Euroheat & Power

How can we cool our cities?

The district cooling solution

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The Heating & Cooling Network

Who we are

- International association for sustainable district heating and cooling
- Voice and Forum of the sector
- Research & Innovation Technology platform involve in 18 active projects
- 150+ members from more than 30 countries

AGENDA

- What is District Cooling?
- Why it can be beneficial for society and investors?
- District Cooling development, description of energy sources and cold generation technologies
- Market outlook and best practices
- Role of public authorities in the development of District Cooling projects

Global Trends:

- Energy demand for cooling doubled over the past decade.
- Cooling accounts for ~20% of total electricity demand (IEA).

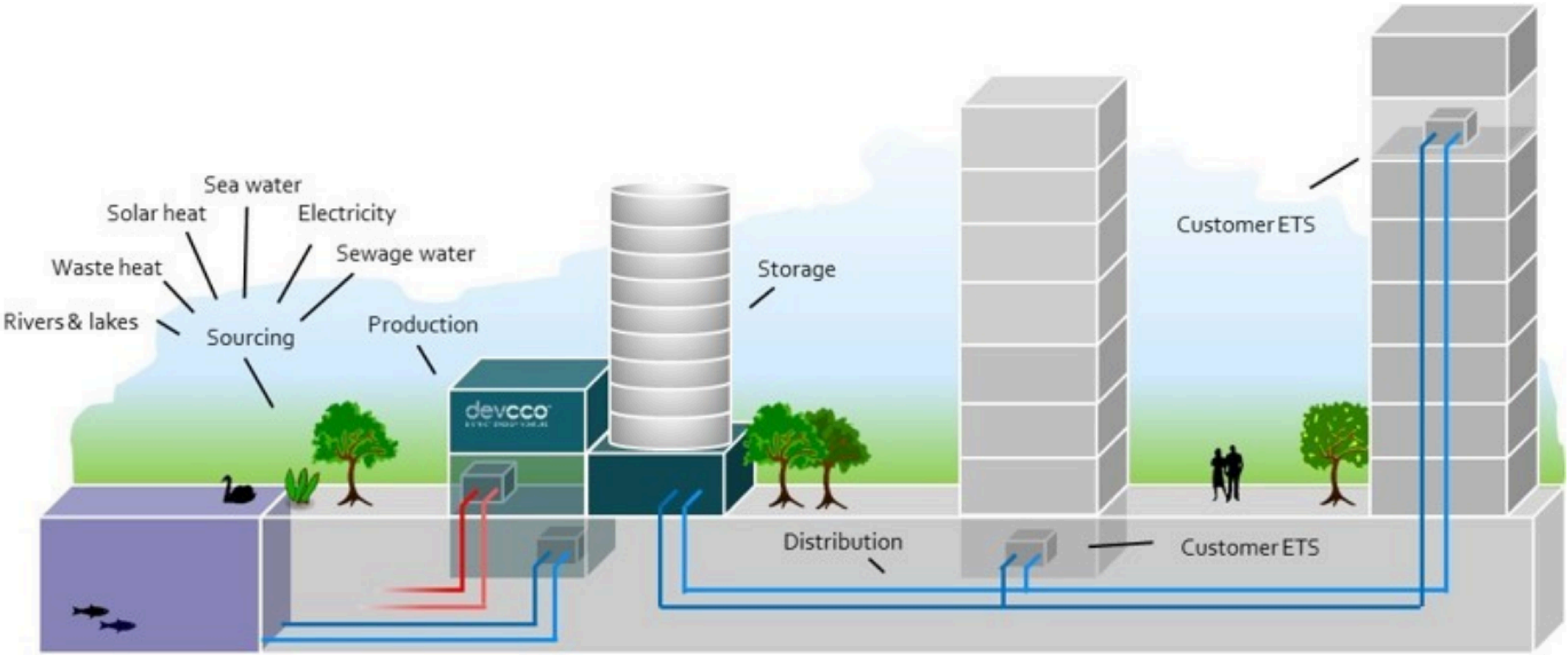
Driving Factors:

- Climate change (e.g., Summer 2023: warmest recorded globally).
- Rising incomes and urbanisation.

Impacts:

- Increased air conditioning installations in secondary sectors and residential areas.
- Elevated electricity peak demands, particularly in Europe.

Introduction to district cooling



Source: IEA, Sustainable DC guidelines, 2020

Why District Cooling?

Environmental Benefits

- <u>CO_2 Emissions Reduction:</u>

E.g. Copenhagen's District Cooling system reduces CO_2 emissions by up to 30,000 tons per year.
The Zuidas International Business Hub (NL) reduced CO_2 emissions by 75% using lake water cooling.

- <u>Energy Efficiency Improvements:</u>

Conventional building cooling has an Energy Efficiency Ratio (EER) of 2.5. By using free cooling from lakes or rivers, EER can double to 5.0, requiring only 1 kWh of electricity per 10 kWh of cooling.

- <u>Reduced Refrigerant Use:</u>

DC helps phase out harmful HCFCs and HFCs in compliance with the Montreal Protocol and Kigali Amendment

Economic & Financial Benefits

- <u>Lower Operating Costs:</u>

DC is 40% more cost-efficient than traditional cooling solutions.
Central energy plants operate at a COP (Coefficient of Performance) between 5.5 and 7.5, while conventional air-cooled package units operate at only 2.8 to 3.1.

Why District Cooling?

Property Benefits

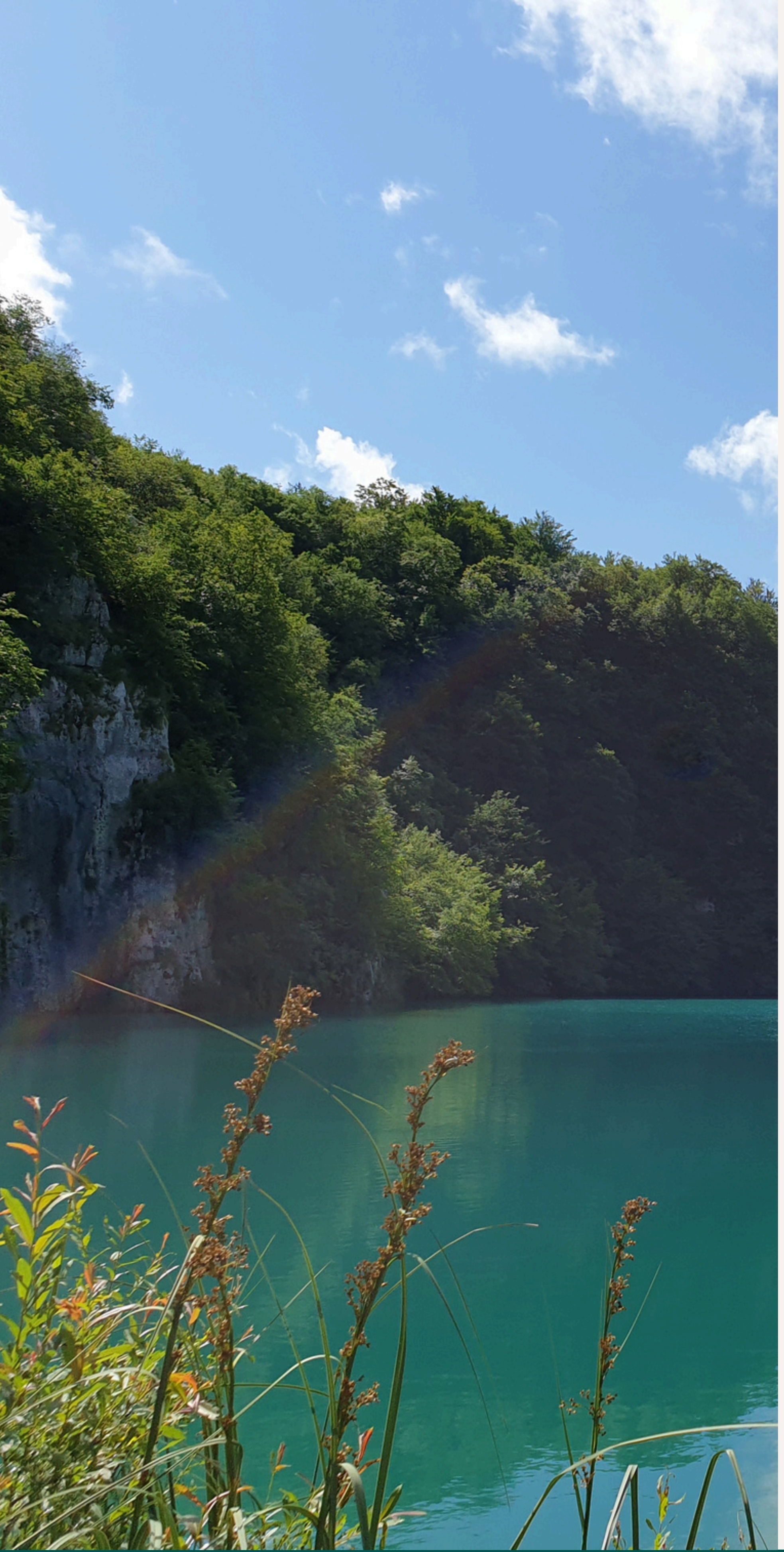
- Space savings: Eliminates the need for individual cooling towers and chillers.
- Noise reduction: Removes noisy rooftop air-conditioning units, urban aesthetics.

Business & Investor Benefits

- Stable Revenue Models: Investors benefit from long-term, stable contracts, Public-Private Partnership (PPP) models are popular, ensuring secure investment returns.
- Future-Proofing Against Energy Price Volatility: Electricity market fluctuations impact conventional cooling costs, while DC offers predictable, stable cooling prices.
- TES optimises installed cooling capacity: increases chiller baseload operation, reducing cost and shabing peak cooling load

Cold Generation Technologies

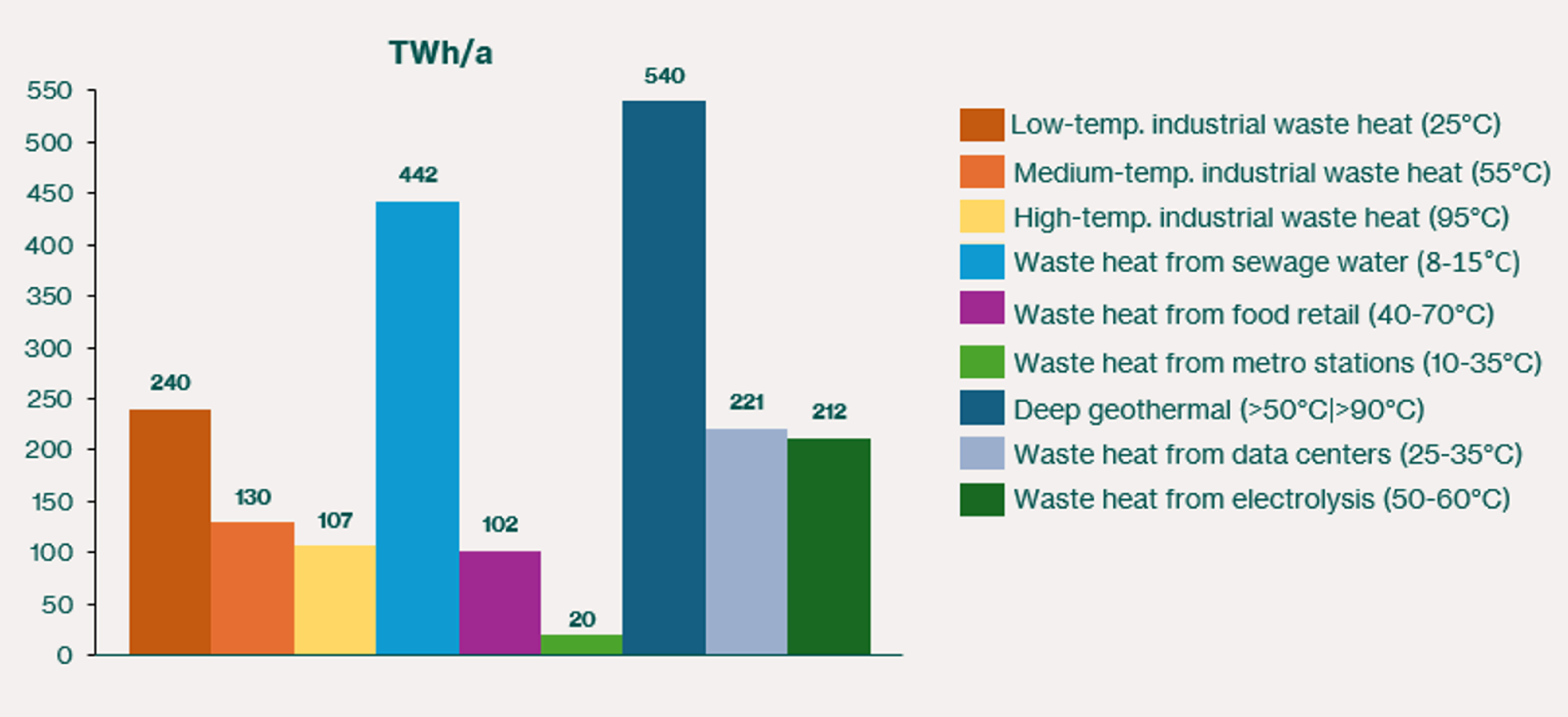
- Compression Chillers
  - Most common technology, operating at COP 4.7 to 5.4.
  - Water-cooled and integrated with heat recovery.
- Absorption & Adsorption Chillers
  - Absorption chillers use waste heat or solar energy to generate cooling.
  - Adsorption chillers use silica gel or zeolites for energy storage
- Trigeneration (CCHP - Combined Cooling, Heating & Power)
  - Produces cooling, heating, and electricity from a single energy source.
- Thermal Energy Storage (TES)



Key Energy Sources

1. Free Cooling (Natural Cooling Sources)
    - Deep lakes, seawater, and rivers.
    - Example: Copenhagen's Opera House uses seawater cooling, reducing energy consumption by up to 50%.
2. LNG Residual Cooling
    - Liquefied Natural Gas (LNG) regasification releases significant amounts of cold energy, which can be harnessed for cooling
3. Waste Heat Recovery
    - Absorption chillers use industrial waste heat to generate cooling.
    - Example: Helsinki's DC system integrates absorption chillers with cogeneration plants to reuse excess heat.
4. Integration with Renewable Energy
    - Solar Cooling: Uses solar thermal energy to drive absorption chillers.
    - Geothermal Cooling: Uses underground temperatures for heat exchange.
    - Wind Energy Integration: Lowers reliance on fossil fuels

Waste heat and RES potential according to the Aalborg study



District Cooling Networks in Europe

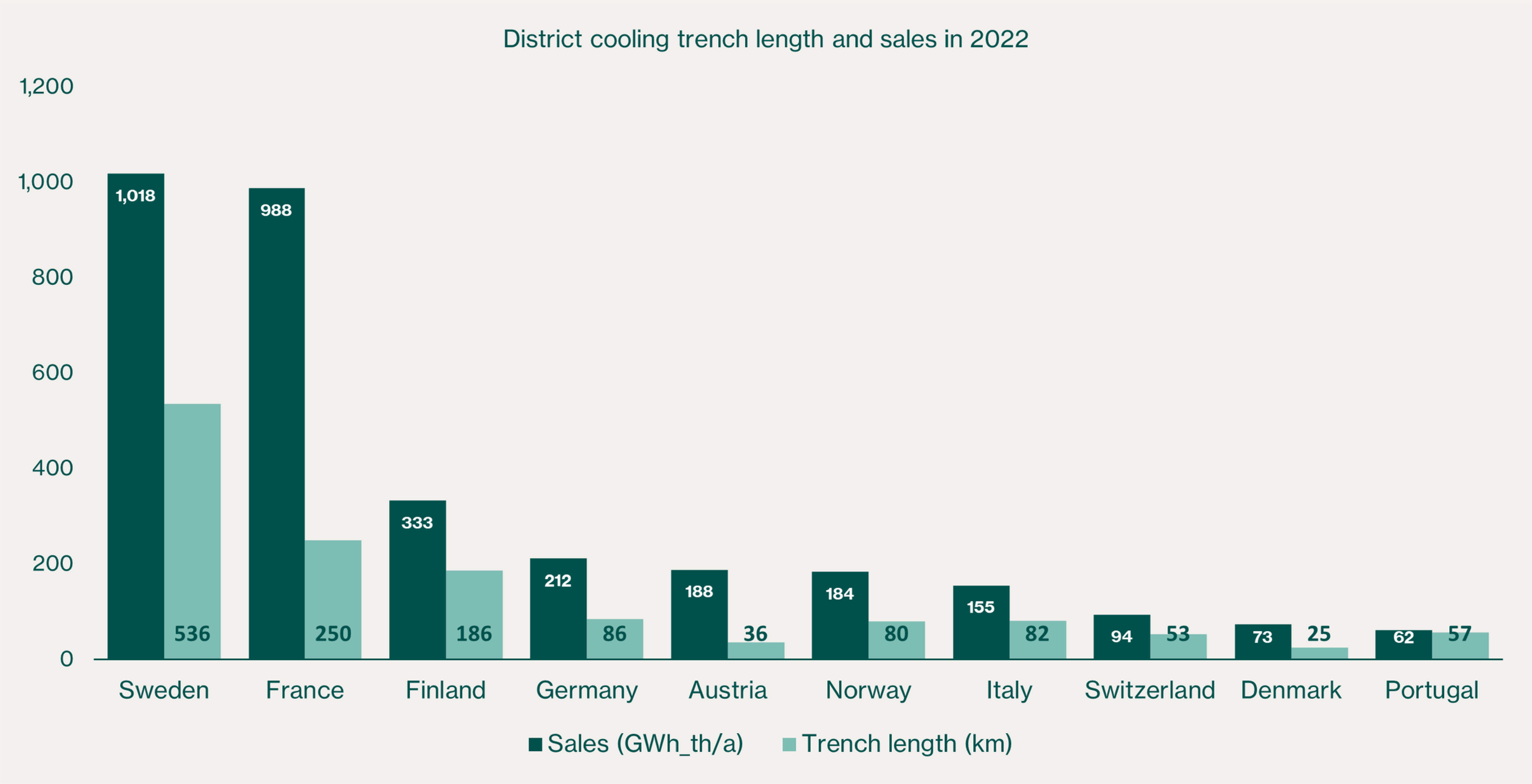
- Market Growth:
  - Sales reached 3.3 TWh in 2022, an 8% increase.
- Geographical Spread:
  - Over 200 networks, spanning 1,375 km of pipelines.
  - Dominant markets: Sweden and France.
- Sector Expansion:
  - Primarily serves tertiary sectors but increasingly integrated into residential and storage needs.

Outlook for District Cooling in Europe

- **Country Highlights:**
  - Sweden: 50% growth expected by 2030.
  - France: Paris network to triple by 2042.
  - Austria: 5.1% annual growth since 2017; Vienna to double supplies by 2030.
  - Other Countries: Developments in Denmark, Finland, and Norway.

- **Key Trends:**
  - Growing demand in hospitals, schools, retirement homes.
  - Shift towards residential cooling.
  - Hybrid systems, smart systems

Country-specific DC sales and trench length in 2022



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Thank you!

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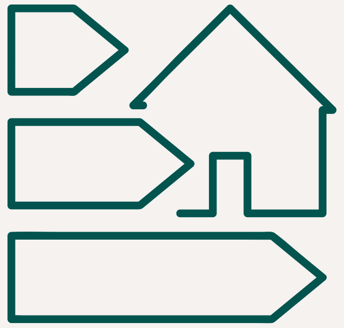
Policy incentives

- Previous EU mandate -> climate policy as the top priority, ‘Green Deal’, a set of policies to tackle climate change.
- FF55 package -> EU’s 2030 target of reducing GHG emissions by at least 55% (compared to 1990) -> set the course towards carbon neutrality in 2050.
- FF55 as a good base for the rollout of DHC.

Most relevant legislative texts for the district heating and cooling sector in the ‘Fit for 55 Package’

Energy Efficiency Directive

Renewable Energy Directive



Energy Performance of Buildings Directive

Energy Efficiency Directive (EED)

The revised EED increases the ambition of energy savings to meet the 2030 emissions reduction target. Energy Efficiency is a key driver of the EU's energy transition. Most relevant measures for DHC include:

- **Art. 3 - Gives legal status to the energy efficiency first principle**
  - Member States have to consider the energy efficiency first principle in their decision makings and investments.
- **Art. 26 - Waste heat recovery from data centre is mandatory if technically or economically feasible**
  - For data centres above 1MW
  - Data centres above 500kW also have a monitoring and reporting obligation on sustainability indicators, including waste heat.
- **Art. 30 - Member states shall adopt financial support for energy-efficiency**

Efficient District Heating and Cooling systems

Article 26 of the Energy Efficiency Directive introduces a new definition of Efficient DHC networks (with 2 options).
Default option: includes milestones to get to net zero by 2050 (below).

until 2028

- 50% Renewable energy or waste heat
- 75% Cogeneration (CHP)
- 50% Combination of RES, WH and CHP

from 2028

- 50% Renewable energy and/or waste heat
- 80% High-efficiency cogeneration
- 50% Combination of RES, WH and HE CHP with a minimum share of RES 5%

from 2035

- 50% Renewable energy and/or waste heat
- 80% Combination of RES, WH and HE CHP with a minimum share of RES 35%

from 2040

- 75% Renewable energy and/or waste heat
- 95% Combination of RES, WH and HE CHP with a minimum share of RES 35%

from 2045

- 75% Renewable energy and/or waste heat

from 2050

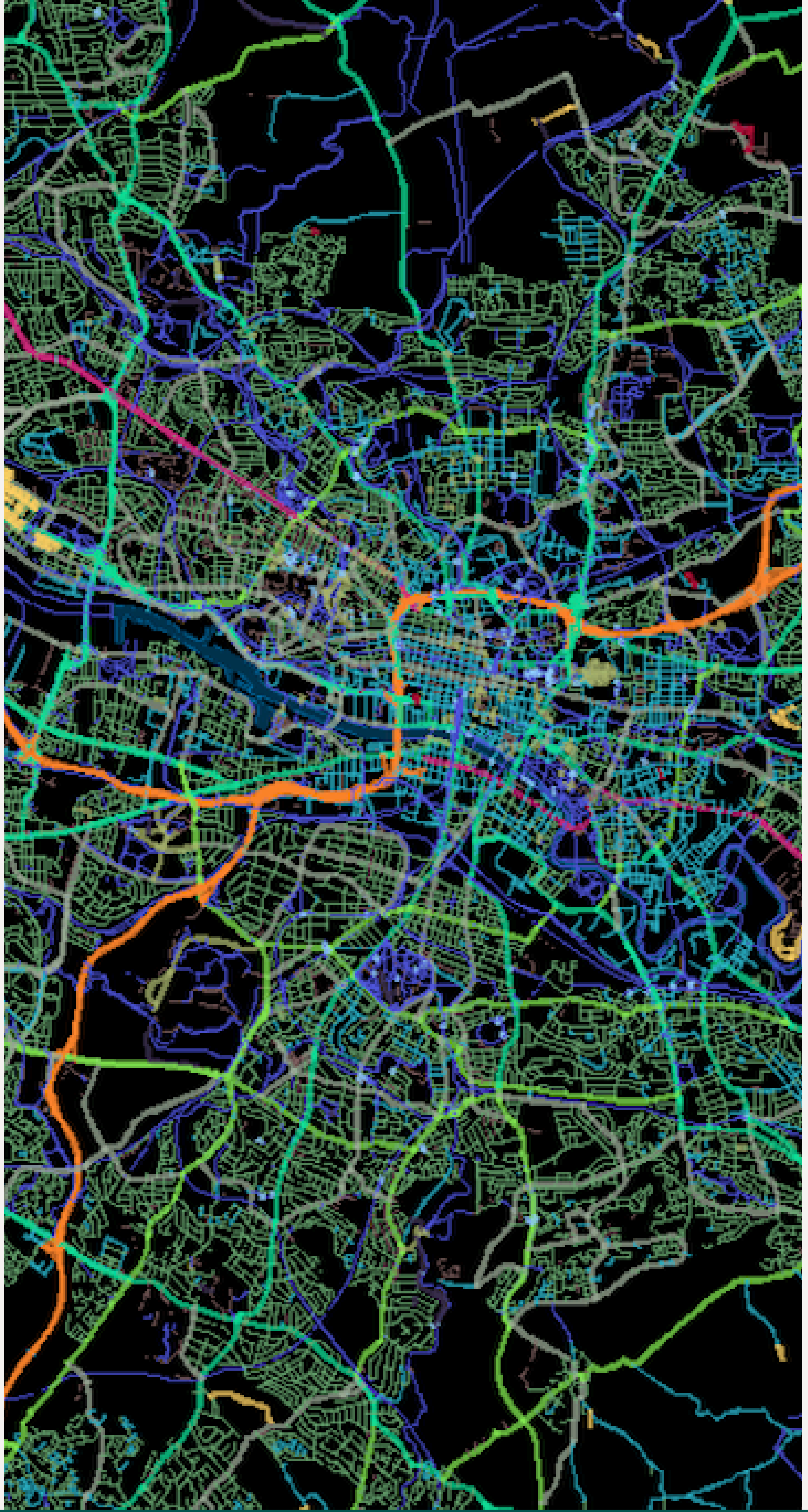
- 100% Renewable energy and/or waste heat

When building or substantially refurbishing DHC:

- No increase in the use of fossil fuels other than natural gas
- No new fossil fuels capacity from 2030

Consequence of definition:

- Not binding but connected to other legislation (e.g. EPBD)
- Conditions funding
- Systems not meeting def. to prepare a plan



Art. 25 Local Heating & Cooling Plans

Regional and local authorities with a population above 45.000 inhabitants will have to prepare local heating and cooling plans. They should:

- Map the potential for increasing energy efficiency, also via low-temperature DHC, high-efficiency CHP, waste heat recovery, and renewables.
- Follow the energy efficiency first principle
- Include a trajectory to achieve the goals of the plans in line with climate neutrality, taking into account existing infrastructure.

MSs are also required to develop national-level comprehensive heating and cooling assessments.

- **Identify the most resource and cost-efficient solutions to meet the heating and cooling demand considering the potential for DHC.**

The preparation and implementation of these plans should ensure that efficient local renewable and recovered heat sources are considered first.
It should enable the rollout of DHC systems in areas with high heat demand density.

REDIII put a stronger emphasis on waste heat recovery

Article 24 (4b)

DHC systems above 25 MW are encouraged to connect third-party suppliers of RES and waste heat /cold

Article 23

Toolbox for Members States to increase RE and WH sources

Articles 15a, 22a, 23 and 24

Waste heat can be accounted towards sectoral targets for buildings, industry, heating and cooling, DHC

REDIII's attempt to foster System Integration

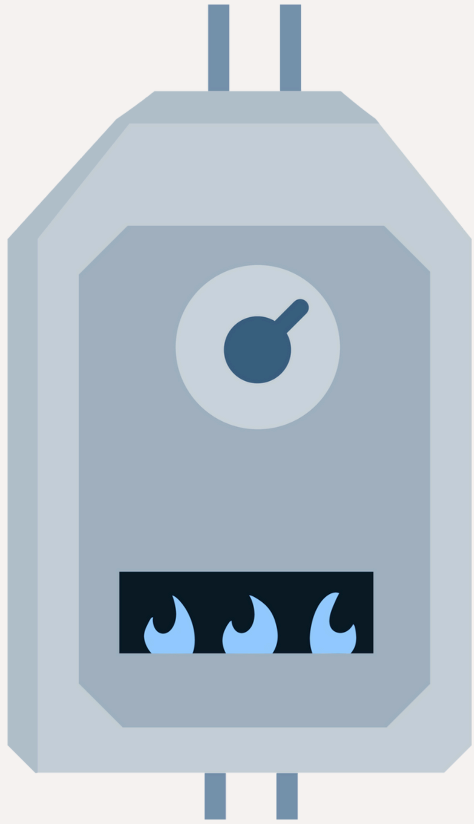
- **Ambition to increase (thermal) energy storage capacity (Art 23.4, Art 24.8)**
- **Increased coordination with electricity grids and gas networks**
  - Enable DHC flexibility services to participate in electricity markets
  - DSO to assess DHC flexibility services in their planning every 4 years
- **Counting of renewable electricity towards H&C and DHC RES and WH targets (Art 23.1, Art 24.4)**
  - H&C target: only from generators with efficiency higher than 100%
  - DHC target: fully accountable from all sources

  (calculation: average share of renewable electricity supplied in their territory in the two previous years)

Energy Performance of Buildings Directive (EPBD)

EPBD foresees:

- A fully decarbonised building stock by 2050, including through district heating and cooling networks
- A standalone fossil boilers phase out in 2 phases:



Financial incentives

Stand-alone fossil fuel boilers

- MS to develop a national building renovation plan to ensure the renovation of the national building stock
- Buildings must progressively decrease their energy consumption to meet the Minimum Energy Performance Standards (MEPS)
- Customers must be informed of the possibility of connecting to EDHC for renovations
- 26% of worst-performing residential buildings shall be improved by 2030-2033