# Danish District Heating Sector Visit to Serbia

## Green transition of the district heating sector – including perspectives for district cooling

**Arandelovac, Serbia – 1-3 April 2025**

**Lars Gullev**
**Senior consultant, VEKS**
**Vice-chair, IEA DHC ExCo**

# Impact point

## The EU sets the framework

# The EU sets the framework
## "Fit for 55" – July 2021

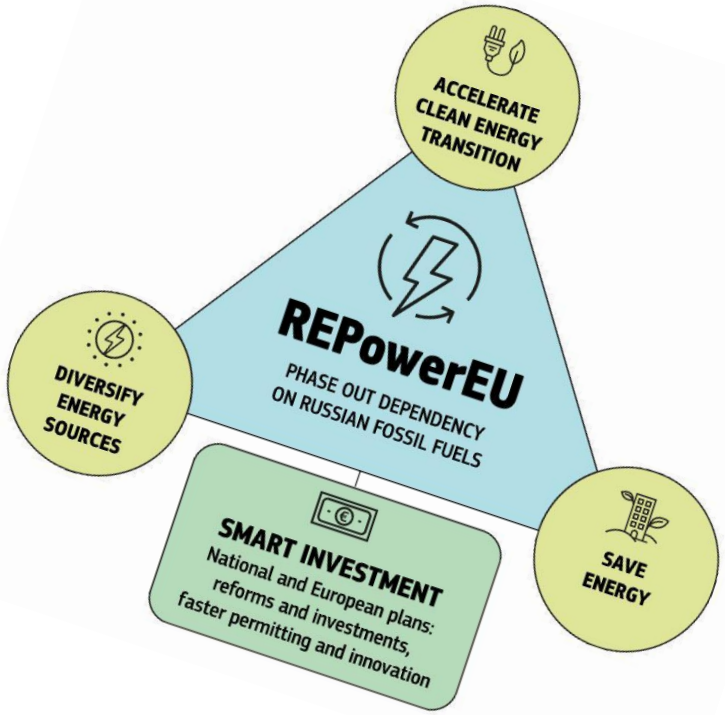
- EU "Fit for 55" package provides the regulatory instruments for the European Union to reduce its greenhouse gas emissions by 55% by 2030.

- The package is expected to drive forward the integration of sustainable heat sources and enhance system optimization synergies with other energy grids – called "System Integration" or "Sector Coupling".

# The EU sets the framework

## REPowerEU - May 2022 after the Russian invasion of Ukraine

- REPowerEU is about rapidly reducing EU's dependence on Russian fossil fuels by fast forwarding the clean transition and joining forces to achieve a more resilient energy system.
- With background in "Fit for 55" REPowerEU puts forward an additional set of actions:
  - save energy;
  - diversify supplies;
  - quickly substitute fossil fuels by accelerating Europe's clean energy transition;
  - smartly combine investments and reforms.

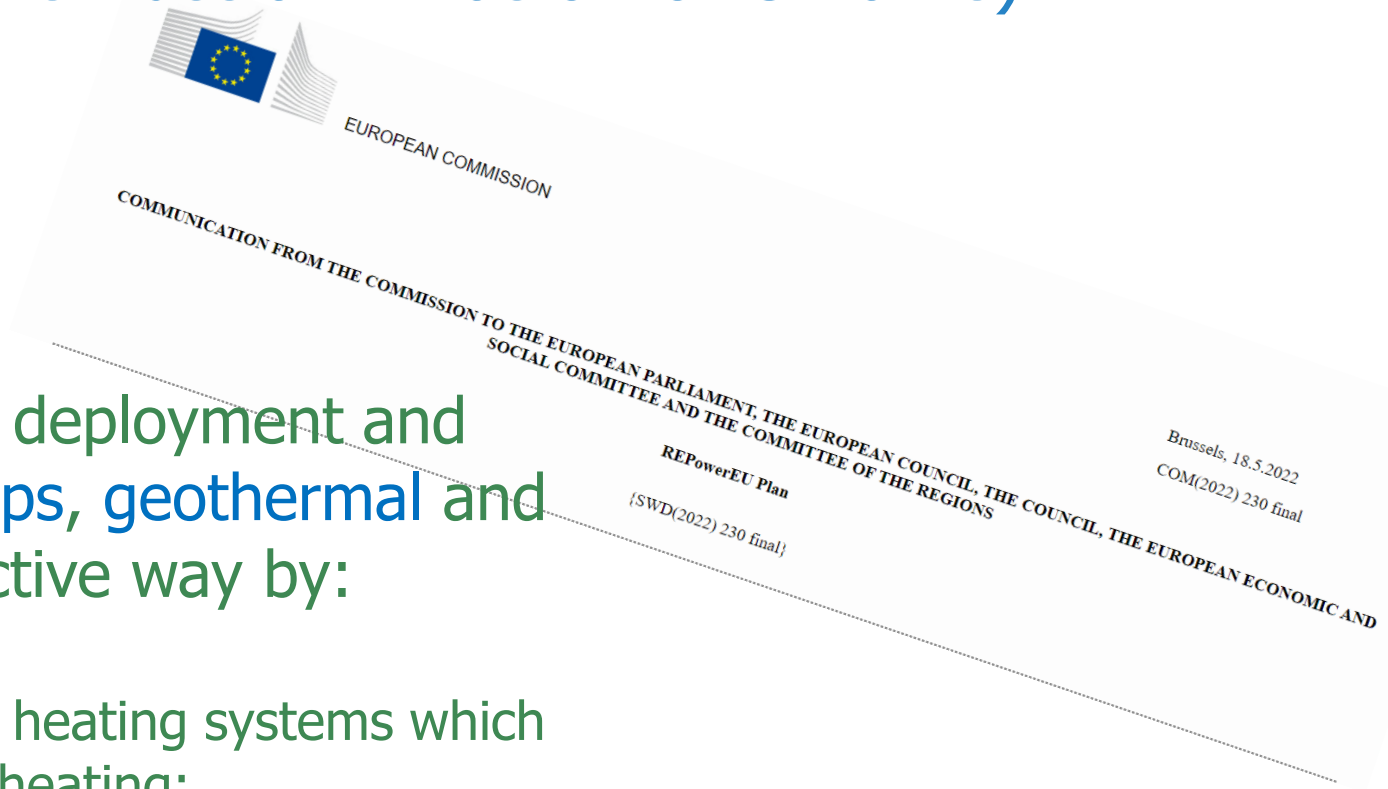



VEKS

Grøn fjernvarme til dig

# The EU sets the framework

## REPowerEU (May 2022 after the Russian invasion of Ukraine)


EUROPEAN COMMISSION

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

REPowerEU Plan

{SWD(2022) 230 final}

Brussels, 18.5.2022
COM(2022) 230 final

"Member States can accelerate the deployment and integration of large-scale heat pumps, geothermal and solar thermal energy in a cost-effective way by:

- Developing and modernizing district heating systems which can replace fossil fuels in individual heating;
- Clean communal heating, especially in densely populated areas and cities;
- Exploiting industrial heat whenever available".

VEKS

Grøn fjernvarme til dig

# The EU sets the framework

## EU Energy Efficiency Directive - Adopted in July 2023

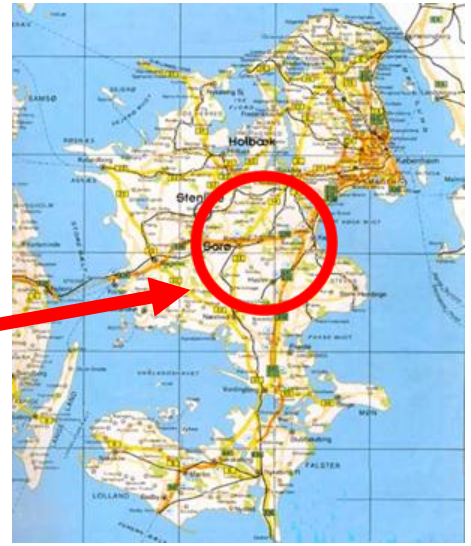
- The recast Energy Efficiency Directive includes a new obligation (Article 25.6), which requires Member States to ensure that municipalities with over 45,000 inhabitants prepare local heating and cooling plans.
- This proposition can be a GAME CHANGER to decarbonise the heating and cooling sector, and to provide citizens with healthier and more resilient living environments.
- To maximise the potential of this measure, the Member States need to put in place robust legal and extensive support frameworks, which ensure that local governments have the knowledge, resources and capacity needed to effectively prepare and implement their plans.

# Impact point

## Bjaeverskov District Heating Company

Almost 100% based on electricity (under construction)






VEKS

*Grøn fjernvarme til dig*

# Bjaeverskov District Heating Company

## History – Excess heat from power system

- The power transformer station is part of the so-called "Kontek connection" between Denmark and Germany – a 170 km long HVDC transmission line between Zealand/Falster and Mecklenburg-Western Pomerania.
- The transmission line was put into operation in 1995 and has a transmission capacity of 600 MW at a voltage of 400 kV.
- Utilization of the excess heat from the power transformer station in Bjaeverskov was only possible with a collective heat supply solution - it was not a possibility with an individual solution.



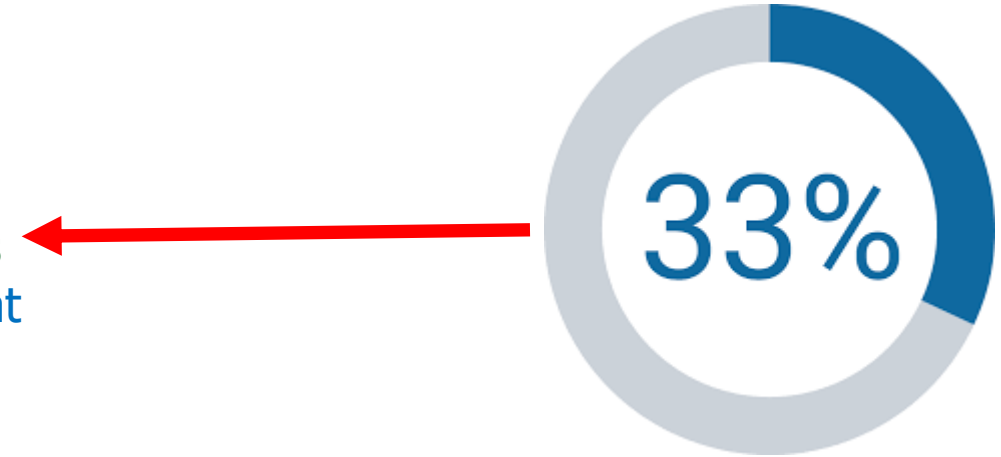
VEKS

*Grøn fjernvarme til dig*

# Bjaeverskov District Heating Company

## Where will the heat be produced?

- The original idea behind the project was to utilize excess heat from the power transformer station connected to the "Kontek connection". However, this energy source could only cover about 1/3 of the heat demand in the city.




- Excess heat is coming from the valve cooling of the transformers – hot water at approx. 35°C, which can be raised to the desired $T_f$ of 75°C in the district heating network via a heat pump.

- From autumn 2024, a working group will investigate the possibilities of utilizing excess heat from cooling transformer oil in a later phase, which will increase the proportion of surplus heat from the transformer.

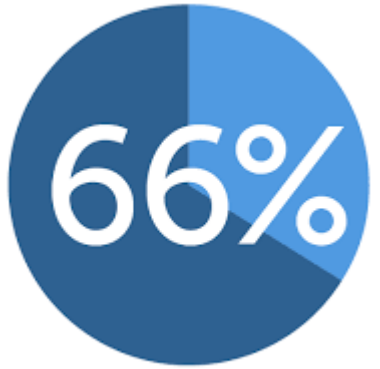
VEKS

*Grøn fjernvarme til dig*

# Bjaeverskov District Heating Company

## Where will the heat be produced?

- Remaining 2/3 of the city's heating demand should be covered by non-fossil energy sources.




Non-fossil energy

- Here the choice fell on:
  - Air/water heat pumps (capacity of 4 MW), which will cover 1/3 of the heating demand.
  - 11 MW electric boiler, which will cover almost the remaining part of the heating demand.
  - Two natural gas boilers (peak- and reserve load).

VEKS

*Grøn fjernvarme til dig*

# Bjaeverskov District Heating Company

## Preliminary model of the heating plant


VEKS

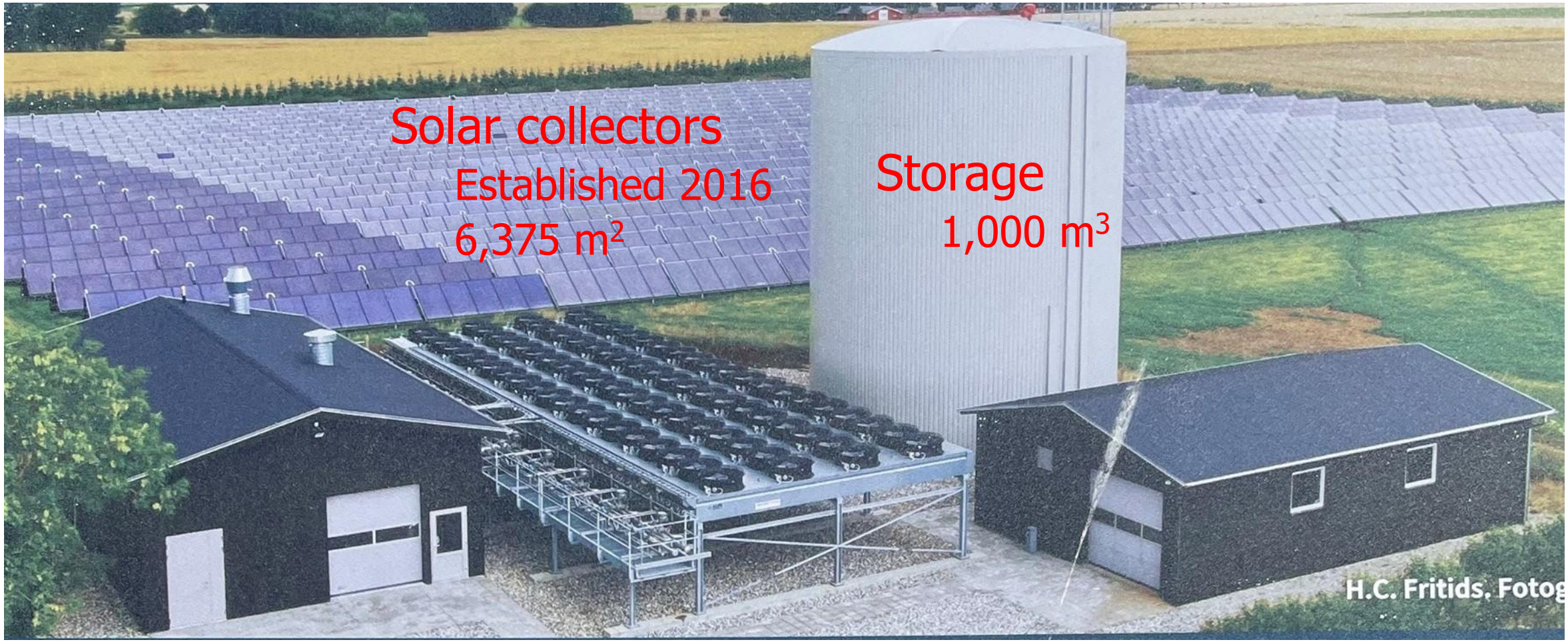
Grøn fjernvarme til dig

# Impact point

Air-water heat pump,
solar collectors and storage

# Ørum District Heating Company, DK

## 720 customers




Air-water heat pump

Established 2020

VEKS

*Grøn fjernvarme til dig*

# Ørum District Heating Company, DK
## Integration of technologies

- The heat pump (HP) is intelligently integrated with the solar collectors from 2016.

- HP is designed to primarily taking heat from the outside air but can also take heat in the form of lukewarm water from the storage tank - thereby increasing the efficiency of the solar heating system.

- Before the establishment of the HP, solar heating accounted for approx. 20% of the heat production - today the HP accounts for 70% of the annual heat production (9,000 MWh) and thus solar and HP cover approx. 90% of the customers' heating demand.

# Impact point

## Carbon Capture

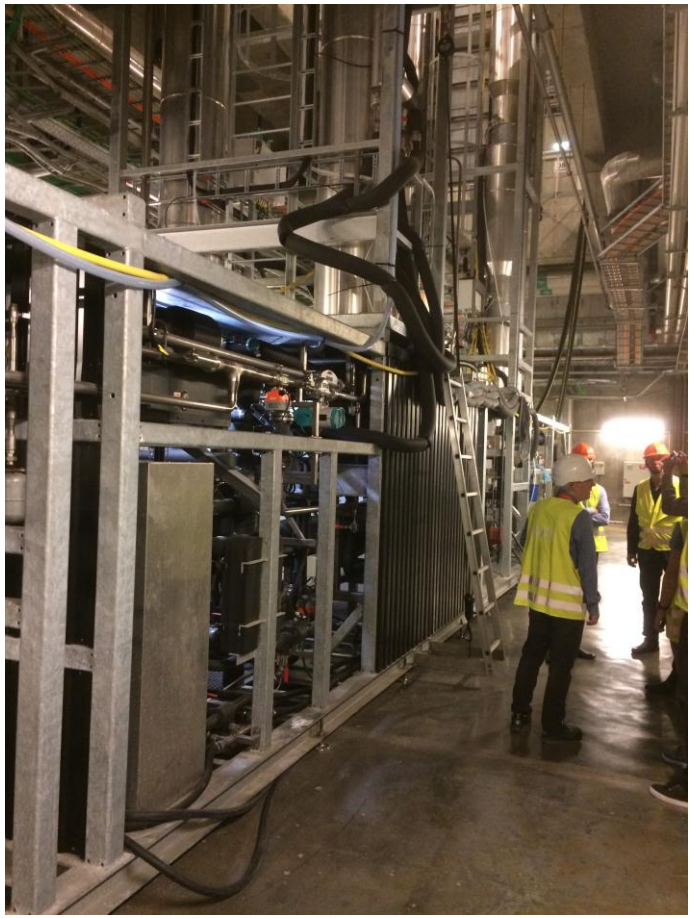

VEKS

*Grøn fjernvarme til dig*

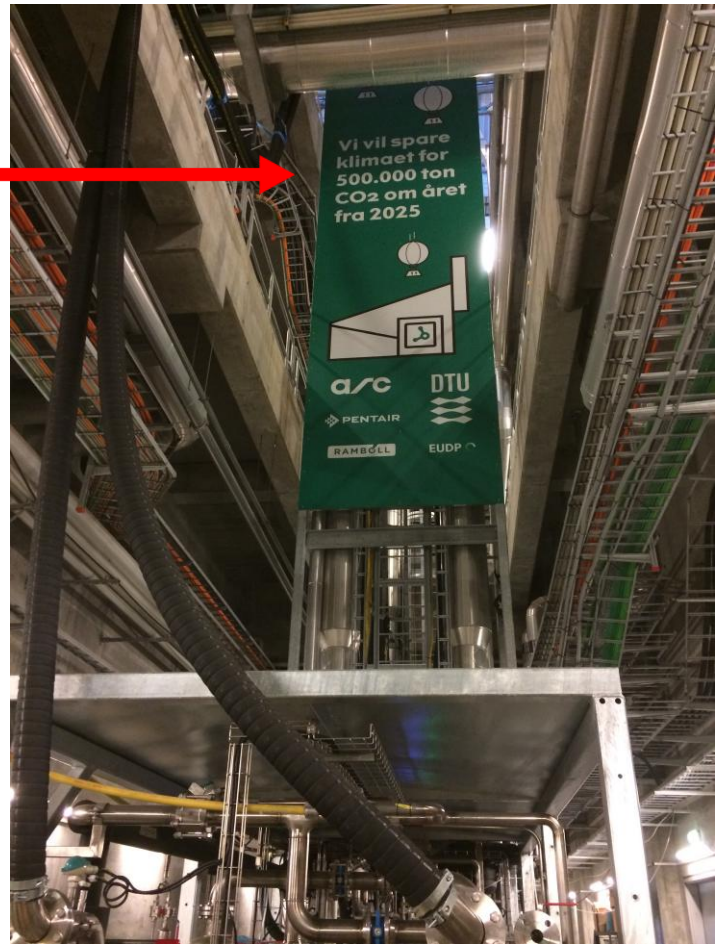
# Waste-to-energy plant in Copenhagen - ARC

- ARC, Amager Ressource Center, manages the waste resources to provide the residents and the city of Copenhagen with recycled materials, electricity, and district heating – and in a few years Carbon Capture.

# Carbon Capture test at ARC – (Waste-to-energy plant)



We will save the climate for 500,000 tons $CO_2$/year from 2025 (plan in 2021).




VEKS

Grøn fjernvarme til dig

# Carbon Capture in Copenhagen 14 August 2023 –ARC (CopenHill)

- Demonstration plant for capturing $CO_2$ at the first Waste-to-Energy plant in Denmark was inaugurated.

VEKS

Grøn fjernvarme til dig

# Carbon Capture in Copenhagen

## 14 August 2023 - ARC (CopenHill)

- Now the captured $CO_2$ is delivered to a horticulture (greenhouse) that produces vegetables (production increase 15% by adding $CO_2$ to the environment in the greenhouses).

- The installation captures 4 tons $CO_2$ per day and the plant gathers experience for the subsequent establishment of a full-scale plant for the capture of 500,000 tons of $CO_2$/year.

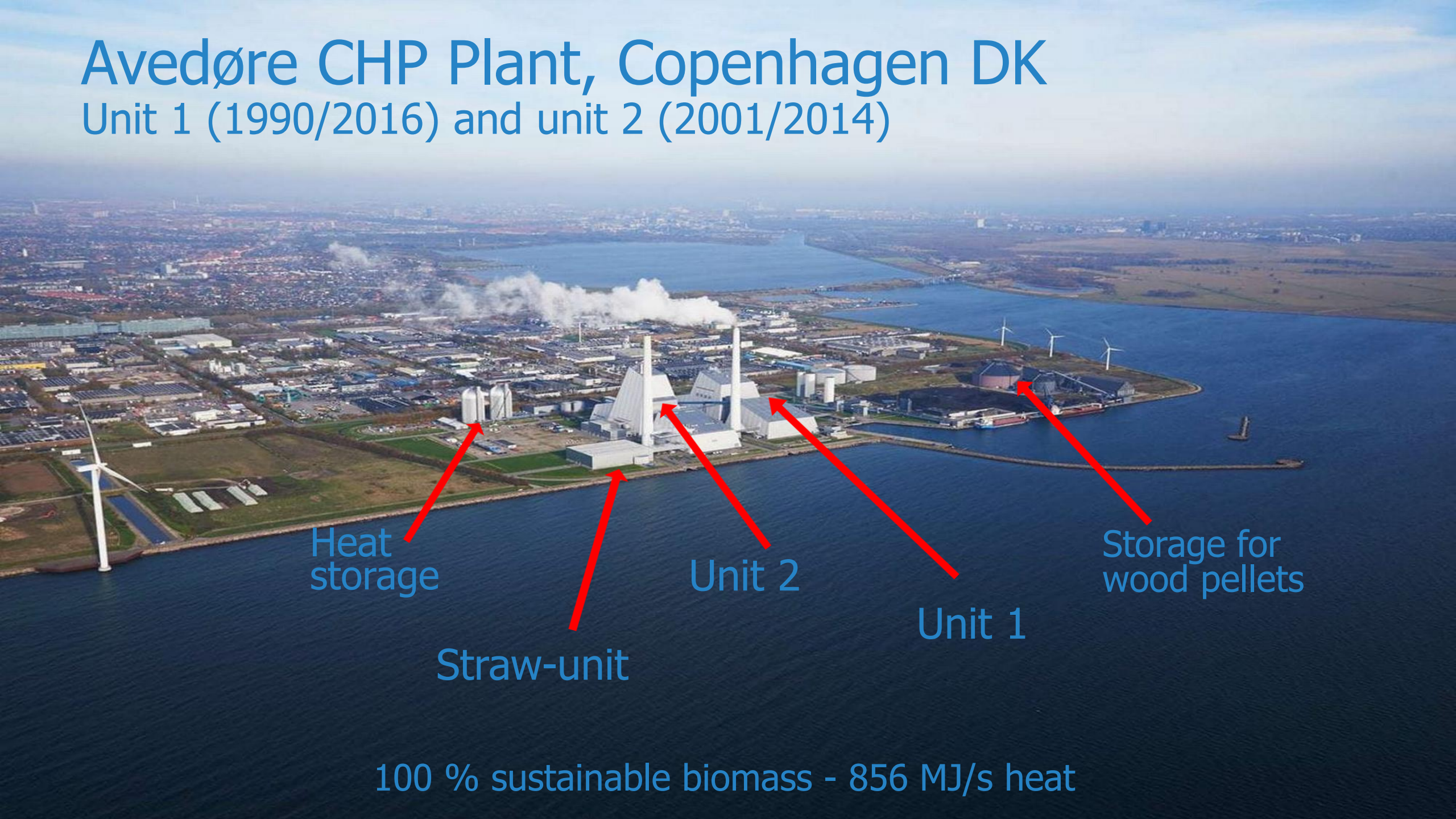



VEKS

Grøn fjernvarme til dig

# Avedøre CHP Plant, Copenhagen DK

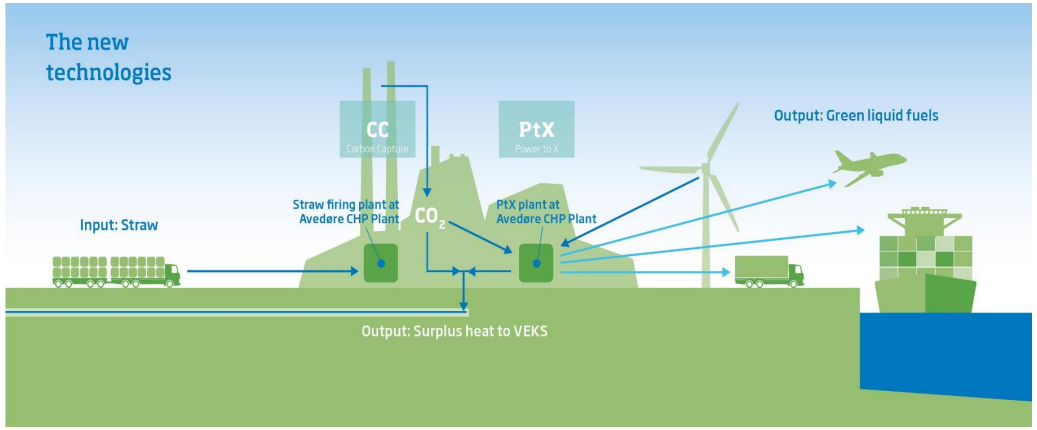
## Unit 1 (1990/2016) and unit 2 (2001/2014)




100 % sustainable biomass - 856 MJ/s heat

# Avedøre CHP Plant – Surplus heat from CC

- In January 2024 VEKS and Ørsted signed a contract to utilize the surplus heat from the capture of 150,000 tons $CO_2$ per year from the CHP plant's straw-fired unit.
- The biogenic $CO_2$ from the chimney will be captured and stored from 2026.
- The CC installation at AVV's straw-fired unit will produce approx. 34 MW excess heat from the CC process and approx. 19 MW from the flue gas condensation process - a total of 53 MW of excess heat corresponds to the annual district heating consumption of around 16,000 households.

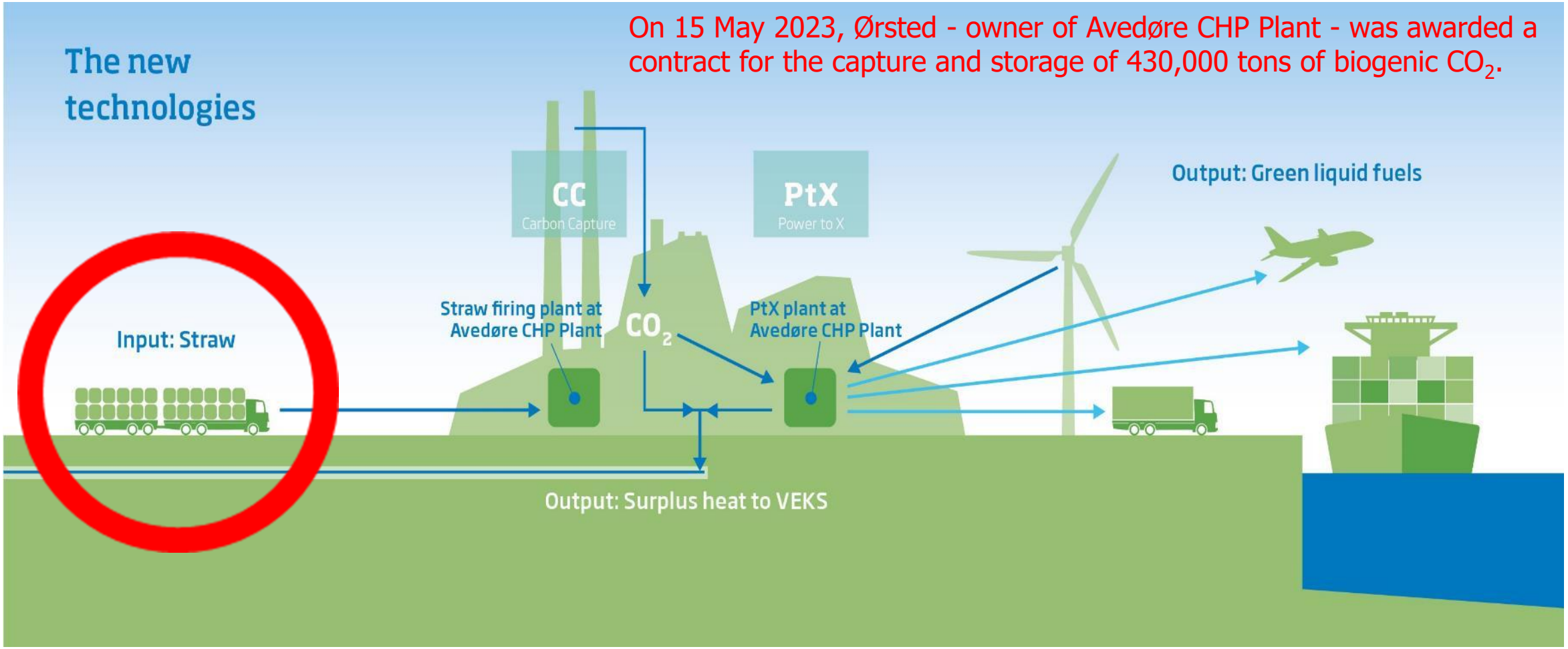



VEKS

Grøn fjernvarme til dig

# Avedøre CHP Plant – Surplus heat from CC

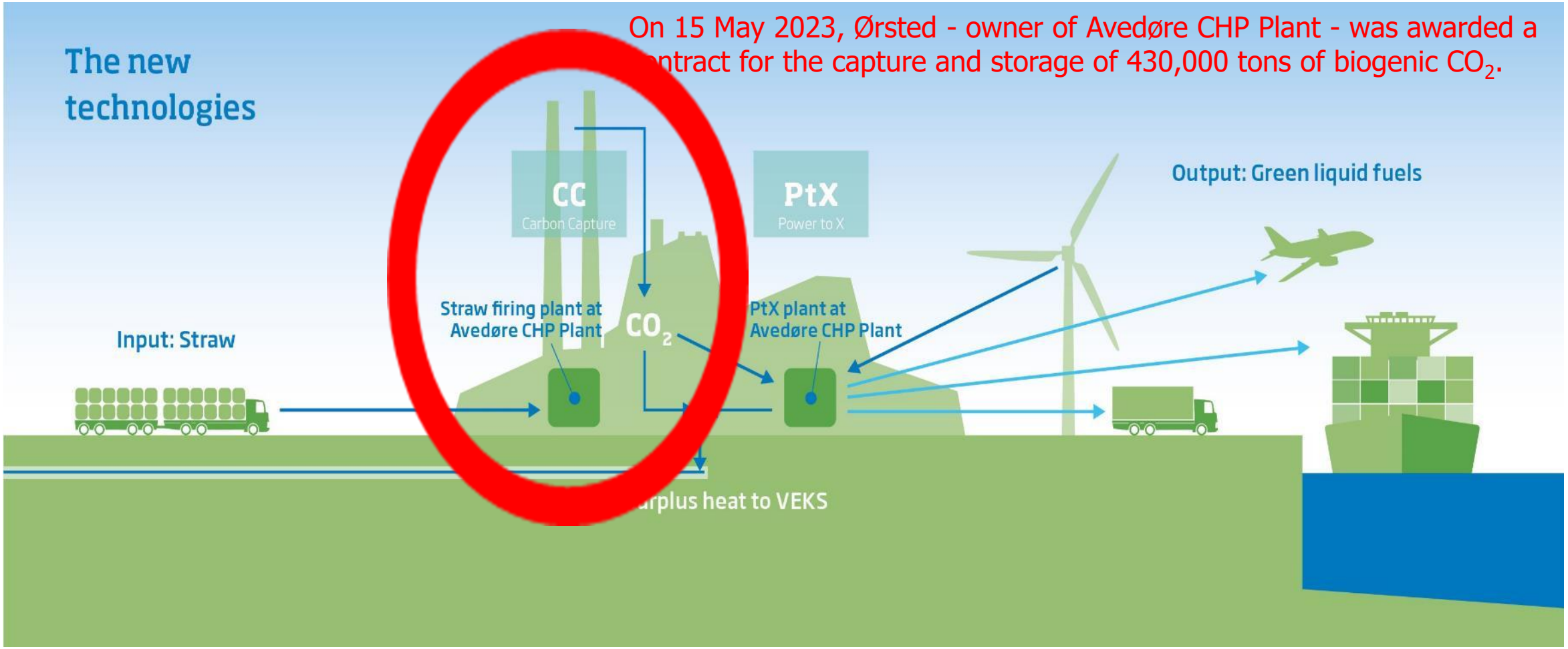
On 15 May 2023, Ørsted - owner of Avedøre CHP Plant - was awarded a contract for the capture and storage of 430,000 tons of biogenic $CO_2$.




VEKS

Grøn fjernvarme til dig

# Avedøre CHP Plant – Surplus heat from CC

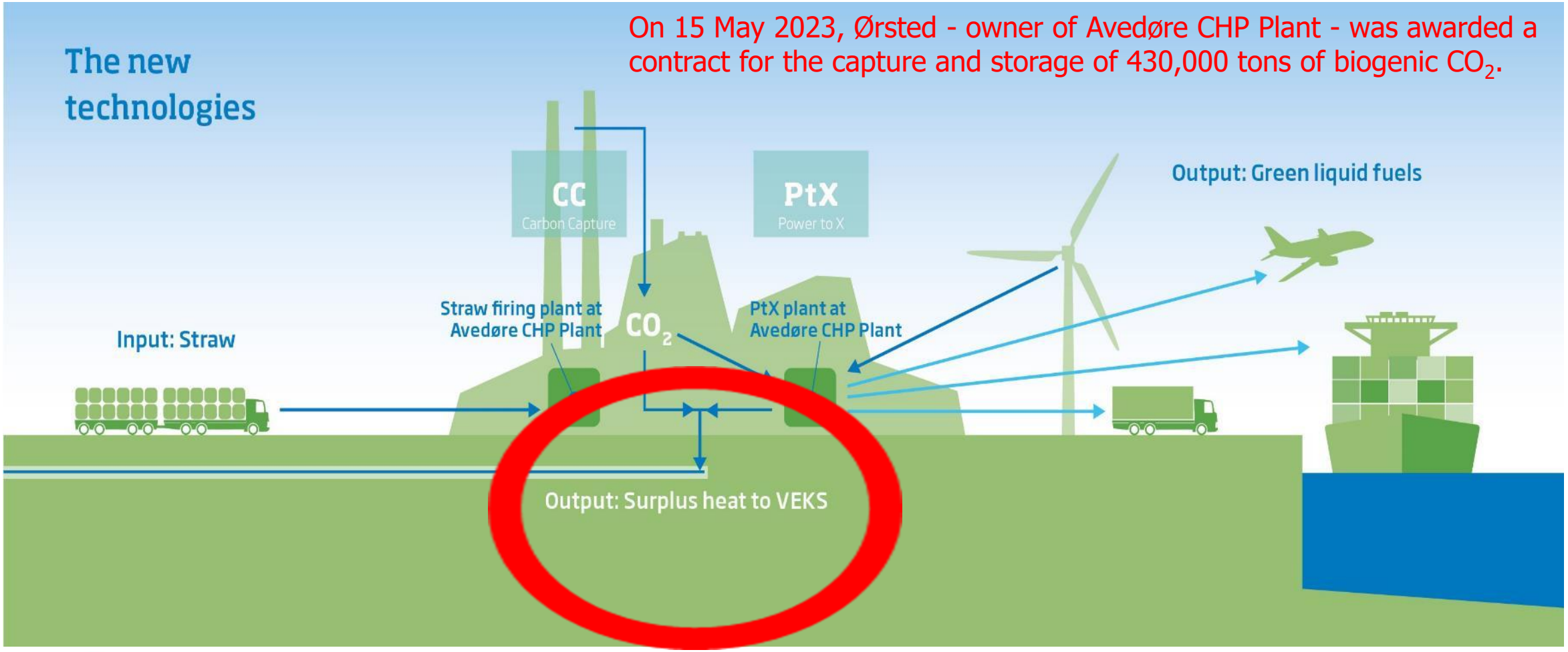



VEKS

Grøn fjernvarme til dig

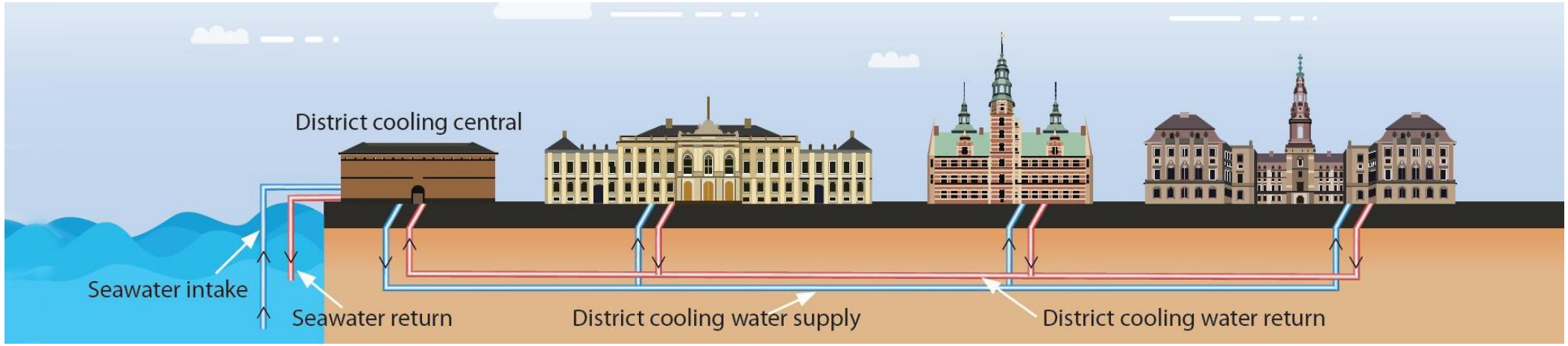
# Avedøre CHP Plant – Surplus heat from CC

On 15 May 2023, Ørsted - owner of Avedøre CHP Plant - was awarded a contract for the capture and storage of 430,000 tons of biogenic $CO_2$.



# Impact point

## District Cooling

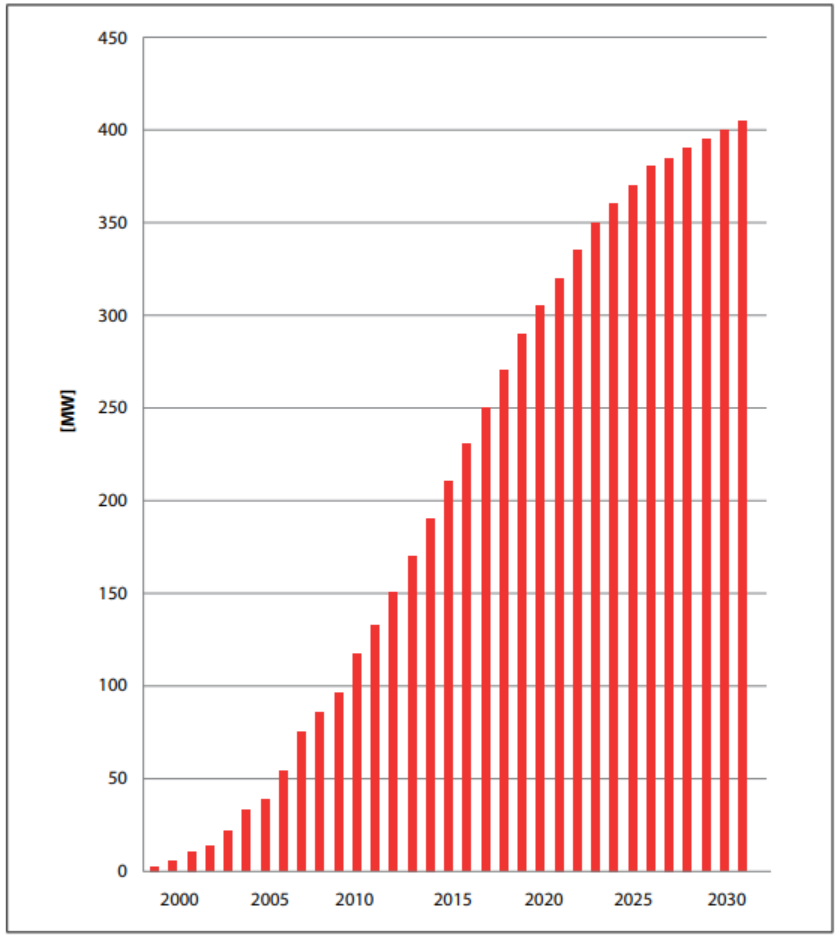


# District Cooling

- It is a fact already today more energy in the world is used to cool buildings then heating buildings.
- The energy need for cooling is also expected to grow in the future along with higher comfort requirements from emerging markets.
- To fulfil the growing cooling demand more and more countries are realizing that district cooling provides a simple, easy and cost-efficient way to provide cooling with high quality and consistent comfort.

# District Cooling

- Heating and cooling account for 55% of the global energy consumption in buildings and is currently 75% fossil-fuel based.
- Decarbonizing heating and cooling by investing in both energy efficiency and renewable energy is essential if we want to succeed with the goal of energy transition.




District cooling growth in Helsinki, Finland, from 1998 to 2012 and project growth to 2030

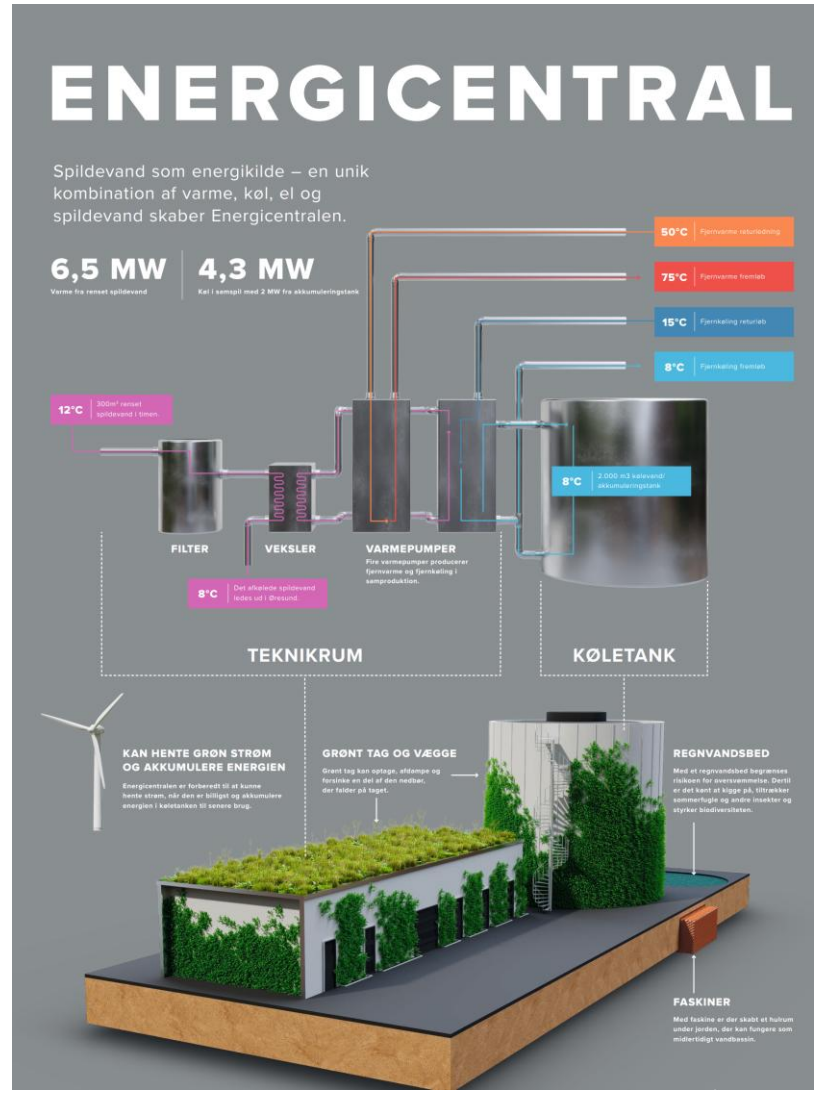
VEKS

*Grøn fjernvarme til dig*

# District Cooling

## Sewage heat pumps provide both district cooling and heating in Tårnby, DK

- The project delivers the following:
  - District cooling, sewage water and groundwater as components of the existing integrated energy system in Copenhagen.
  - A heat pump installation connected to both a 2,000 $m^3$ cold water tank and the district heating system, allowing for optimized energy production in relation to electricity prices and alternative heat production costs for all plants producing heat for the district heating system in Greater Copenhagen.
  - Reduced environmental impact through reduction of noise, vibrations and utilization of space for individual cooling equipment.



# Integration of RES
## Summary

- A modern society can integrate RES in many ways, but society's resources can only be utilized optimally if there is a well-functioning district heating system.
- Optimum utilization of our resources therefore requires that we consider district heating as an integral part of the infrastructure of every modern society - the backbone of the energy system that binds different sectors together – System Integration
- Without district heating huge RES would be lost for the society.

***Grøn fjernvarme til dig***

# Thank you

Further information:

www.veks.dk

lg@veks.dk

***Grøn fjernvarme til dig***