does not produce due to maintenance</td>
<td>Total of about 5% per year plus 4 to 6 weeks every 10 years</td>
</tr>
<tr>
<td>Greenhouse gas emissions</td>
<td>Emission of CO₂ in milligram per normal cubic meter</td>
<td>0 mg/Nm³</td>
</tr>
<tr>
<td>Atmospheric pollutant emissions</td>
<td>Emission of major pollutants in milligram per normal cubic meter</td>
<td>0 mg/Nm³</td>
</tr>
</tbody>
</table>

#### Figure 76: Aquifer geothermal installation
(Source: Leibniz Institute for Applied Geophysics 2014)

#### Case study of Bordeaux DHC (FR): Low temperature geothermal energy (Annex 6)

Designed to supply the emblematic museum "Cité du Vin" in Bordeaux, a low temperature geothermal system coupled with heat pumps was implemented to satisfy the cold demand of this significant client and was interconnected with the existing DHC network to meet the heat demand.

The 16°C geothermal fluid is produced from 4 wells at 30 m depth in the alluvial sandstone of the Garonne River (the produced fluid being rejected back to the river bed at around 32°C). The fluid is then directed to heat pumps supplying 1 MW of cold.

The use of geothermal energy to produce both heat and cold is under analysis to find a profitable operating mode. At the moment, geothermal energy is only used to supply heat as a back-up of the main DHC network (due to a low Coefficient Of Performance given the temperature levels at stake).

#### Figure 80: Illustration of the 30 m depth geothermal wells used for the production of cooling and heating on Bordeaux DHC (source: EDB)
Operational guidelines for the integration of renewable and waste energy sources

Case studies

Best practices in DHC – 10 case studies analysed

Scope of Case study analysis

- National context
- Local context
- Presentation of the DHC system
- Governance and business model
- Use of RES and/or waste heat/cold
- Sector integration approaches and local value creation
- Prospects
- Conclusion / Key Success Factors
Conclusions
Tackling the existing data gap across Europe

Block A: Detailed market overview of DHC in Europe

• DH & DC in the EU-27: **445 TWh and 3,1 TWh**, with market shares ranging from 50% in Scandinavian and Baltic countries to less than 1% in some countries (e.g., Belgium, Ireland, Spain)

• DH production mainly comes from **cogeneration plants** (63%), and 2/3 of the DH supply is generated with **fossil fuels** (mainly natural gas)

• **4GDH** development is significantly limited by the energy characteristics of existing buildings → need for a municipal comprehensive heat planning process addressing the **DH-buildings nexus**

• National DHC markets are **highly concentrated** (i.e., a few suppliers control more than 70% of the market)

• A **positive perception** from consumers results from high transparency of prices, high quality of heat supply without interruptions and good customer service
Conclusions
Tackling the existing data gap across Europe

Block B: Overview of the regulatory regimes applied to DHC

- DHC systems are natural monopolies, and most EU Member States consider DH to be an integrated service (unbundling might lead to higher heating prices)

- In more than half of the analysed countries, DH prices are regulated (liberalised DH prices with ex-post price control on request or regulated DH prices with mandatory price control)

- In about half of the analysed countries, Third Party Access (TPA) is regulated in some form; in the other half, TPA is usually permitted (voluntary TPA) and limited to the generation side (i.e. excluding supply)

- No obvious correlation between the share of renewables or waste heat and the degree of market opening

- Subsidies targeting DHC grid infrastructure as well as renewable and efficient energy generation are largely available in most EU Member States (less common for R&D and connection of end-users to DHC networks is less common), but significant efforts need to be done to include waste energy sources

- Building codes have a strong impact on the introduction of renewable H&C technologies (through PEC, minimum RES shares, and PEF), but would benefit from standardized procedures across Europe

- Urban planning appears as a powerful decarbonisation lever allowing energy savings and the deployment of the renewable H&C solutions available locally, but National Urban Policies are still not developed enough
Conclusions
Tackling the existing data gap across Europe

Block C: Overview of available technologies enabling the use of renewable and waste energy sources in DHC

- DHC systems can play a key role as **backbones for the integration of the various local renewable** (biomass, geothermal, biogas, solar thermal, ambient energy, and renewable electricity) **and waste energy sources** power generation, industrial production, tertiary buildings, data centres, and underground railways), using **mature technologies**

- All these sources demonstrate their **complementarity**, provided their **own opportunities and limits** are properly taken into account to ensure their optimized and efficient integration in DHC systems

- **Ten flagship European DHC systems** have been investigated through holistic case study analyses, identifying **key success factors (KSF)** for H&C decarbonisation through DHC

- The main KSF at local level include the **support of municipalities**, a suitable and robust business model, **strategic (long-term) technical choices for DHC supply** and addressing the DHC-building nexus, as well as the implementation of **collaborative and innovative approaches** including consumer empowerment
Conclusions
Recommendations

Recommendations for H&C decarbonisation through DHC systems

✓ Quantified sustainable DHC targets at national level

✓ Steady and sufficiently high indirect support schemes (e.g., CO₂ taxes for fossil fuels, taxes on non-recovered waste heat, reduced VAT)

✓ Direct financial support to sustainable DHC systems

✓ Mainstreaming strategic long-term local/urban heat planning, identifying centralized RES-H generation potential, sector synergies, etc.

✓ Obligation to DHC companies to develop long-term decarbonisation plans

✓ RES and waste heat quota obligations for DHC companies

✓ Incentives to facilitate the use of waste heat

✓ Incentives for higher customer participation and energy communities in DHC systems

✓ Improved transparency (e.g., information obligations)
Thank you

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alexandre.bacquet@tilia.info