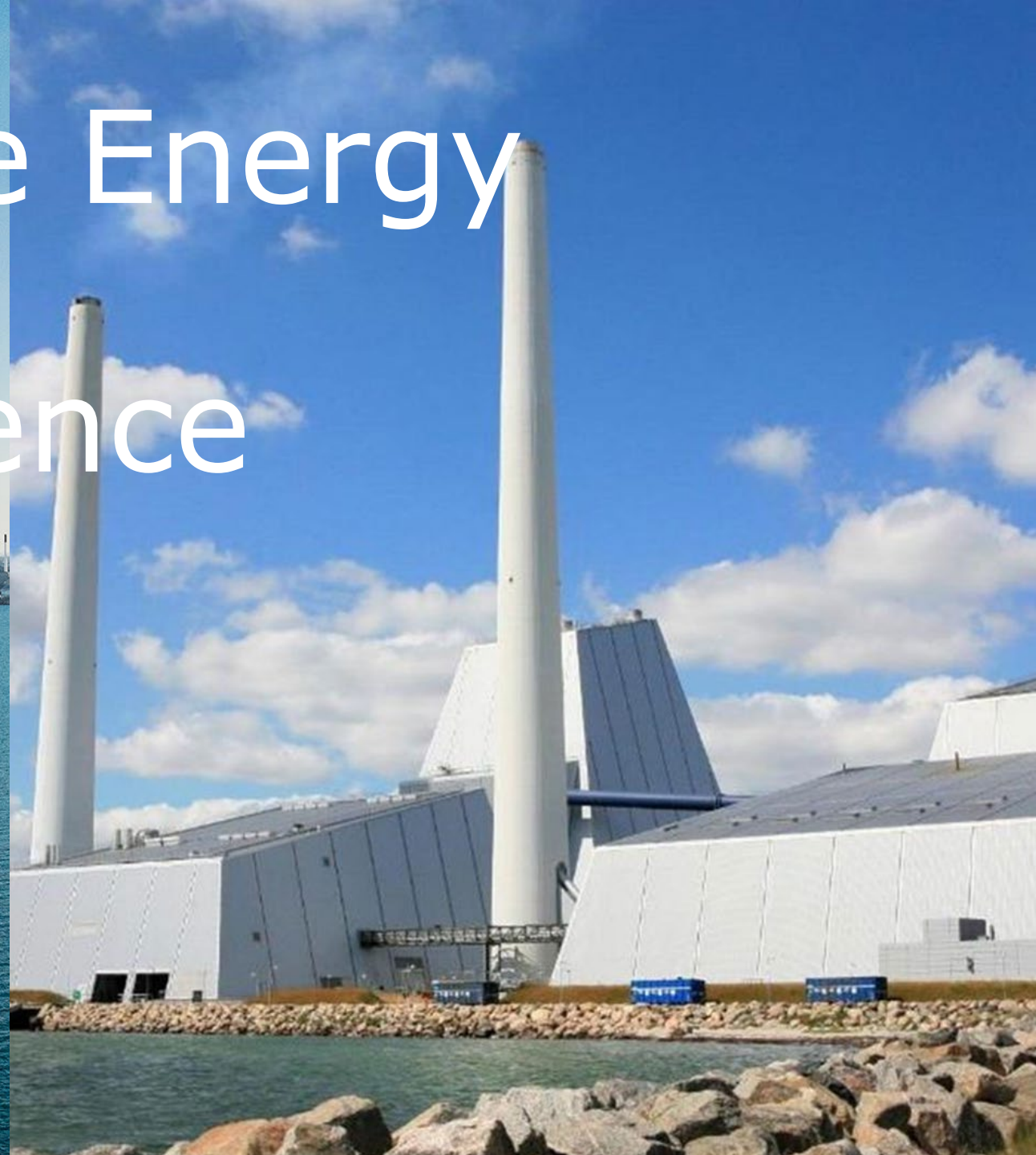


# Navigating the Energy Transition Nordic Experience

**Silviu Stoica**, GM Ramboll SEE  
19th November, 2025

**RAMBOLL**

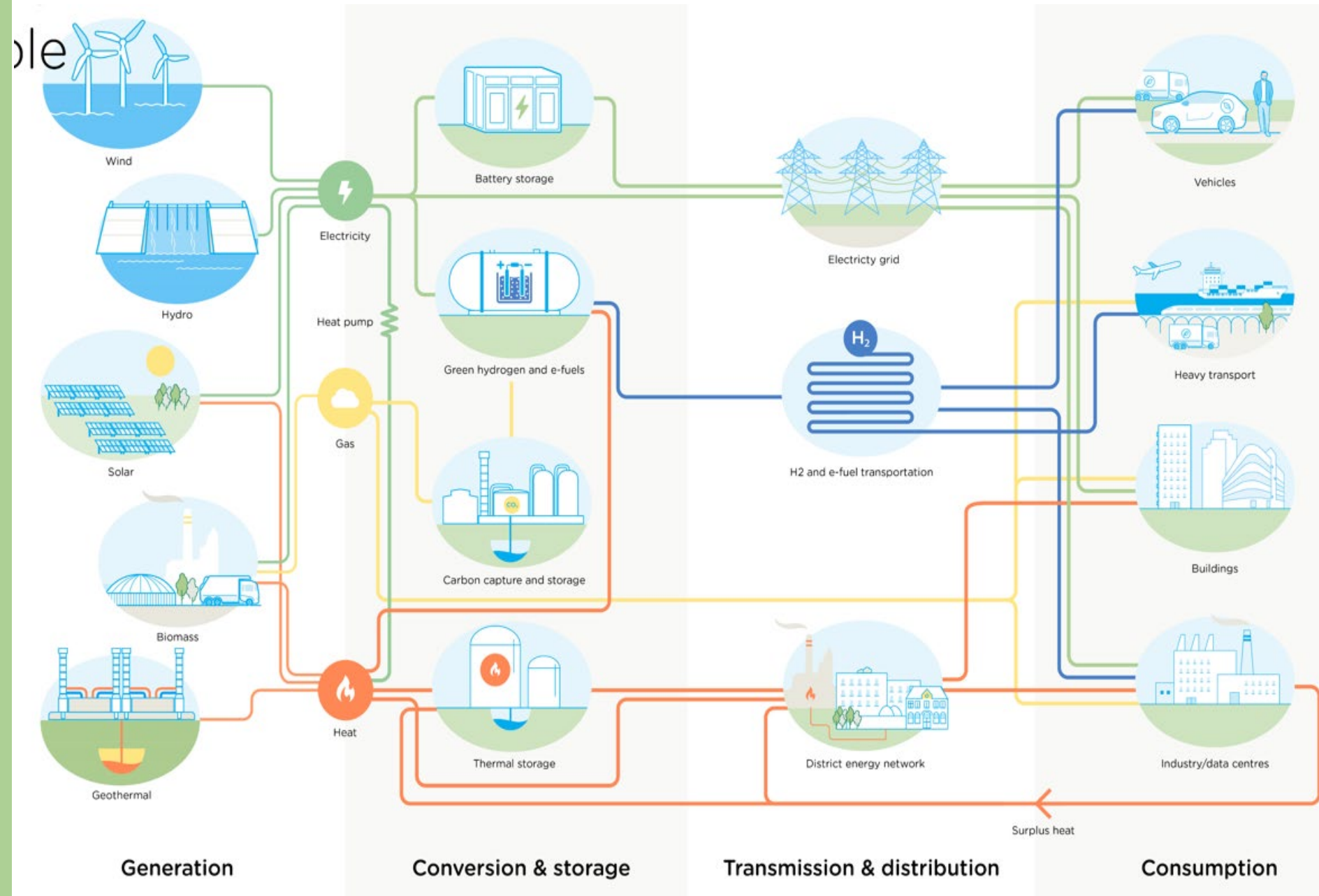
Bright ideas.  
Sustainable change.

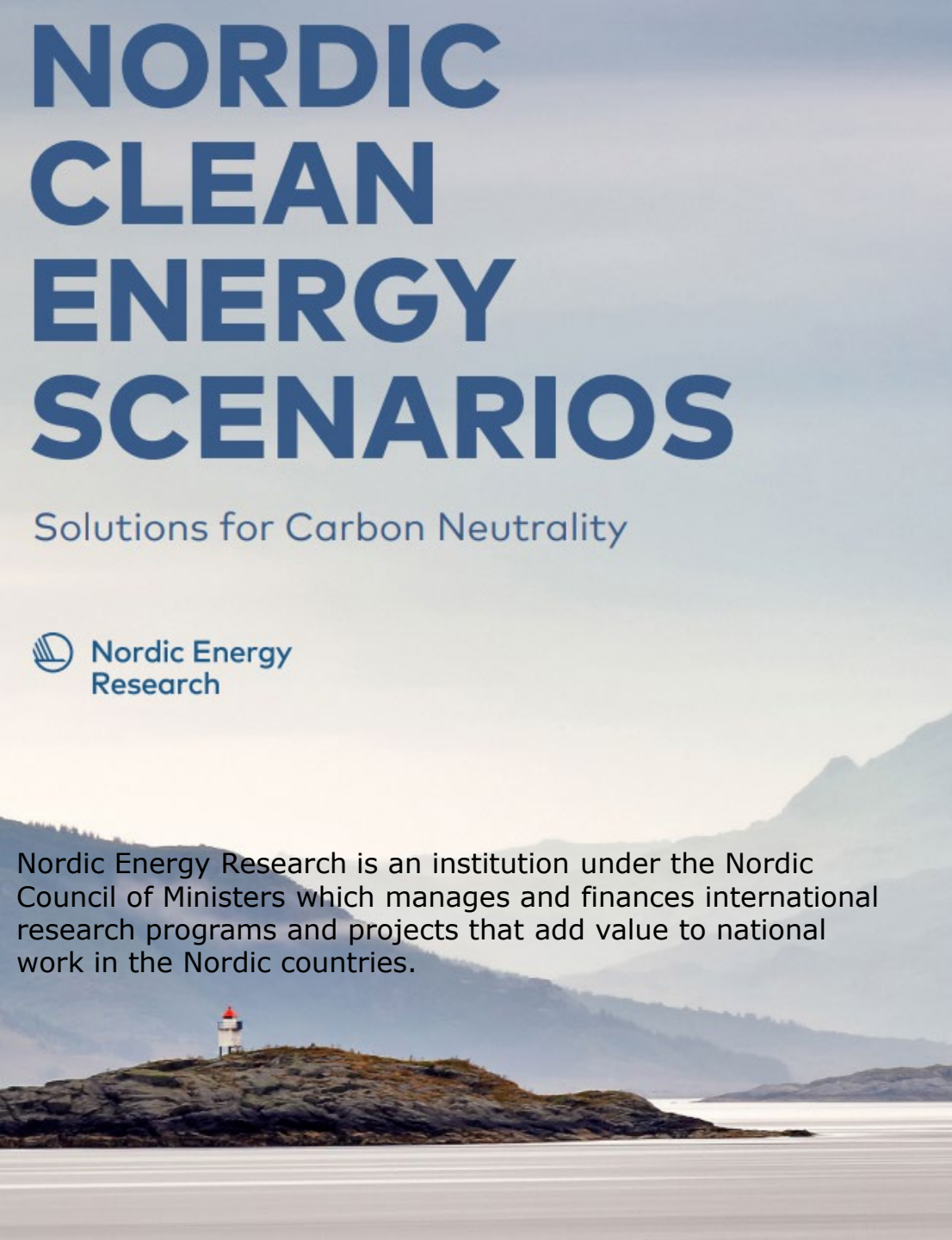


# Transition to the Future Sustainable Energy System

The **decarbonisation** megatrend coupled with **continuous increase of energy demand** will drive the transition to:

- Renewables and new technologies
- Grid capacity expansion
- Enhanced balancing mechanisms (storage and sector coupling)





# NORDIC CLEAN ENERGY SCENARIOS

Solutions for Carbon Neutrality



Nordic Energy Research is an institution under the Nordic Council of Ministers which manages and finances international research programs and projects that add value to national work in the Nordic countries.

Energy-related emissions make up 4/5 of Nordic emissions

In 2019, the Nordic countries signed a joint ***Declaration on Carbon Neutrality***.

The ***Nordic Clean Energy Scenarios Project*** aims to identify and prioritise the actions necessary by 2030 to respond to the 2 imperatives:

- reach carbon neutrality
- and meet energy demand.

# The Nordic Clean Energy Scenarios Project

## Three scenarios - different pathways to carbon neutrality

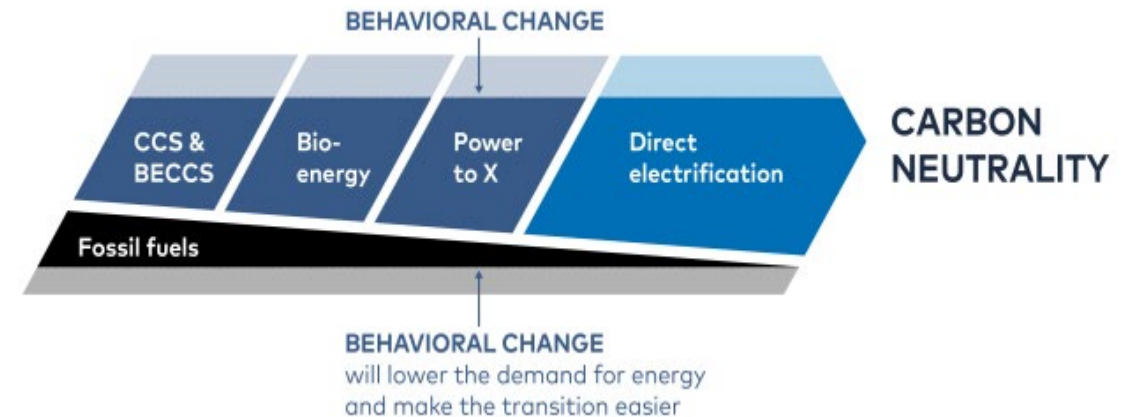
**Carbon Neutral Nordic (CNN):**  
the least-cost measures considering the national plans, strategies, targets.

**Nordic Powerhouse (NPH):**  
Nordics playing a larger role in European energy transition by providing clean electricity, clean fuels, carbon storage.

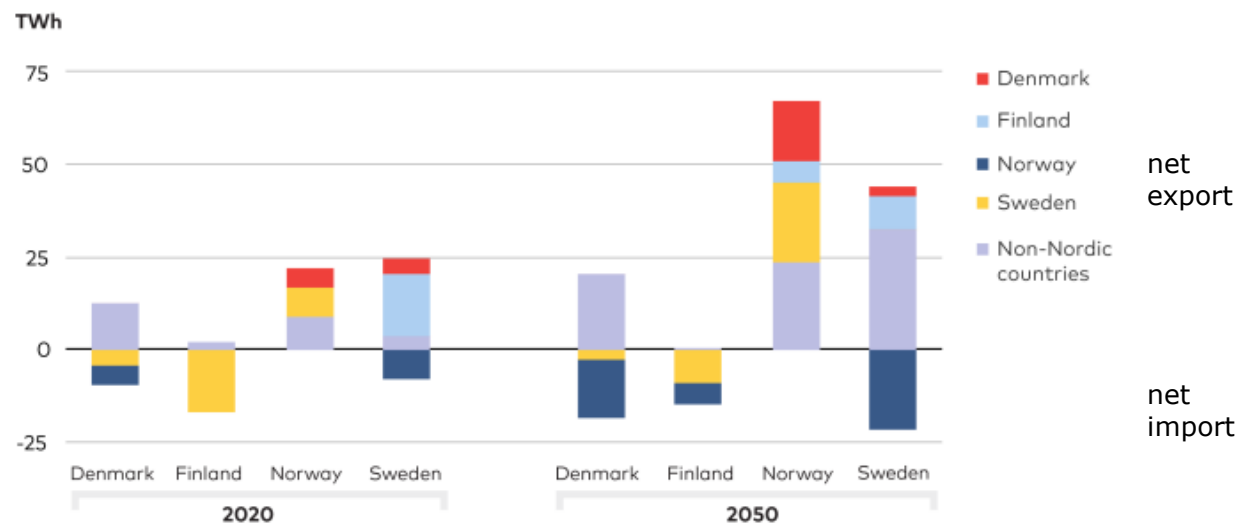
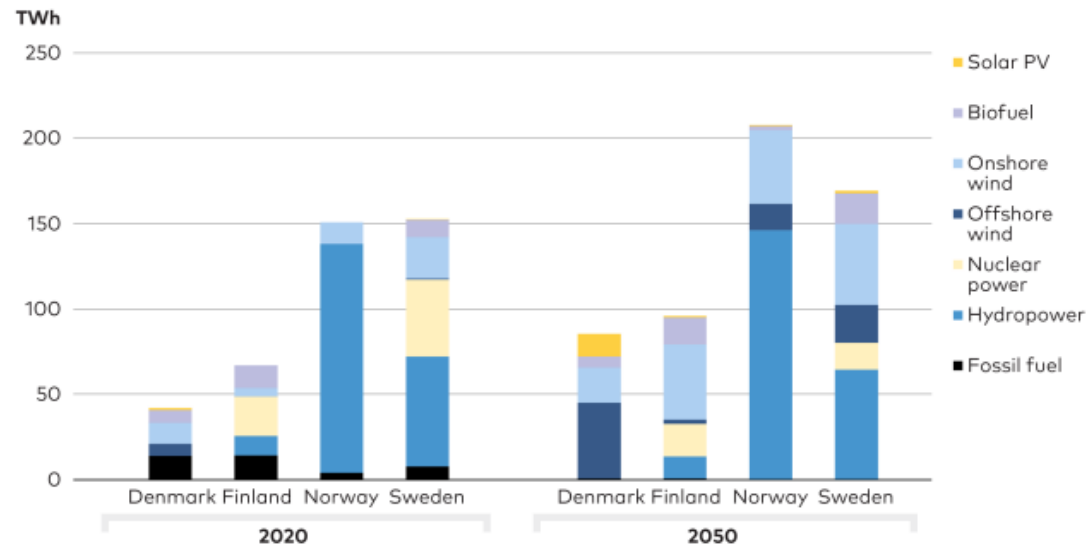
**Climate Neutral Behaviour (CNB):**  
lower demand by adoption of additional energy and material efficiency measures in all sectors.

Regardless of which decarbonisation pathway:

- a balanced mix of new technologies, infrastructure, and behaviour change to lower demand is required
- energy efficiency is vital
- sector coupling reduces energy system losses.



# The integrated Nordic power market strengthens the Nordics' Role in the European transition



An integrated and more balanced future Nordic power system in 2050:

Increase the exchange capacity between the Nordic bidding zones by 60-70%, infrastructure and interconnectors.

Norwegian hydropower balancing wind, onshore (N-Norway, Sweden, Finland), and offshore (Denmark, Sweden).

Swedish and Danish transmission grids and interconnectors facilitate large net electricity exports transit from Norway to Europe.

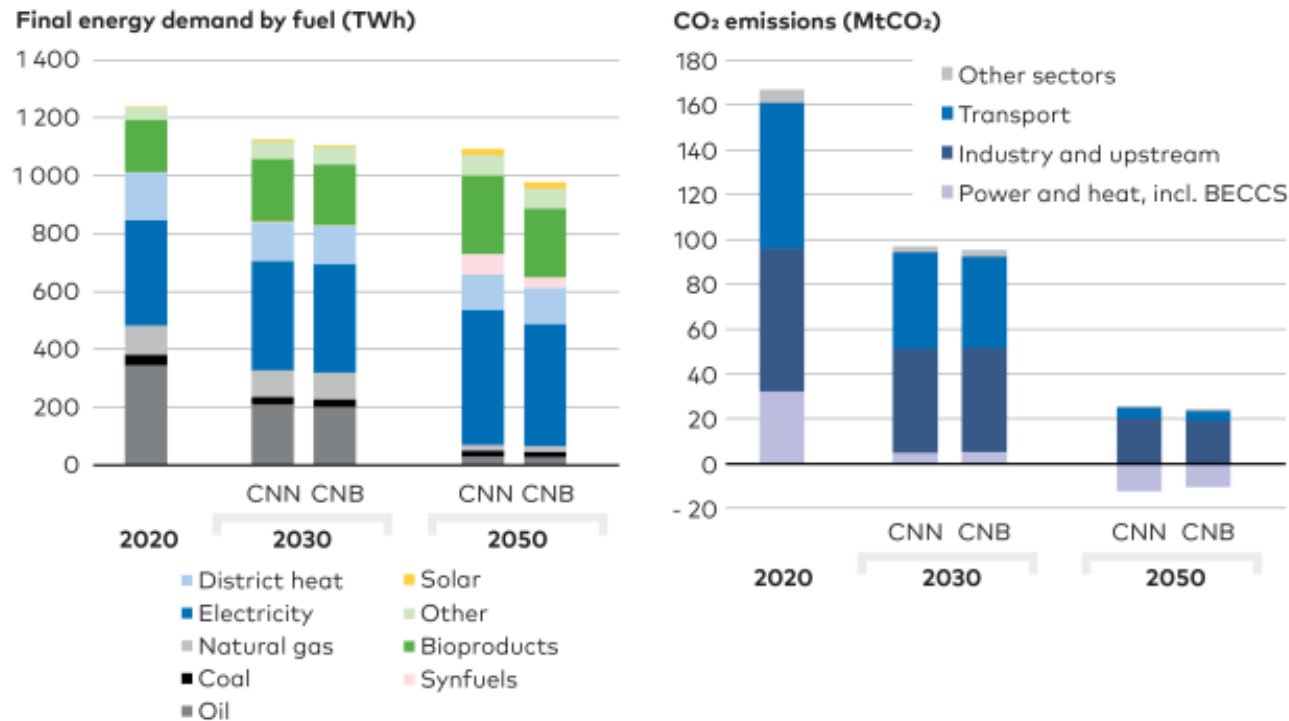
Nordics to scale up power generation, by >x3, considering the PtX fuels export opportunity to Europe.

A PtX roadmap and best sites for production next to power grids and district heating networks to maximise energy efficiency and minimise infrastructure cost.

The large presence of bio-based sectors and bioenergy in district heating, opportunities to reach negative emissions.

A Carbon capture and storage strategy is essential, driving economy of scale.

# Behavioural change will direct impact the Nordic energy transition



Final energy demand (left) and CO<sub>2</sub> emissions (right) in CNN and CNB scenarios

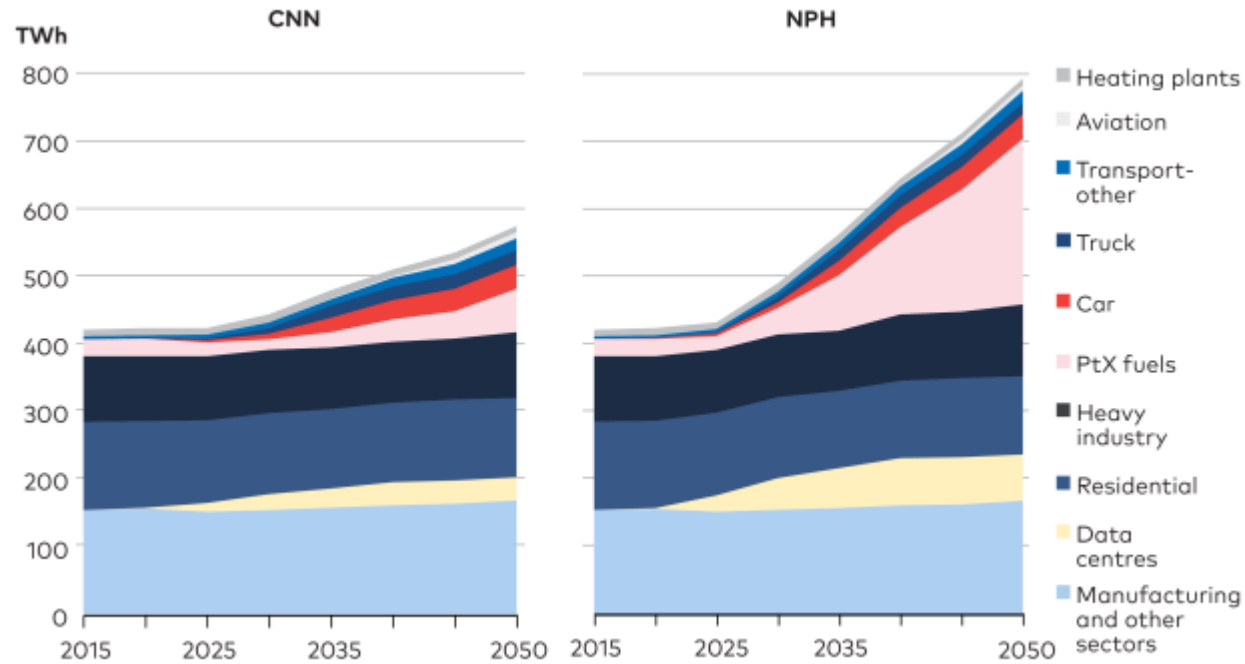
*By 2050, compared to CNN, in the CNB: passenger transport demand is reduced by 20%, industrial energy demand by 10%, freight transport volumes by 5%, final energy demand falls by 17% and power demand by only 5%.*

Carbon neutrality is achieved in all scenarios, but the behavioural change to reduce energy demand could buy time for the transition, reduce pressure on biomass resources, reduce costs of infrastructure build and create co-benefits (decreased transport congestion, improved air quality)

Total system costs by 2050 in the CNB are about 10% lower than the CNN.

CNB, the lowest demand growth scenario, requires a massive scale-up of electricity generation.

# Direct electrification is central to all decarbonisation strategies



With strong electricity grids and large hydropower reservoirs, the Nordic region can leverage the falling costs of renewable electricity generation to accelerate deployment of electric end-use technologies.

**Projected growth in Nordic electricity demand:** by 40-100% in all scenarios, with transport and PtX fuels being the main drivers.  
**Electricity's share of final energy consumption** rises from around 30% in 2020 to 50% by 2050

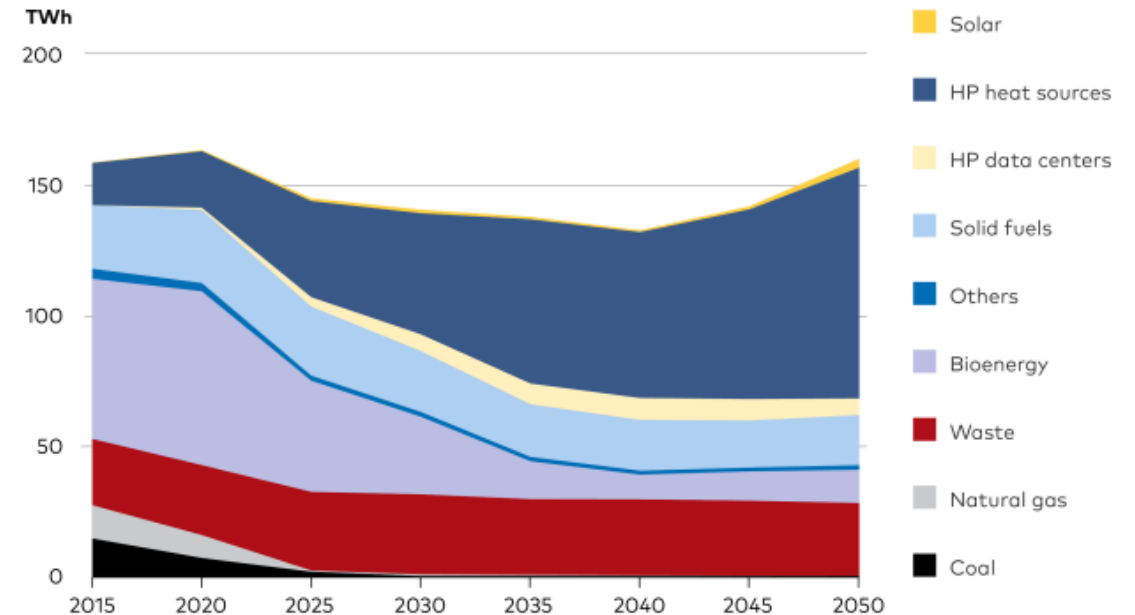
# Sector coupling by district heating creates additional value

Integration of markets for heat, electricity, and gas, including sector coupling, will unlock new flexibility resources.

Electrification of district heating production can happen by **introducing large scale heat pumps utilising different and new heat sources**: ambient heat, seawater, industrial waste heat, and surplus heat from data centres.

The share of heat pumps increases mainly driven by waste heat from PtX plants and bio-refineries.

Such synergies would also reduce reliance on biomass, freeing up currently used resources for other parts of the economy where they have higher value.



**Figure 3.11. Development of district heat production - CNN scenario.**  
District heat production in the Nordic countries in CNN scenario divided on energy type.

# District Energy Ramboll project cases

# Ramboll in District energy



35

Countries covered by  
global office network

1945

Year when founded in  
Denmark

1990

Year since presence in  
Romania



10

Market areas: [energy](#), real  
estate, transport, water,  
waste, industry, finance,  
technology, healthcare &  
public sectors

+50

Years of experience in  
planning, design and  
implementation of  
[energy solutions](#)

+40

Years of [district energy](#)  
experience



Top 10

Leading energy consultancies in  
Europe, and [one of the most  
experienced district energy  
consultants in the world.](#)

#1

We have developed [the  
world's largest pit thermal  
energy storage facility](#)

>250

District energy systems  
around the world



>18,000

In Energy: **1,750**

Multidisciplinary  
Experts





# Copenhagen district heating system, Denmark

## **The challenge**

Develop an integrated 160 km transmission network to utilise all available heat sources in the Copenhagen region in the most efficient way.

## **Our approach**

Ramboll has since 1970 provided a wide range of consultancy services to most of the energy companies and authorities in the region, including heat supply planning for most of the municipalities; planning, design and implementation of the heat transmission networks and more than 10 distribution networks; design of three waste-to-energy plants and a sludge incineration plant; design of CHP plants and heat accumulators; rehabilitation of old district heating networks for several of the district heating companies; and stationary and pressure transient hydraulic analysis of the whole transmission system.

## **The result**

One of the largest city-wide district heating systems in the world, supplying one million people with 30,000 TJ of green heat annually.



# Citigen: Heat pumps in London, UK

## **The challenge**

Turn London's Citigen energy centre into one of UK's largest combined heating and cooling heat pump low-carbon energy systems.

## **The result**

Ramboll designed three heat pumps with a capacity of 4 MW heating and 3 MW cooling, supplemented by three 200-metre-deep ground boreholes for energy balancing. The solution is expected to generate heat with 50% fewer CO2 emissions.



# Avedøre power plant, Denmark

## **The challenge**

Develop the plant's continuous and flexible adaptations to new fuel types and establish a state-of-the-art multi-fuel production of power and heat, including a pressurised heat storage tank.

## **The result**

The Avedøre power plant is one of the most energy efficient plants in the world. It exploits up to 94 percent of energy in the fuels and operates with an electrical efficiency of up to 49 percent.

It generates heat for more than 215,000 households and enough power to supply electricity to one third of Zealand, corresponding to 1.3 million households.



# Sector coupling between district heating, cooling and wastewater, Taarnby utility, Denmark

## The challenge

Establish a new district cooling system based on smart sector integration with the existing district heating network in the new mixed-used urban and business area near the Copenhagen airport.

## The result

The project is a showcase for smart energy solutions.

The synergies between district heating, district cooling and wastewater are exploited, and no energy is wasted. Energy can be stored and electricity used when it is greenest and cheapest.

It is a contribution to the green transition, cost-efficient for the consumers and a good business case for Taarnby Utility.

# Heat extraction from data centre, Odense, Denmark

## The challenge

Design a solution that extracts surplus heat from Meta-owned data centre in Odense and redistributes it via Denmark's largest heat pump, established by district heating company Fjernvarme Fyn.

## The result

With Ramboll's solution, the plant will recover 175,000 MWh of energy from Meta's data centre and redistribute the surplus heat to the district heating network in Odense. The plant will provide heat to more than 12,000 homes, reducing the city's reliance on coal, and supporting the transition to green energy.



Bright  
ideas.  
Sustainable  
change.

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