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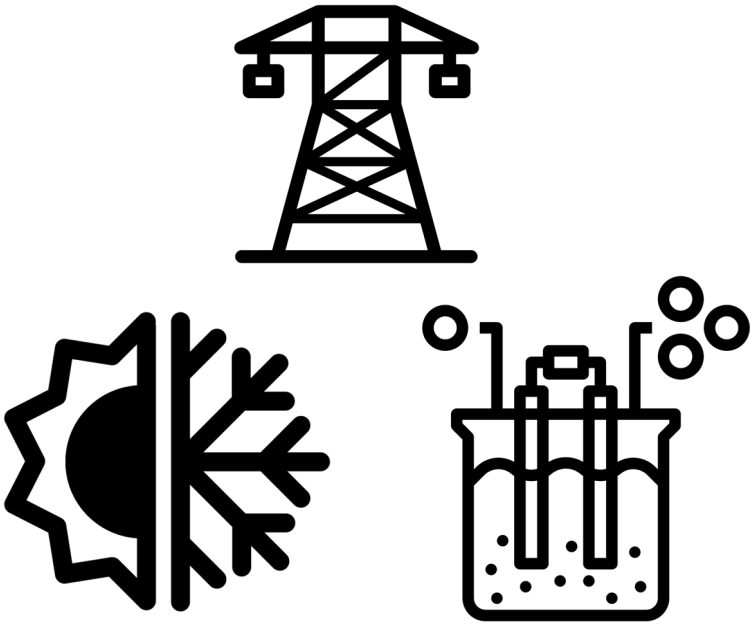
INTERNATIONAL ENERGY AGENCY
TECHNOLOGY COLLABORATION PROGRAMME ON
DISTRICT HEATING AND COOLING



IEA DHC ANNEX TS3: HYBRID ENERGY NETWORKS

APPENDIX B
COUNTRY REPORT AUSTRIA

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CONTENT

1 INTRODUCTION

This Appendix is part of the IEA DHC Annex TS3 guidebook. The full guidebook is available at https://www.iea-dhc.org/the-research/annexes/2017-2021-annex-ts3

Authors: Mostafa Fallahnejad (TU Wien), Lukas Kranzl (TU Wien)

2 THE OVERALL PICTURE

The Austrian Federal Government has set the target of achieving climate neutrality in Austria by 2040. As a mid-term target achieving a renewable energy share of 46 to 50% until 2030 is set by Austrian National Energy and Climate Plan 2019 (NECP 2019). Furthermore, a 100% renewable-based electricity demand coverage is foreseen for 2030. One of the key challenges in meeting the targets is the transformation of the energy system towards renewable, efficient and safe energy supplies throughout all sectors. Besides an extensive increase in the use of renewable energies, decarbonisation through direct electrification is considered an efficient option for various applications. Further steps to enhance energy efficiency can additionally increase the decarbonisation potential of electrification.

In 2021, renewable energies covered 36.4% of the gross final energy consumption in Austria. The share of renewable energy sources in electricity, transport, and H&C sectors are ca. 76.2%, 9.4% and 35.5%, respectively. Thanks to the abundance of hydropower in Austria, achieving the decarbonization targets in the electricity sector is comparatively easier than in other sectors. However, the expansion of electricity grids and investment in renewable energy sources need to be expedited.

One key challenge for meeting the climate neutrality targets is the decarbonization of the heating and cooling sector. Most consumers in Austria use fossil fuels for heating. A swap in the heating system is required to meet emissions targets. Electrification of the heating sector is considered a part of the solution; however, due to the seasonality of heating, it may lead to a large winter peak in electricity demand, subsequently causing issues for generators and distribution networks. Based on the 2020 comprehensive assessment of the efficient heating and cooling supply in Austria, the decarbonization of heating and cooling supply in Austria is possible only with an extensive effort to renovate buildings, parallel decarbonization of electricity generation and the successful integration of industrial waste heating (accompanied by the decarbonization of the industry).

2.1 KEY STATISTICS

Austria's energy consumption is fluctuating around 1400 PJ in since 2005 (Figure 1). Compared to 2020, it was increased by 6.0% in 2021 although the total energy consumption is still lower than before the outbreak of the Covid-19 pandemic. As of 2021, natural gas covered 22.7% of Austria's gross domestic energy consumption, trailing behind oil (34.5%)

and renewable energy sources such as hydropower, wind, photovoltaics, biogenic energies, and ambient heat (31.4%). The primary source of natural gas is still from the Russian Federation.

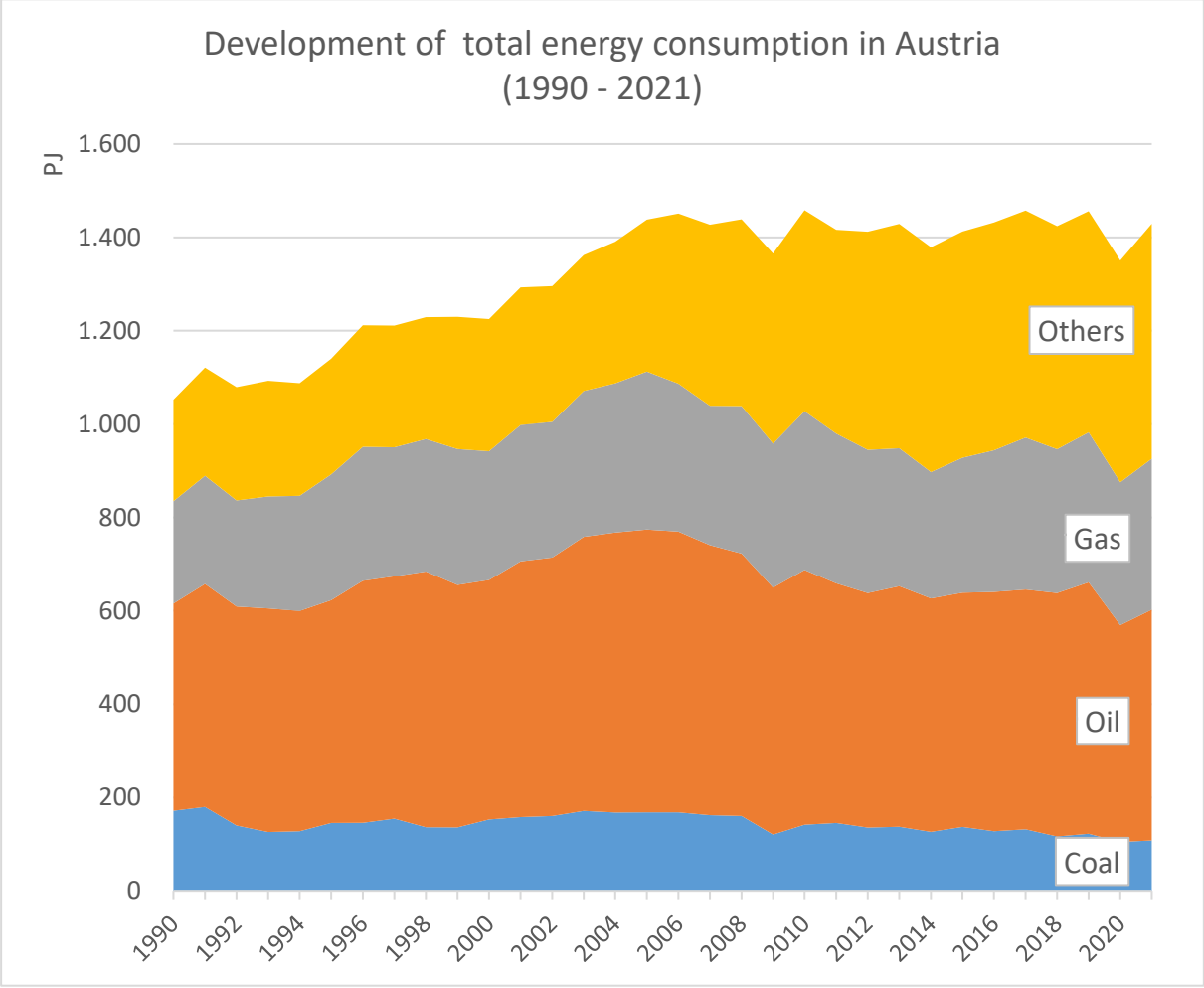

Figure 1 Development of total energy consumption in Austria from 1990 to 2021 (Source: Statistik Austria, (FGW, 2022))

Figure 2 shows the final energy demand in Austria. Since 1990, the final energy demand in residential and service sectors has remained relatively stable. However, the final energy demand in the manufacturing and transportation sectors has increased significantly. The final

energy demand has been fluctuating around 1100 PJ since 2010.

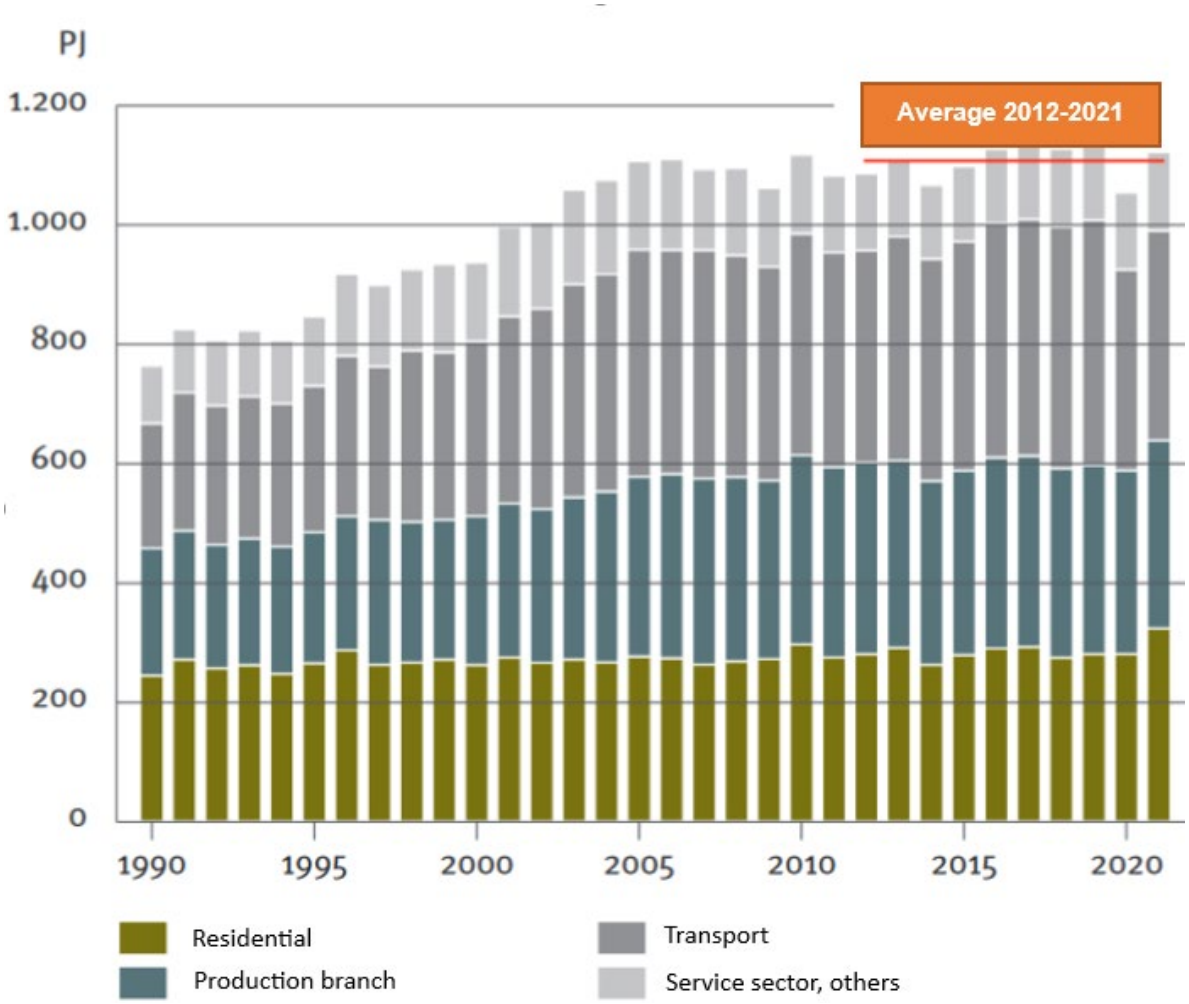

Figure 2 Final energy consumption per sector in Austria (Source: Statistik Austria, (FGW, 2022))

Figure 3 displays a breakdown of the final energy demand in 2021 according to various energy carriers. Benzene and diesel jointly account for approximately one-third of the final energy demand, highlighting the significant share of the transport sector in the total final energy demand. Renewables contribute around 17.5% of the final energy demand, while coal still covers 1.7% of the final energy demand, indicating that it has not been fully decommissioned. District heating accounts for 7.2% of the final energy demand, but is playing an increasingly important role in the heating market alone.

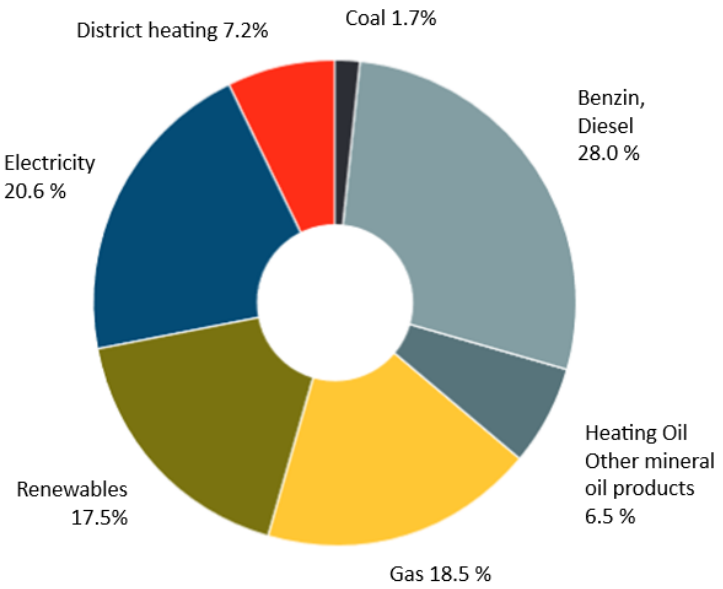

Figure 3 Final energy consumption per energy carrier, 2021 (Source: Statistic Austria, (FGW, 2022))

Figure 4 depicts the primary energy sources utilized in district heating from 1990 to 2020. In the early 1990s, coal and oil contributed to half of the total district heating generation in heating and cogeneration plants, resulting in higher emissions. However, nowadays, low-CO2 and CO2-neutral primary energy sources such as natural gas and biogenic fuels are predominantly used.

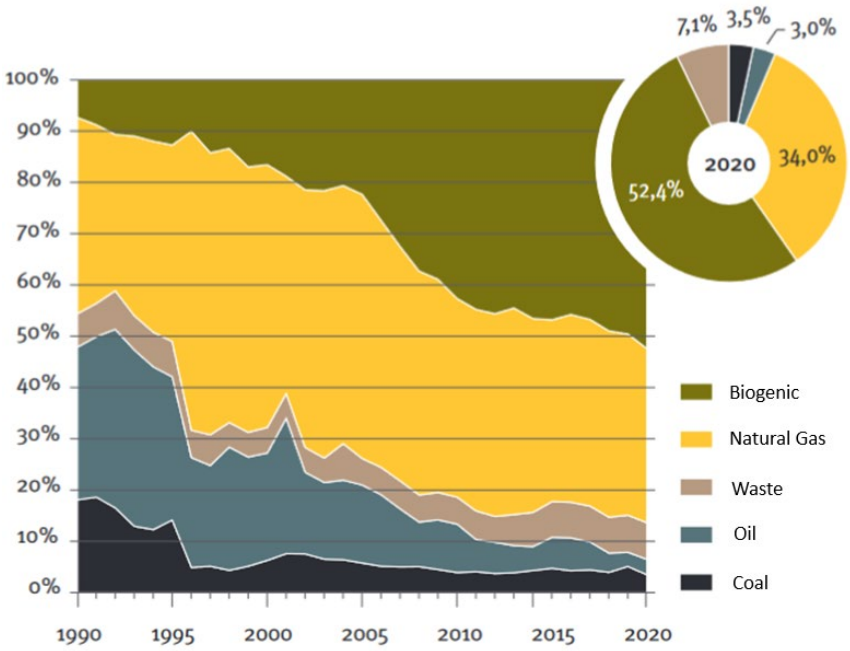

Figure 4 District heating supply per energy carrier (Source: Statistic Austria, (FGW, 2022))

As shown in Figure 5, in 1998, the combined heat and power (CHP) share of Austria's district heating production reached a historic high of 71%. However, due to various factors such as the liberalization of the electricity market, the financial crisis, the energy transition, and the current energy price crisis, the economic basis of the CHP portfolio gradually weakened. As of 2021, the CHP share of total district heating generation has decreased to 56%. Therefore, to ensure the long-term continuation of CHP plants, they need financial stability under the current conditions.

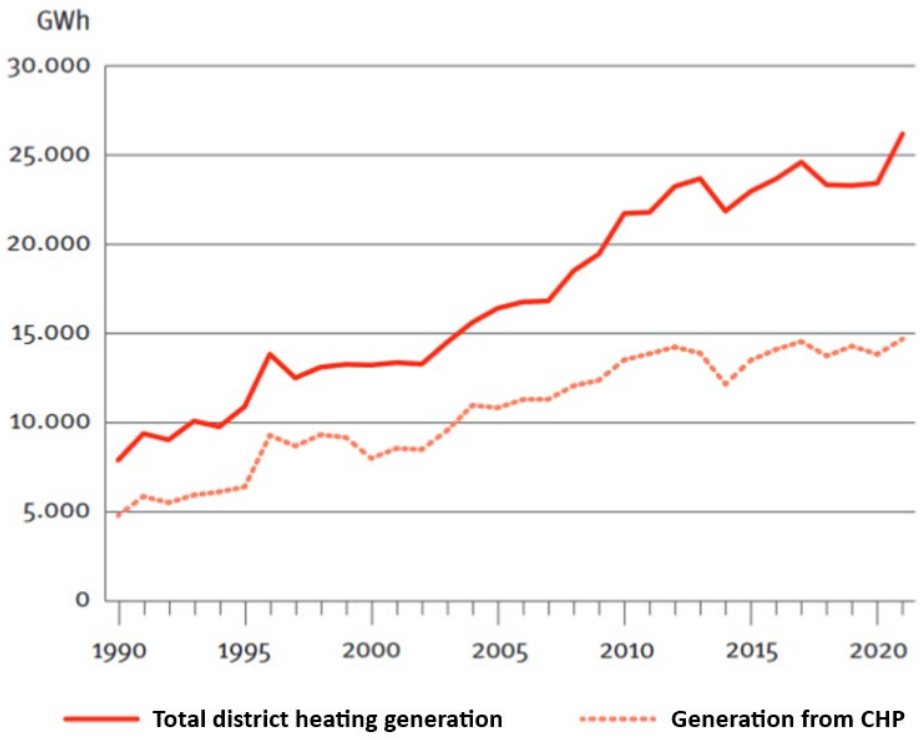

Figure 5 Total district heating generation and heat generation from CHP (1990-2021) (Source: Statistik Austria, (FGW, 2022))

The integration of renewable energies has made district heating a crucial element in transitioning towards sustainable heating systems. Several European countries have already recognized this shift, resulting in a steady increase in the share of renewables in heat generation. Iceland, Norway, Sweden, and Lithuania have the highest proportion of renewable energy in heat generation. Austria's district heating system has a remarkable 52% share of renewables (Figure 6).

Figure 6 Share of renewables in heat generation in an international comparison (Source: Statistik Austria, Euroheat & Power, (FGW, 2022))

3 POLICY AND STRATEGY

Being part of the European Union (EU), Austria is obligated to contribute to realizing the common European greenhouse gas emission reduction targets. Austria aspires to have net-zero carbon dioxide emissions by 2040. This chapter describes these targets in more detail.

3.1 POLITICAL GOALS AND AGREEMENTS

The Austrian Federal Government has set the target of achieving climate neutrality in Austria by 2040. As a mid-term target achieving a renewable energy share of 46 to 50% until 2030 is set by Austrian National Energy and Climate Plan 2019 (NECP 2019). Furthermore, a 100% renewable-based electricity demand coverage is foreseen for 2030. One of the key challenges in meeting the targets is the transformation of the energy system towards renewable, efficient and safe energy supplies throughout all sectors. Besides an extensive increase in the use of renewable energies, decarbonisation through direct electrification is considered as an efficient option for various applications. Further steps to enhance energy efficiency can additionally increase the decarbonisation potential of electrification.

Below, the main regulations in related to the energy sector have been listed:

- **Renewable Energy Expansion Act (Erneuerbaren-Ausbau-Gesetz, “EAG”)**

  The Energy and Climate Protection Act (EAG) is a crucial legislative initiative designed to accelerate Austria's transition to renewable energy, with a goal of achieving 100% renewable electricity production by 2030 and carbon neutrality by 2040. The EAG replaces the Green Electricity Act (ÖSG, also ÖkostromG) and addresses key issues related to the promotion of renewable energy. The plan sets a target of increasing renewable energy production by 27 TWh by 2030, while adhering to strict ecological standards. To put this into context, Austria's total electricity consumption in 2021 was approximately 72 TWh.

  In addition to the electricity sector, the EAG calls for the decarbonization of other sectors, such as heating. While the plan does not outline specific steps for expanding renewable energy capacity in these areas, it does encourage the development of renewable gases, such as hydrogen or synthetic gases, and provides investment subsidies and simplified network fee collection to promote their production.

- **Renewable Heat Act (Erneuerbaren-Wärme-Gesetz, "EWG")**

  The law stipulates the phase-out of fossil heating systems (coal, oil and gas heating) by 2040. For the replacement and conversion of existing systems that can be operated with fossil energy sources, an increased and improved funding offer will enable the conversion to climate-friendly systems in order to advance the decarbonization of the building sector by 2040.

- **Renewable Energy Expansion Acceleration Act (Erneuerbaren-Ausbau-Beschleunigungsgesetz, "EABG")**

  The purpose of this legislation is to expedite the growth of renewable energies in Austria by proposing a quicker permitting process for projects related to renewable energy, district heating and cooling networks, and hydrogen networks. Furthermore, the EABG will be in alignment with the objectives outlined in the REPowerEU Package. However, it is still uncertain as to when the Austrian government plans to release a consultation draft of this law.

- **Green Gas Act (Erneuerbares-Gas-Gesetz, "EGG")**

  In February 2023, the Austrian government introduced a consultation draft of the Green Gas Act, which proposes to require gas suppliers to replace some of the natural gas with renewable gas in the future. This is intended to increase the amount of domestically produced renewable gases, ultimately decreasing dependence on imports and strengthening supply security. The proposed legislation includes a "Grün-Gas-Quote" that mandates a gradual transition to renewable gases.

3.2 ENERGY PRICE STRUCTURE

Austria has a liberalized electricity and gas market. Prices are determined in the market and they can vary between providers and plans. Government policies can have an impact on pricing. For instance, during the Russian war, there was a surge in energy prices (Figure 7), and to reduce electricity bills for residential consumers, the government provided subsidies. Unlike electricity and gas markets where the prices are determined by the market, district heating and cooling prices vary between different Federal States. Local governments have the power to influence these prices. Generally, the price is defined by DHC operator with a price calculation scheme.

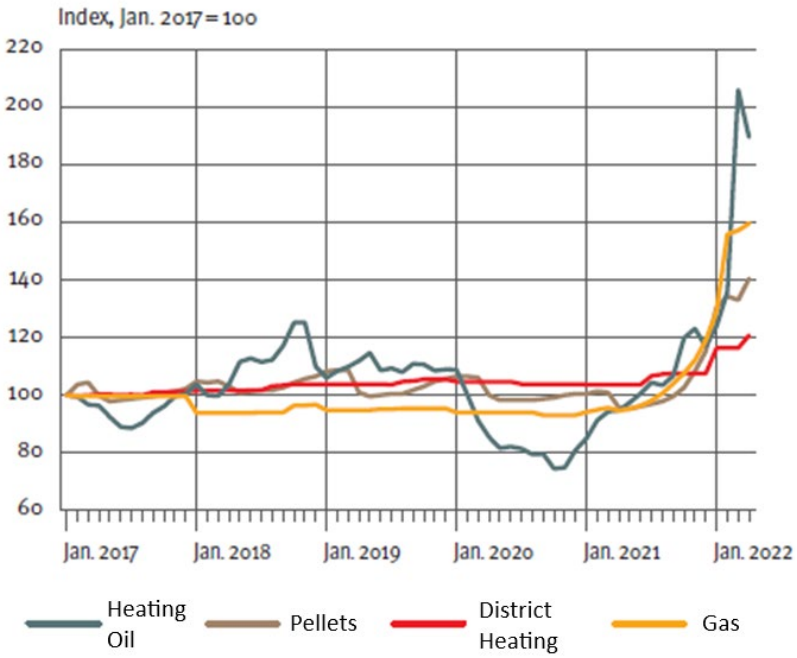

Figure 7 Impact of Russian war on energy carrier prices (Source: Statistik Austria, (FGW, 2022))

For the end-consumers, the Heating and Cooling Cost Billing Act (Heiz- und Kältekostenabrechnungsgesetz, “HeizKG”) determines the details of heating and cooling billings whereever “common supply system” is used. It is based on EU law and serves to implement the Energy Efficiency Directive (EED II). A key point of HeizKG is to strengthen the dependence of heating and cooling costs on consumption. This is intended to create an incentive for users to use energy economically. It should, however, be noted that the HeizKG is not applicable to individual heating and cooling systems.

As per §89 of the Renewable Energy Expansion Act (EAG), the Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology is required to publish the heating and cooling tariffs reported by suppliers on an internet website. These tariffs must be updated at least once a year. The platform "waermepreise.at" provides access to the reported tariffs.

3.3 SUBSIDIES AND LEVIES

Subsidies related to district heating and cooling in Austria can be divided into 4 categories (EC - DG Ener et al., 2022):

- **DHC grid infrastructure**

  In the period of 2017 to 2021, annually, 80 million Euro were available via financing grants for DHC suppliers, and natural and legal persons.

- **Renewable and efficient DHC generation**

  In 2020 and 2021, 20 million euros was available for financing the renewable and efficient DHC generation via financing grants covering up to 35% of the eligible costs for companies.

- **Research, technology development and demonstration of innovative DHC systems**

  Austrian Research Promotion Agency (FFG) supports financing research and innovation projects, and helps to absorb the risks involved in research. Depending on the project, companies, municipalities, research institutions, and private entities can apply for financial support related to the DHC projects.

- **Connection of end users to DHC grids**

  For the connection of the buildings to the DHC grids, there are support programs from federal states, municipalities or Kommunalkredit Public Consulting (KPC) up to 35% of the eligible costs.

3.4 KNOWN OBSTACLES TO THE INTRODUCTION OF NEW OPERATION AND BUSINESS STRATEGIES FOR HYBRID NETWORKS FROM A REGULATORY POINT OF VIEW

A strong instrument for pushing the development of the district heating and cooling networks is the definition of the district heating and cooling zones. In this manner, it can be expected that in a foreseeable time period, the old (and often fossil fuel-based) heating systems will be replaced by district heating systems.

The concept of district heating zones is often intertwined with the heating and cooling plans. The Renewable Heat Act (EWG), however, does not provide any additional support for district heating zoning in Austria. The lack of policy support in EWG is regarded as the main barrier to implementing district heating zoning in Austria. Municipalities cannot obligate utility companies to expand DH grids. Without political support, district heating expansions and extensions advance very slowly.

Examples of procedures for heating and cooling planning, as well as district heating zoning in the states of Salzburg and Styria were collected by the authors via participating in workshops and conferences and provided below.

Salzburg:

In the Federal State of Salzburg, the State Government determines the priority areas for renewable district heating supply. This is communicated to communes, and they are obliged to follow.

The main question in Salzburg is the choice of technologies. Biomass is seen as an accessible choice for decarbonizing the district heating systems and for district heating supply to new areas. However, due to the restricted potential for biomass, the State Government determines the priority of using biomass in identified potential district heating zones.

The potential district zones are mainly identified based on the heat demand densities. The available potential from biomass is less than the identified potential DH zones. Therefore, the alternative options are used wherever the heat supply via alternative renewable sources is economically and technically viable, e.g., by large-scale heat pumps.

Styria:

In contrast to Salzburg, the Styrian communes are responsible for their own heat planning. The activities of heat planning for communes in Styria are obligatory and fall under the "Sachbereichkonzept Energie", which encompasses electricity, heating, cooling and mobility. The communes should provide their plans until 2025 to the State Government("Das Sachbereichskonzept Energie - Leitfaden (Version 2.1)," 2023). Accordingly, the State will analyze on top of all the provided plans and develop a strategy which will be binding for all communes.

Communes have the freedom to consider their priorities in heat planning. However, a clear problem is the lack of coordination between communes in their heat planning measures. To tackle this issue, the State Government has introduced a so-called "inter-communal funding program", in which common activities of heat planning between two or more communes are supported. However, this requires the agreement of communes to do common heat planning.

The zoning activities, therefore, should also be done separately by each commune. The city of Graz, in this respect, is successful in defining DH zones. This is, however, a long process, starting with informing residents that they must change their heating system with a relatively long deadline.

3.5 TRENDS FOR NEW BUSINESS STRATEGIES

Utilizing geothermal energy technology is a sustainable and eco-friendly method for tapping into heat sources. The heat that is stored beneath the Earth's surface has the potential to power heating and cooling systems, produce electricity, or even function within combined heat and power (CHP) plants. It is especially well-suited for local energy supply initiatives. Additionally, this technology is becoming increasingly vital for the underground storage of heat during certain seasons.

Austria boasts a considerable 90,000 geothermal heat pump systems that currently generate approximately 2.3 TWh of heat, including the electrical component of the heat pump. In addition, the country has ten heat generation plants that utilize naturally occurring thermal water sources, producing a combined output of approximately 300 GWh of heat. Furthermore, the two sites also leverage heat to generate roughly 2.5 GWh of electrical energy. Low-temperature geothermal energy applications are also experiencing a surge in cooling capabilities and importance. Energie Krieau has implemented such a system in Viertel Zwei, a parish in 2nd district of Vienna.

Wien Energie, the Viennese utility company, has announced its plan to utilize hydrothermal geothermal energy from a depth of around 3,000 meters and transfer the heat into the district heating networks. This green energy initiative is expected to provide environmentally friendly district heating to up to 200,000 households by the 2030s. Wien Energie and OMV are planning to develop up to seven deep geothermal energy systems in the city as part of their joint venture dubbed “Deep”.

4 CURRENT ENERGY SYSTEMS IN AUSTRIA

4.1 THERMAL SECTOR

4.1.1 DISTRICT HEATING AND DISTRICT COOLING

District heating mainly supplies the residential and service sectors in Austria. District cooling, on the other hand, mainly focuses on the service sectors. In Vienna, there are districts where residential buildings are also supplied by district cooling. In general, district cooling is a growing market; however, its share compared to the district heating is very small.

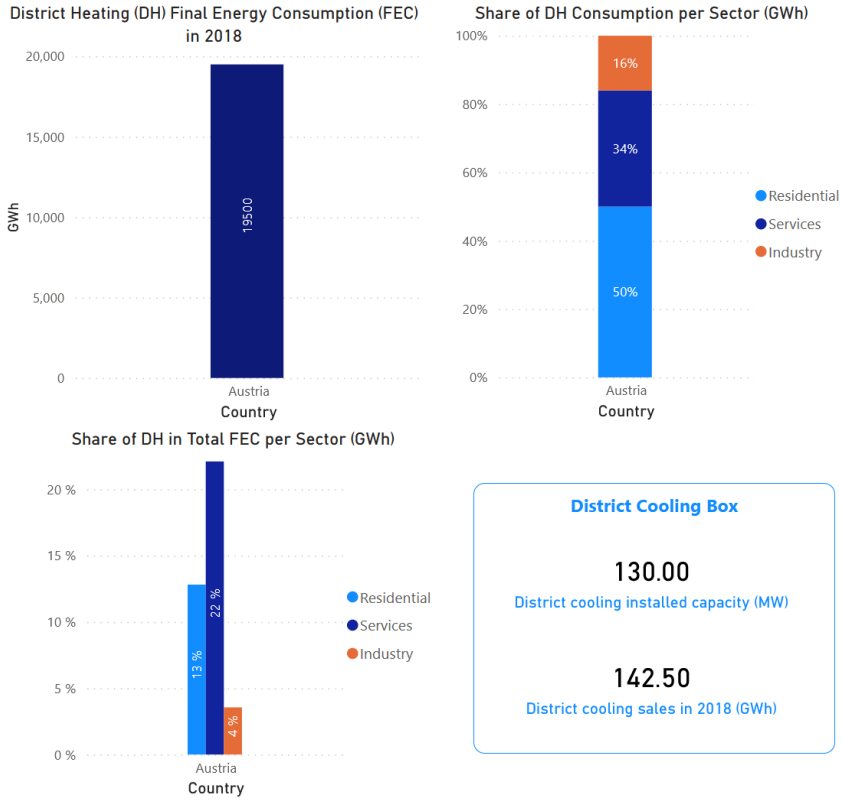

Figure 8 DHC supply in Austria (EC - DG Ener et al., 2022)

In 2018, the district heating systems had an installed capacity of over 11 $GW_{thermal}$, while the installed capacity for district cooling was only 130 $MW_{thermal}$. However, there has been a

positive market uptake of district cooling, as its installed capacity has increased to 180 $MW_{thermal}$ in 2021 (Figure 9). Figure 4 shows that a significant portion of Austria's heat supply (over 40%) is derived from fossil fuels, which means there is a need to decarbonize it in the coming years.

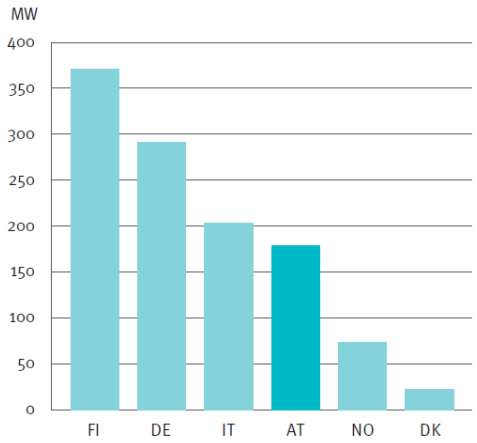

Figure 9 Installed capacities of district cooling in 2021 in European context (source: Euroheat & Power, (FGW, 2022))

4.1.2 DISTRICT HEATING AND DISTRICT COOLING – OBSTACLES AND OPPORTUNITIES

District heating and cooling (DHC) companies are confronting a significant challenge due to the uncertain future framework conditions that could potentially affect the feasibility of their supplier's portfolio. The Energy Efficiency Directive's concrete targets and the gradual increase in efficiency and renewable heat generation share until 2050 pose a challenge for DHC operators. Besides, the rise in energy prices due to the Corona pandemic and the war in Ukraine is a significant challenge that requires a faster transition towards renewables and reducing dependence on fossil fuel imports (Büchele et al., 2020).

Furthermore, the DHC sector must also address sector coupling and the expected reduction in heat demand resulting from thermal building renovation measures and global warming. These factors will impact the techno-economic parameters of district heating. To tackle these challenges, DHC suppliers must deal with the uncertainties of future framework conditions and their effect on different concrete investment options. However, smaller suppliers often lack sufficient monetary and human resources to analyze these aspects, unlike larger suppliers.

As Austria is home to a large number of small DHC operators, they need adequate support and incentives to take the necessary technical and financial measures at the right moment. Therefore, addressing these challenges demands a concerted effort from all stakeholders to ensure sustainable and reliable district heating and cooling systems for the future.

Data of DHC suppliers are seen as an asset of the DHC operators and are not published. Besides data availability, restrictions imposed by the General Data Protection Regulation (GDPR) hinder the researchers from performing detailed, independent analyses of the DHC sector with a high granularity.

5 FUTURE SCENARIOS FOR THE ENERGY SYSTEM

The available energy scenario for the Austrian energy system can be extracted from the study “Energy and greenhouse gas scenarios with a view to 2030 and 2050” (Krutzler et al., 2017). It shows the possible development of Austrian greenhouse gas emissions, which serve as a basis for fulfilling the EU reporting obligations under the Monitoring Mechanism Regulation (Regulation (EU) No 525/2013). Two scenarios were created in this study: WEM and Transition scenarios. The scenarios are still the basis for the draft of the National Energy and Climate Plan (NECP) for the period of 2021 to 2030.

For the scenario WEM (With Existing Measures), the measures that were obligatorily implemented by the deadline of May 30, 2016, were taken into account. The Transition scenario, on the other hand, aims to demonstrate how implementation of the Paris Agreement can occur by reducing greenhouse gas emissions by at least 80% compared to 1990 levels by the year 2050. Additionally, this scenario aims to provide insights into achieving the climate targets for 2030. These targets include a reduction of greenhouse gas emissions not covered by emissions trading by at least 36% for Austria.

The report "Potential for efficient heating and cooling" provides a detailed assessment of the potential for efficient heating and cooling in Austria, in accordance with Article 14 of the Energy Efficiency Directive II (R. Büchele et al., 2021). The report takes into account not only the WEM and Transition scenarios but also the actual policies that were in place at the time of writing. The aim of achieving climate neutrality in Austria is to eliminate the use of fossil fuels by the year 2045. Based on the report, although fossil fuels will still be in use in 2030, they will no longer be economically feasible by 2050. It is projected that renewable sources will provide all gas requirements by 2050.

With regards to the district heating systems, it was concluded that the share of district heating depends above all on the connection rate that can be achieved in the district heating regions, which in turn is strongly related to the spatial energy planning framework conditions. The report concludes that depending on the achievable connection rate, an economic potential for district heating is calculated from about 20% to over 50%.

The report provides the following statements regarding the technology mix of the district heating supply:

- Under the assumptions made in this study, renewable gas does not prove to be a cost-effective option for decarbonising the sector.

- Biomass continues to represent a significant share of the renewable heat supply, both decentralised and in district heating. It can be observed that in the scenarios with low-efficiency increases, the pressure on the use of biomass resources would increase very strongly.
- It can be seen that heat pumps play an essential role not only in decentralised applications but also in district heating.
- The role of thermal power plants and CHPs in a future renewable electricity system was not the focus of this study. In the sense of high fuel utilisation, heat extraction from existing thermal power plants should definitely be strived for. Until 2050, however, the analyses show that gas-fired CHP plants will only be used with relatively low full load hours.
- Large solar thermal plants can be an economically viable option, although there is a strong dependence on the overall structure of the generation portfolio on the one hand and on the achievable cost reductions on the other; these, in turn, scale strongly with the size of the plants.
- The use of large thermal storage systems is shown to contribute significantly to the economic operation of the heating networks. At the same time, there are significant uncertainties regarding the associated costs, which depend not least on the exact location.

BIBLIOGRAPHY

Büchele, R., Kranzl, L., Hartner, M., Hasani, J., 2020. Opportunities and Challenges of Future District Heating Portfolios of an Austrian Utility. Energies 13, 2457. https://doi.org/10.3390/en13102457

Das Sachbereichskonzept Energie - Leitfaden (Version 2.1), 2023.

EC - DG Ener, TU Wien., Tilia GmbH., Institute for Resource Efficiency and Energy Strategies GmbH., Fraunhofer ISI., Öko Institut., 2022. District heating and cooling in the European Union: overview of markets and regulatory frameworks under the revised Renewable Energy Directive. Publications Office, LU.

FGW, 2022. Zahlenspiegel Gas und Fernwärme in Österreich.

Krutzler, T., Zechmeister, A., Stranner, G., Wiesenberger, H., Gallauner, T., Gössl, M., Heller, C., Heinfellner, H., Ibesich, N., Lichtblau, G., Schieder, W., Schneider Ilse Schindler, J., Storch, A., Winter, R., 2017. Energie- und Treibhausgas-Szenarien im Hinblick auf 2030 und 2050 (Synthesebericht No. REP-0628). Umweltbundesamt, Vienna.

R. Büchele, M. Fallahnejad, B. Felber, J. Hasani, L. Kranzl, N. Themeßl, J. Habiger, M. Hummel, A. Müller, D. Schmidinger, 2021. Potential for efficient heating and cooling.