



# Nordic Energy Technology Perspectives 2016

Cities, flexibility and pathways to carbon-neutrality



# Presentation of key results

Benjamin Donald Smith

Nordic Energy Research

19.05.2016, Bonn

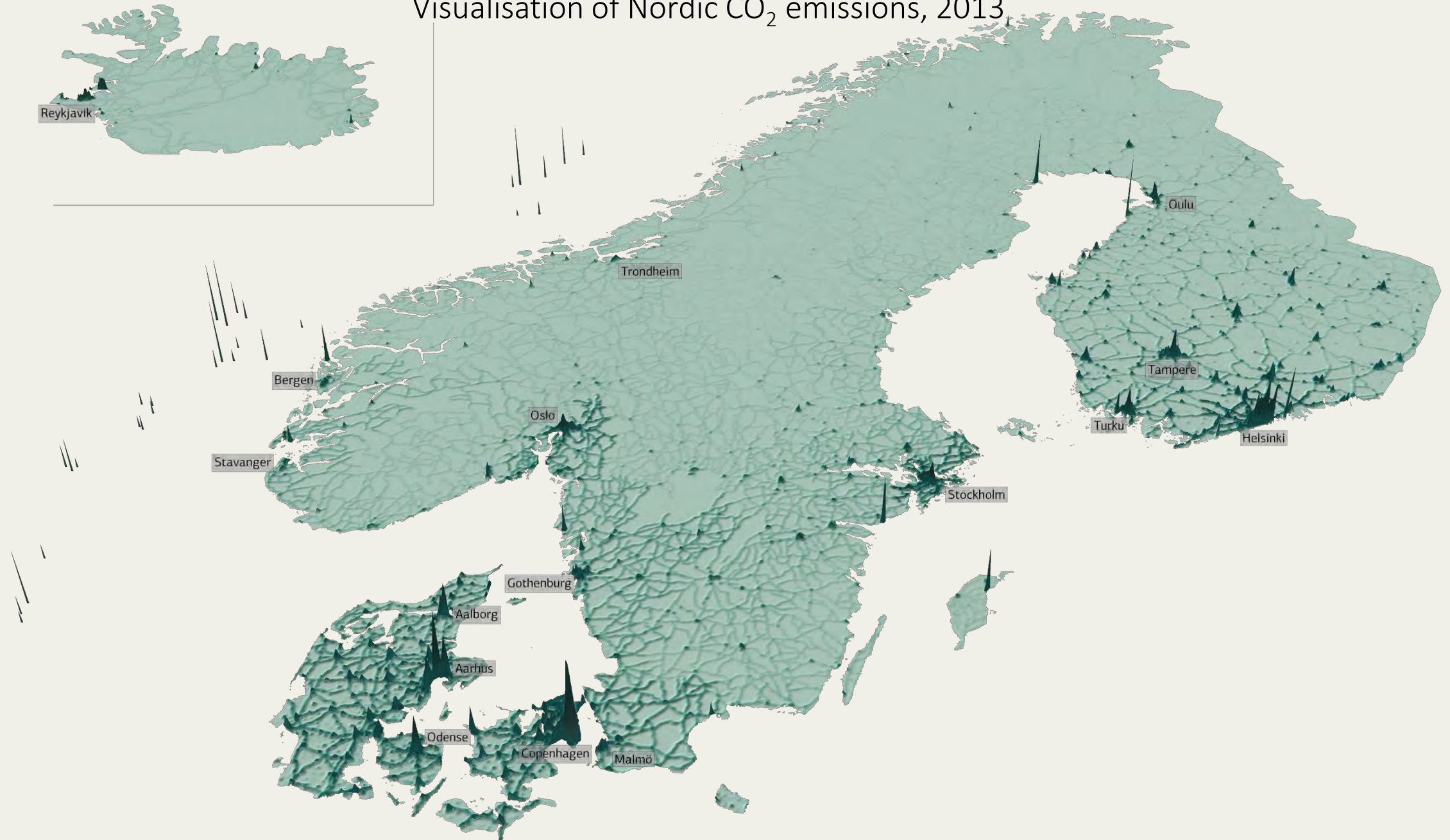
# Three strategic actions

1. Incentivise and plan for a more distributed, interconnected and flexible energy system
2. Tap into the positive momentum of cities in transport and buildings
3. Ramp up decarbonisation of long-distance transport and the industrial sector





Visualisation of Nordic CO<sub>2</sub> emissions, 2013





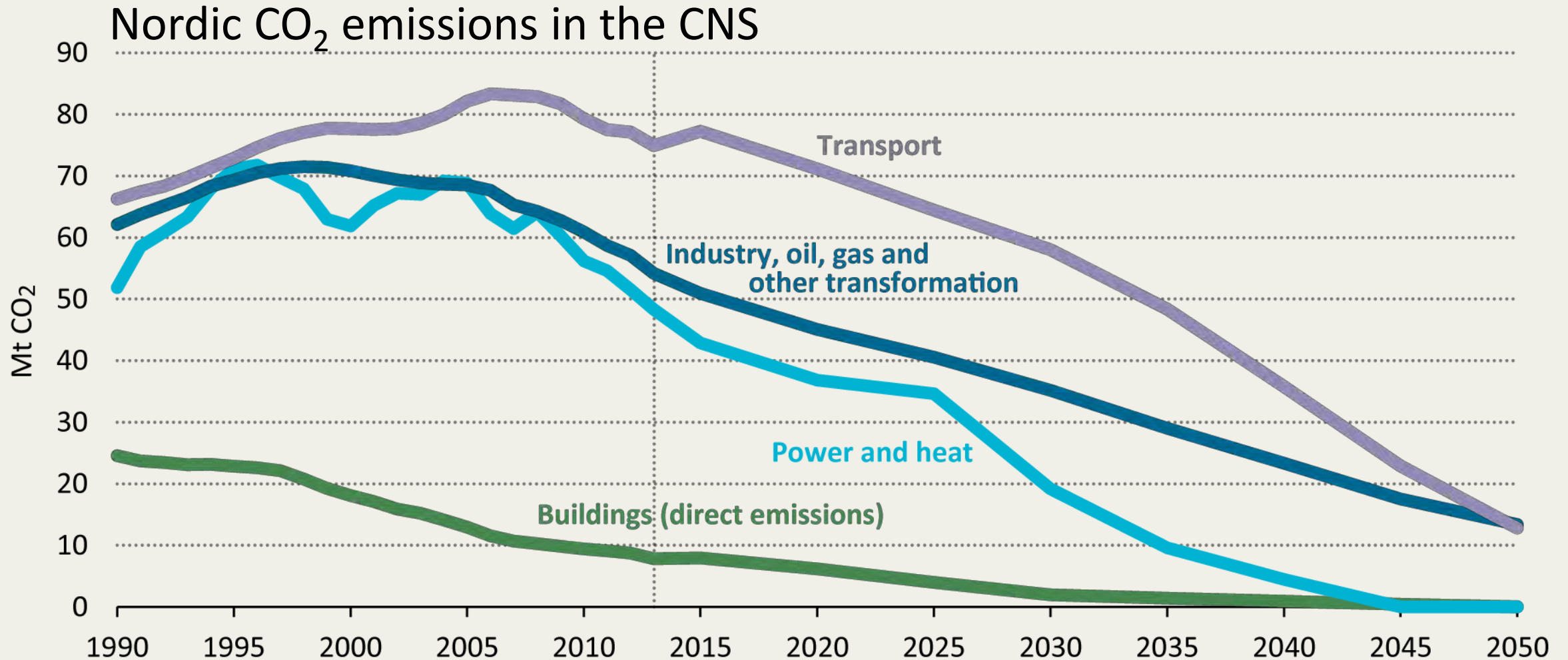


Tampere

Turku

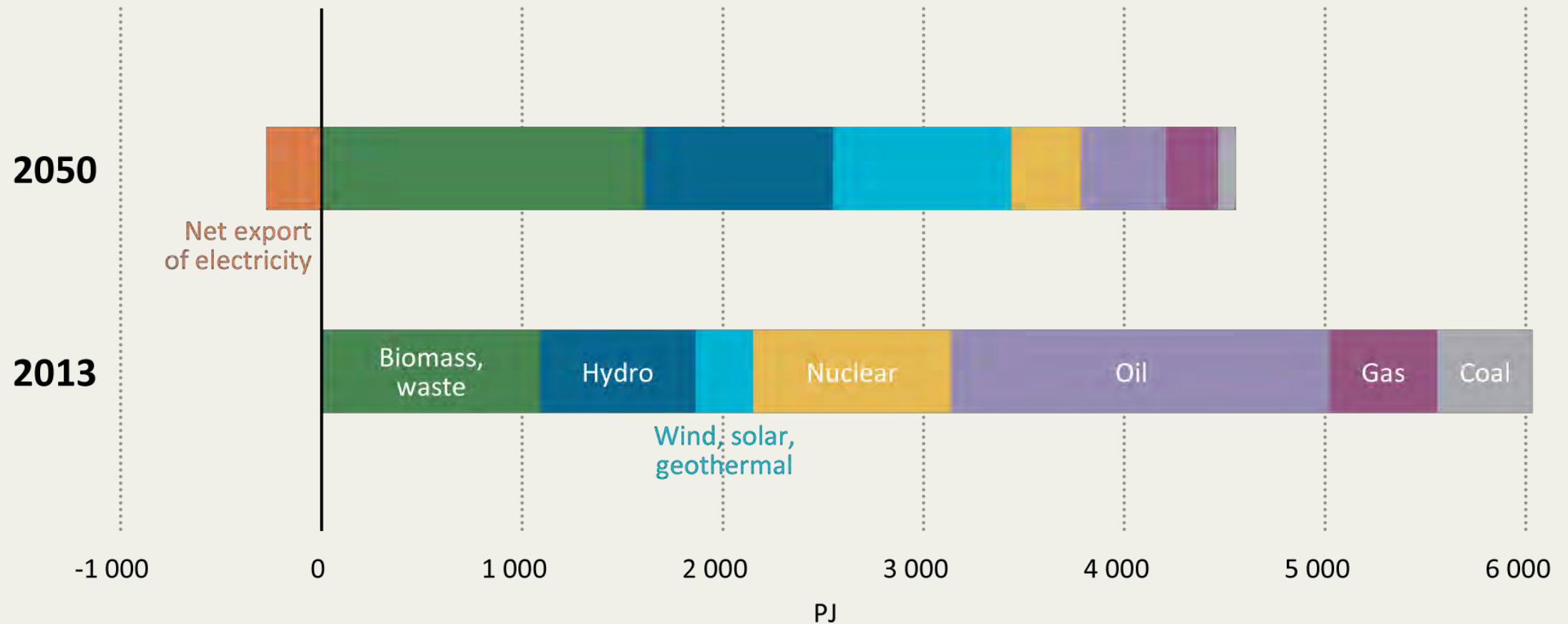
Stockholm

# Demand sectors most challenging



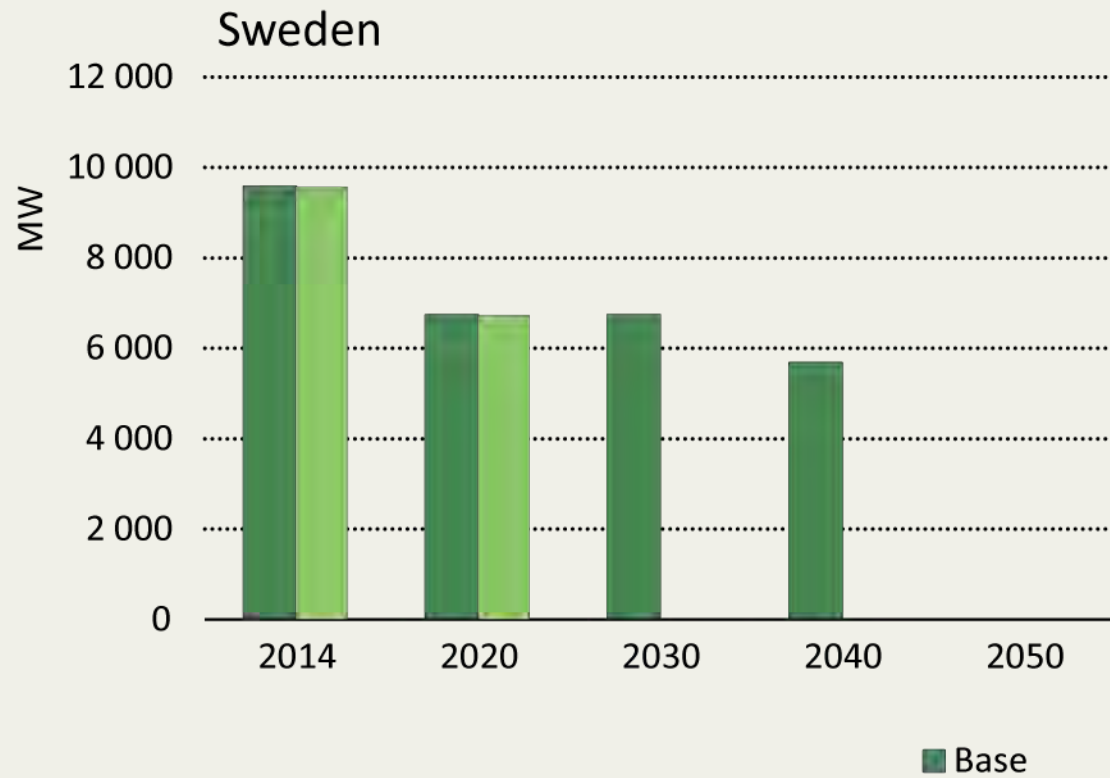
# Transforming the energy system

## Nordic Total Primary Energy Supply in the CNS



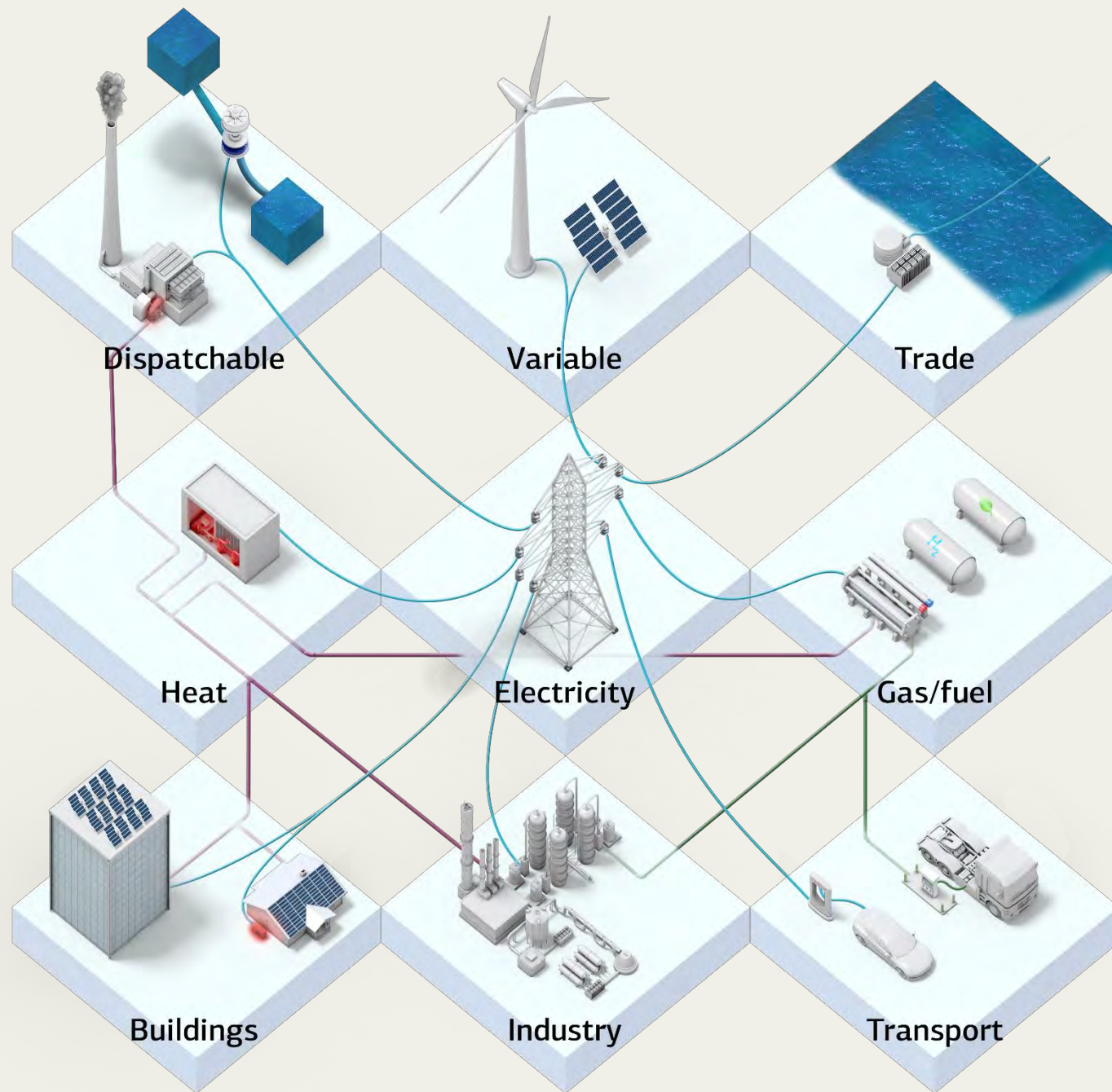
# Early nuclear phase-out increases emissions

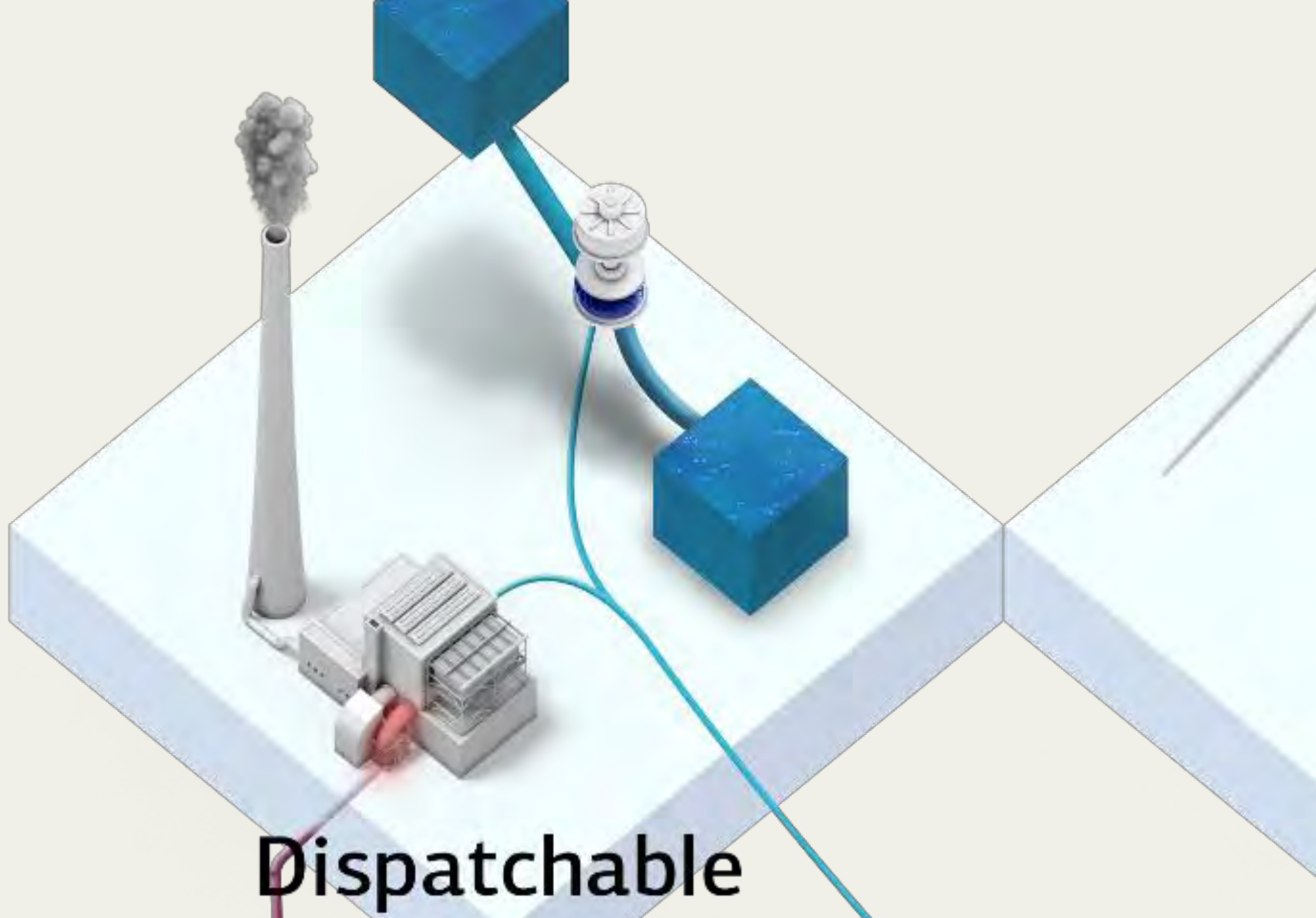
Nordic nuclear capacity in the CNS and a fast phase-out sensitivity analysis





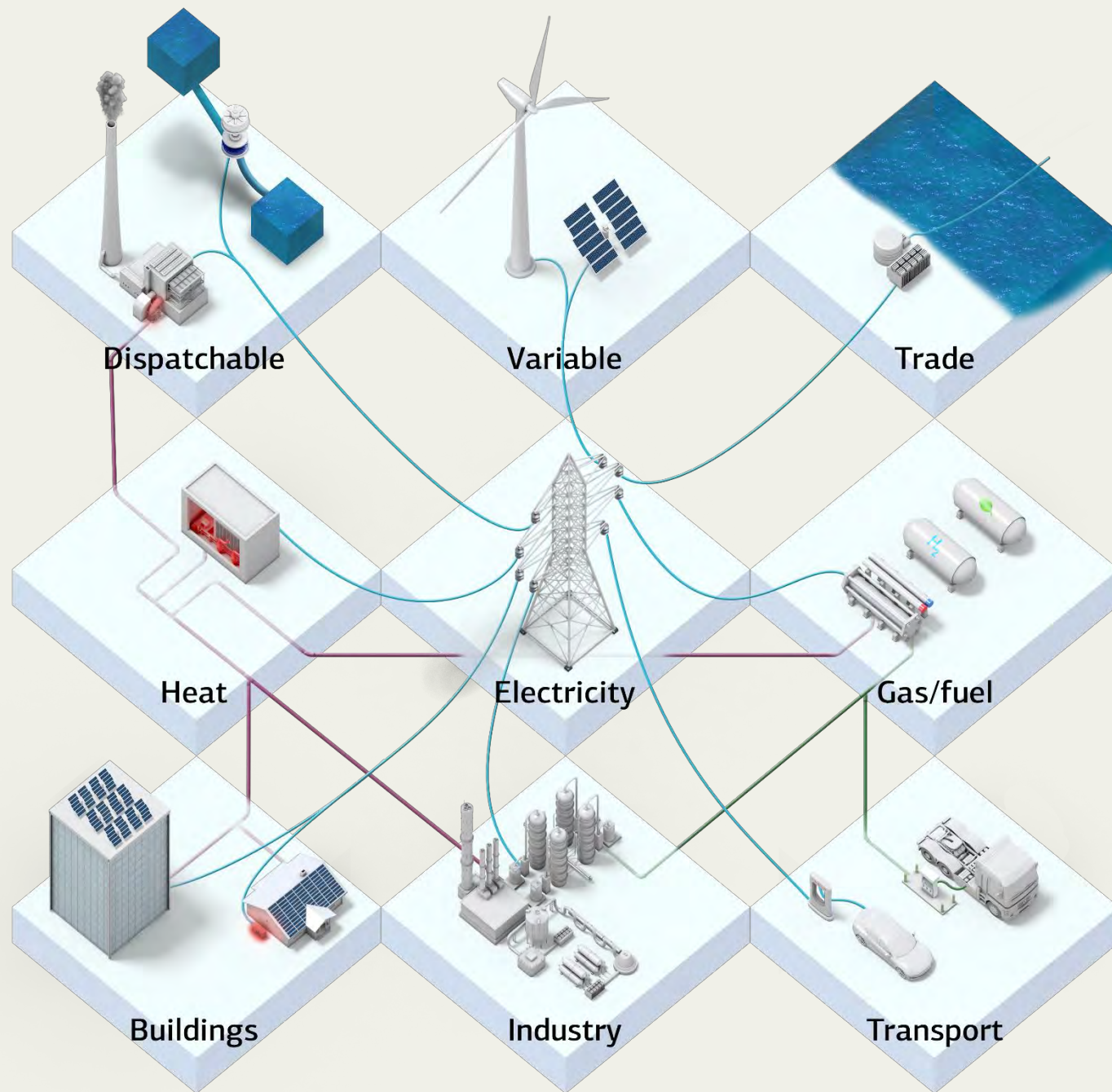






**Dispatchable**



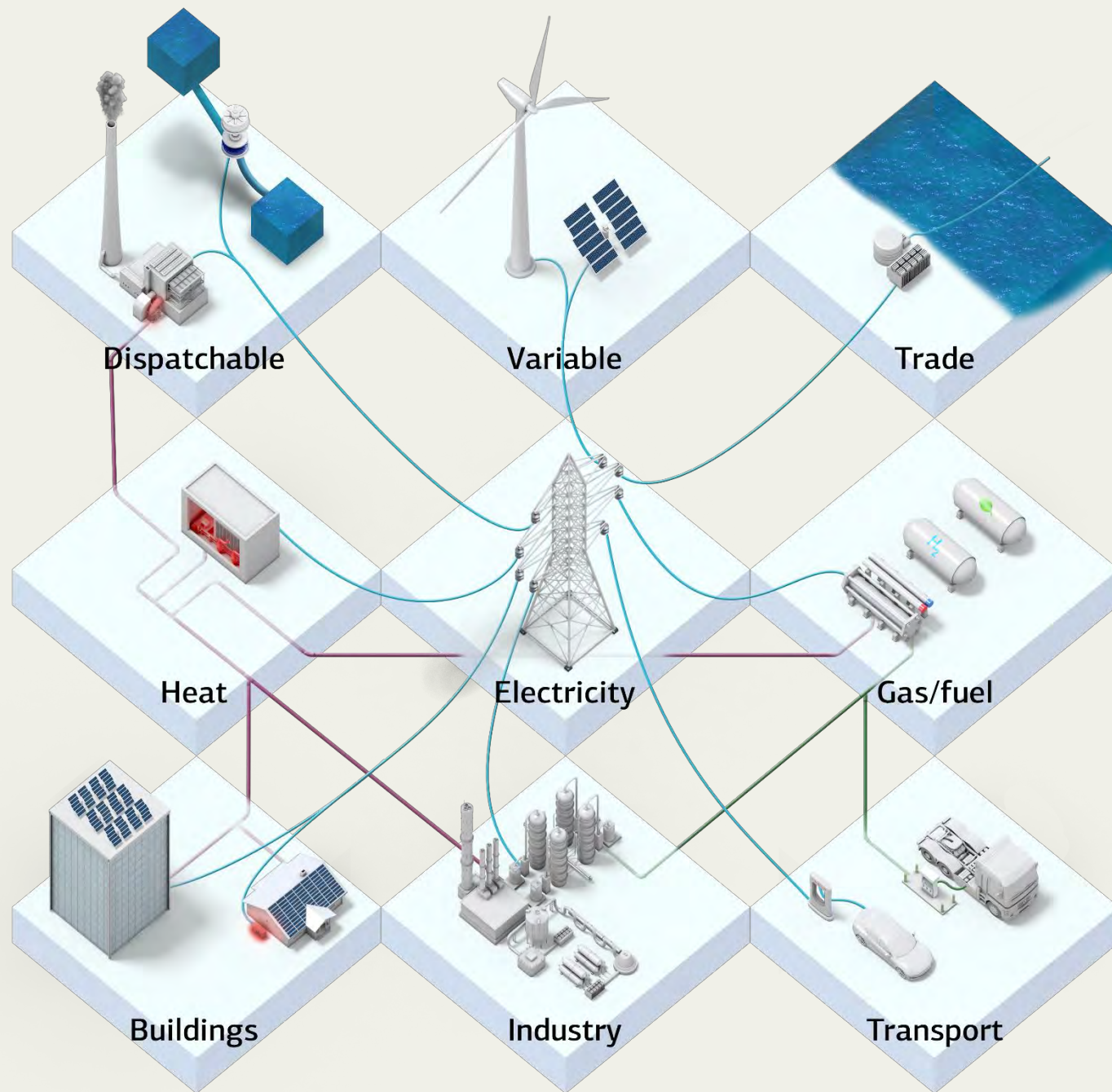


A 3D perspective diagram of a utility-scale heat pump system. A grey rectangular unit with red internal components sits on a light blue platform. A network of purple and teal lines, representing pipes or conduits, connects the unit to other parts of the system, including a circular structure on the right. The background is a light tan color.

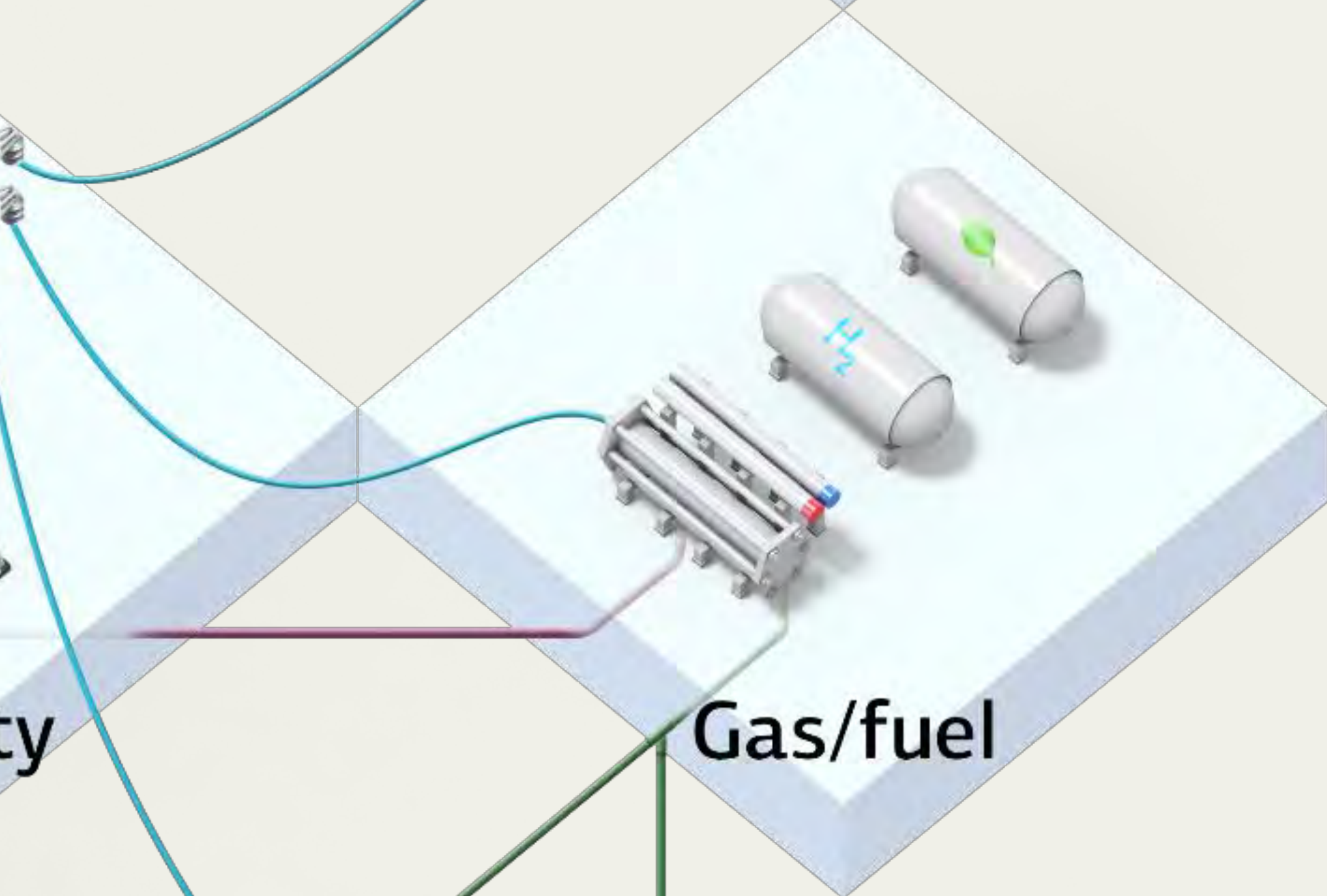
**3-4 GW**

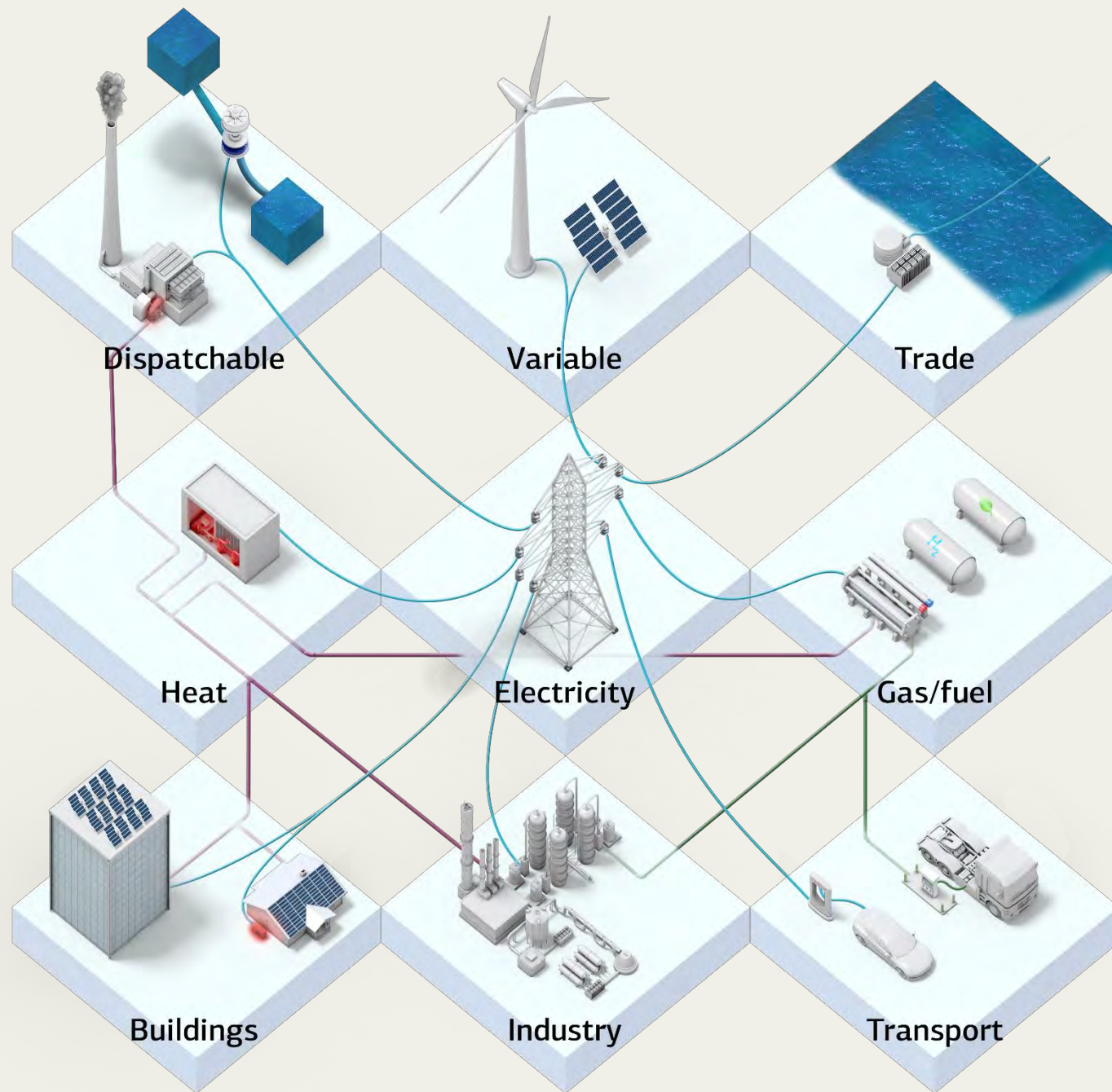
of utility-scale  
heat pumps in 2050

**Heat**













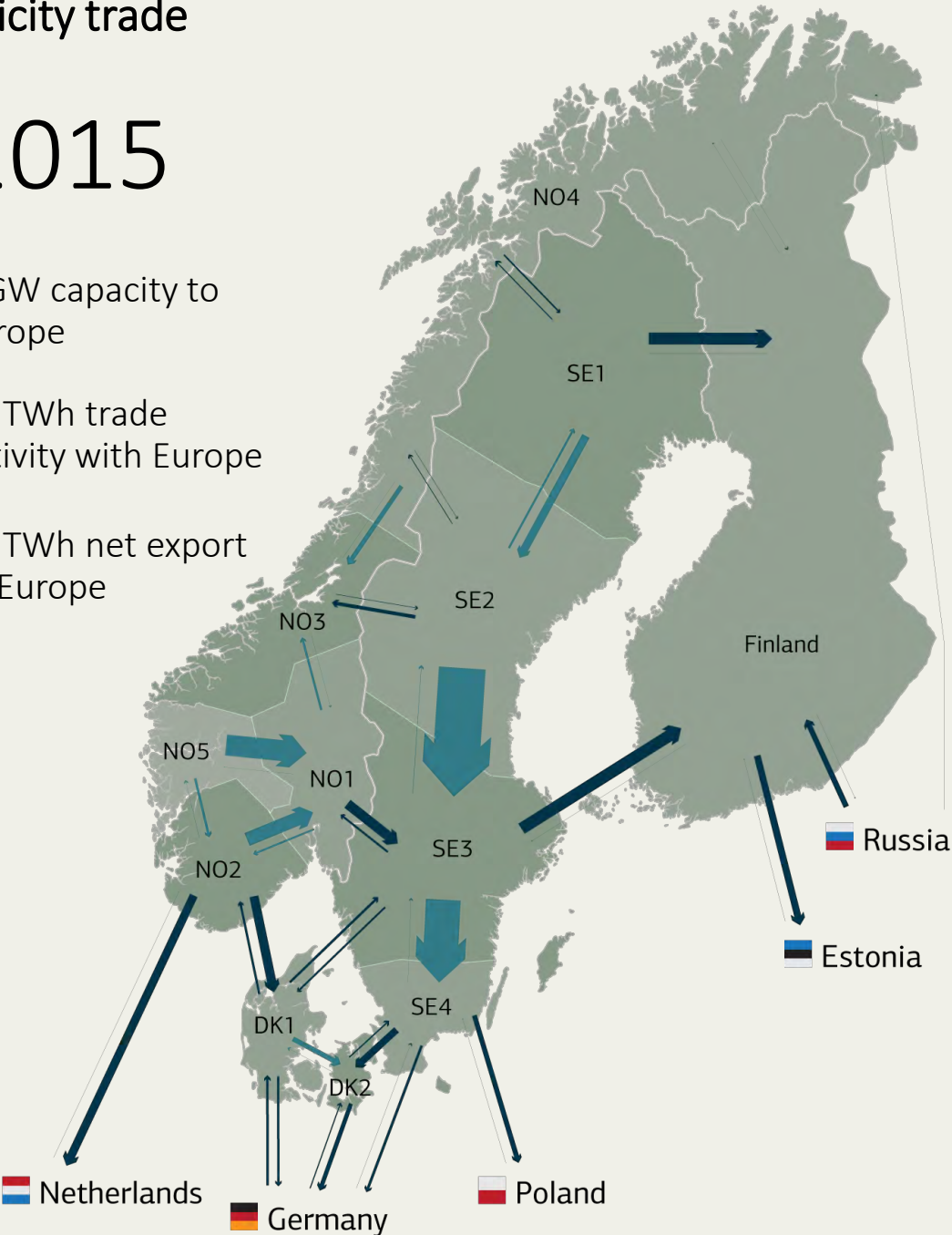
Electricity trade

2015

5 GW capacity to Europe

28 TWh trade activity with Europe

14 TWh net export to Europe

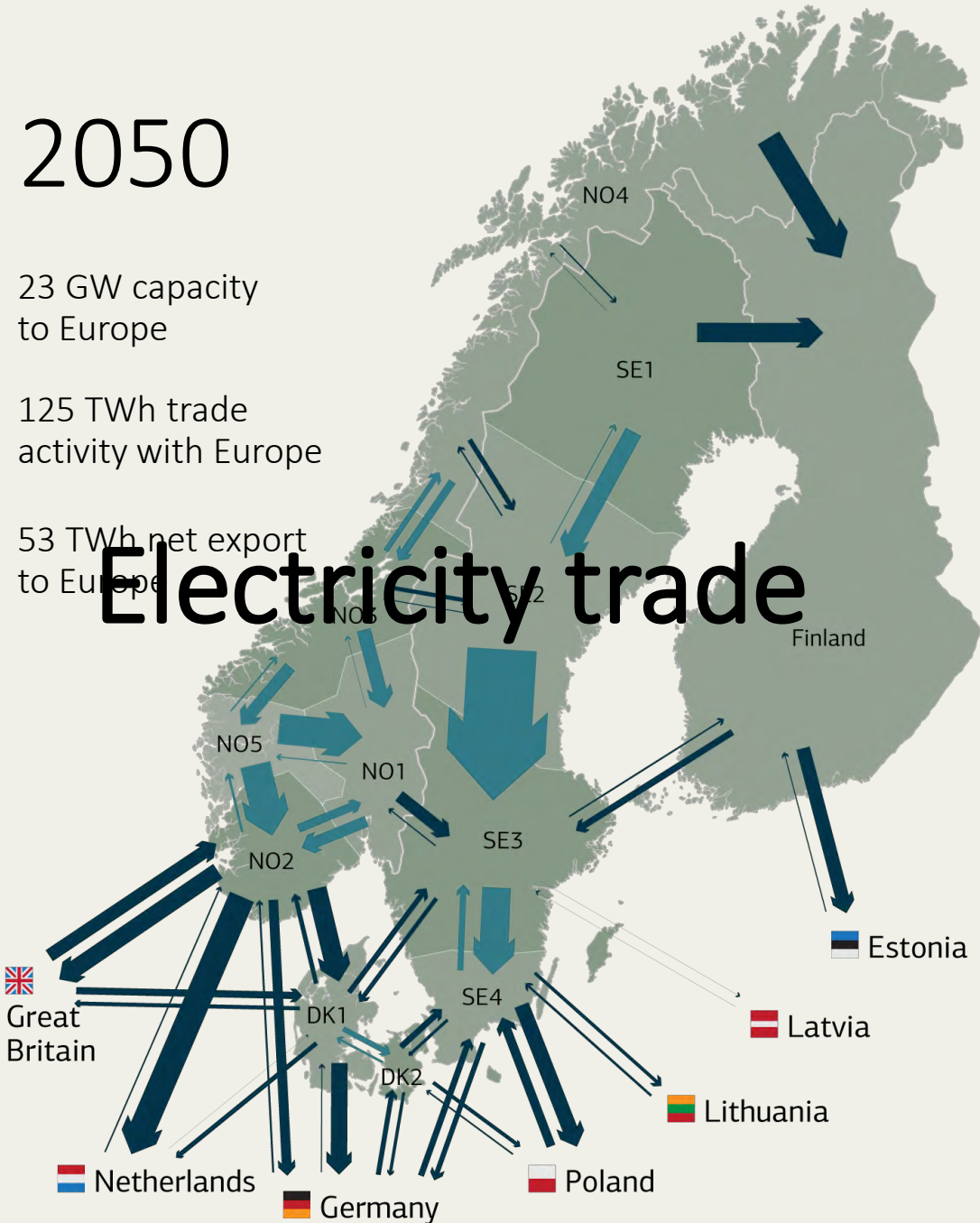


2050

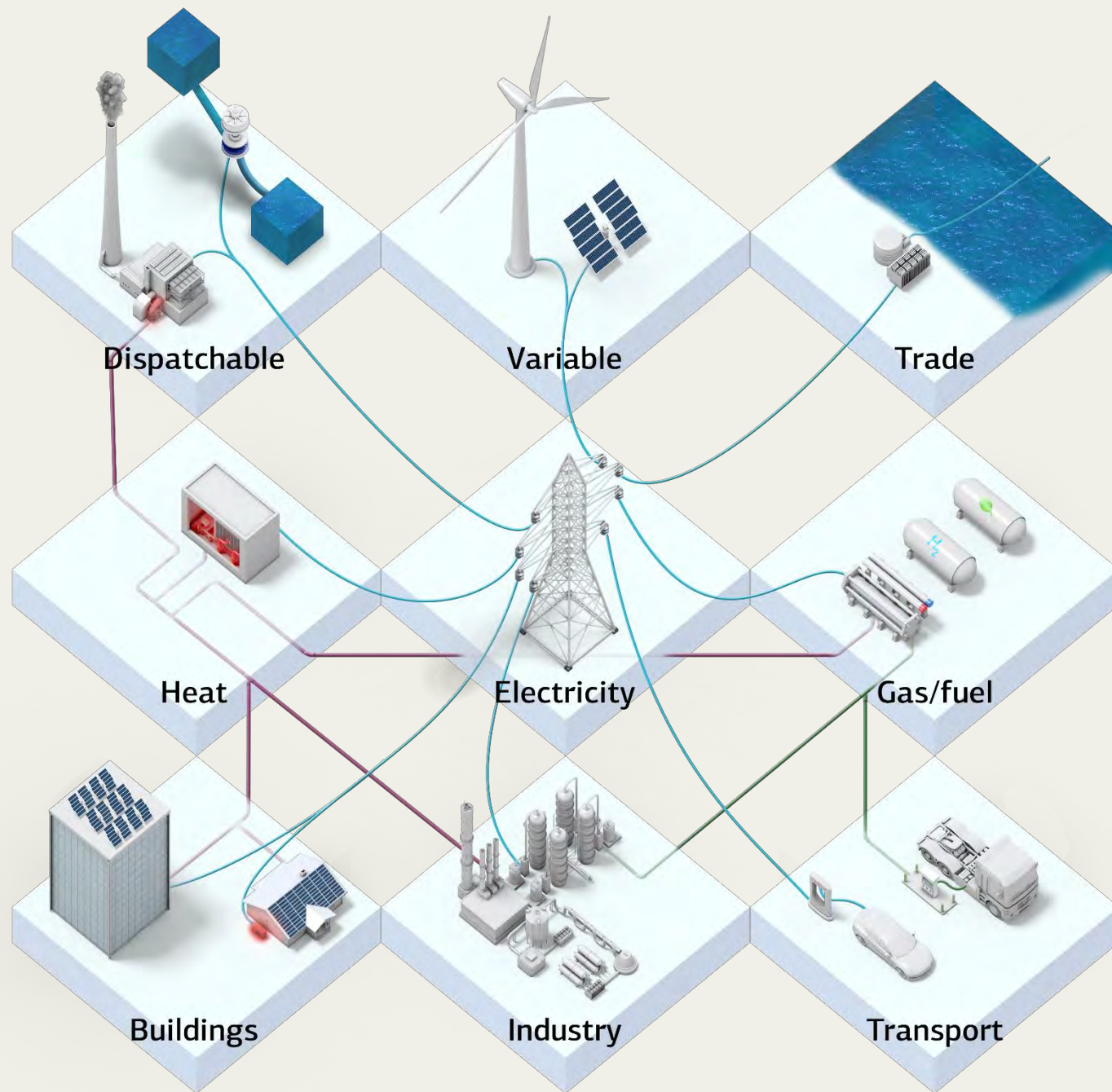
23 GW capacity to Europe

125 TWh trade activity with Europe

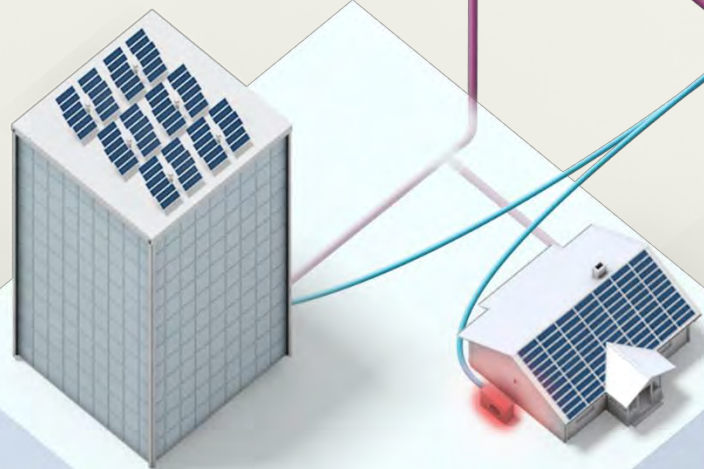
53 TWh net export to Europe



Electricity trade



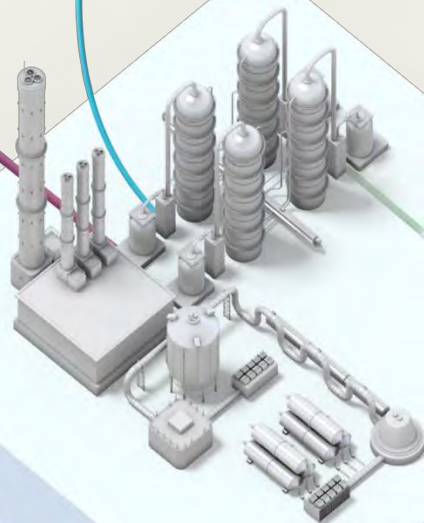




**Buildings**

**5-6 GW**

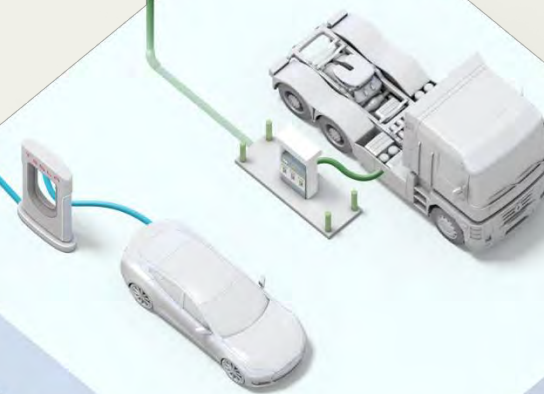
in 2050



**Industry**

**5-6 GW**

in 2050

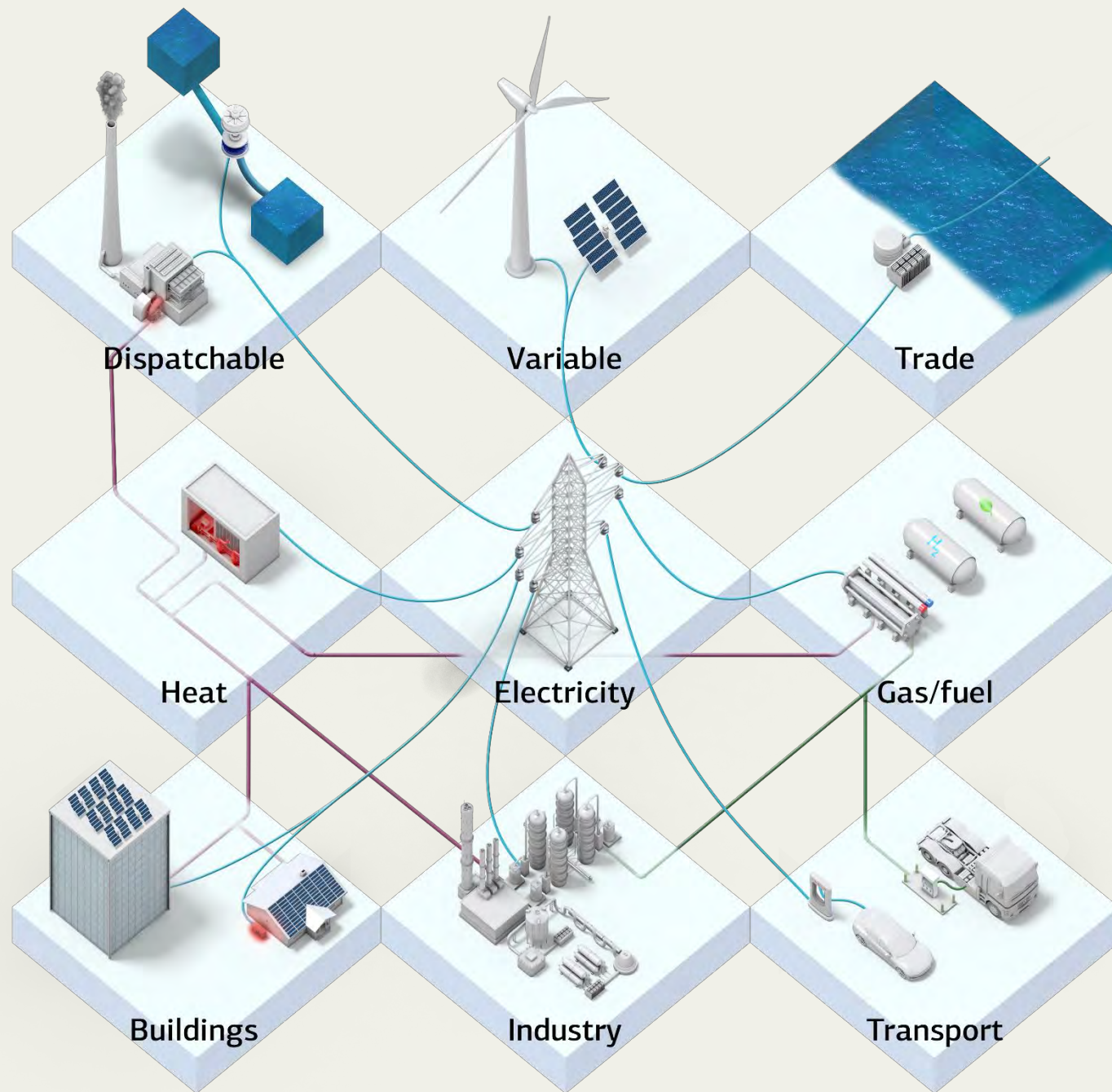


**Transport**

**1-2 GW**

in 2050





Trondheim

Oslo









# Space heating energy intensity in Nordic buildings

126

kWh/m<sup>2</sup> in 2013

0.8%

annual improvement,  
1990-2013

60

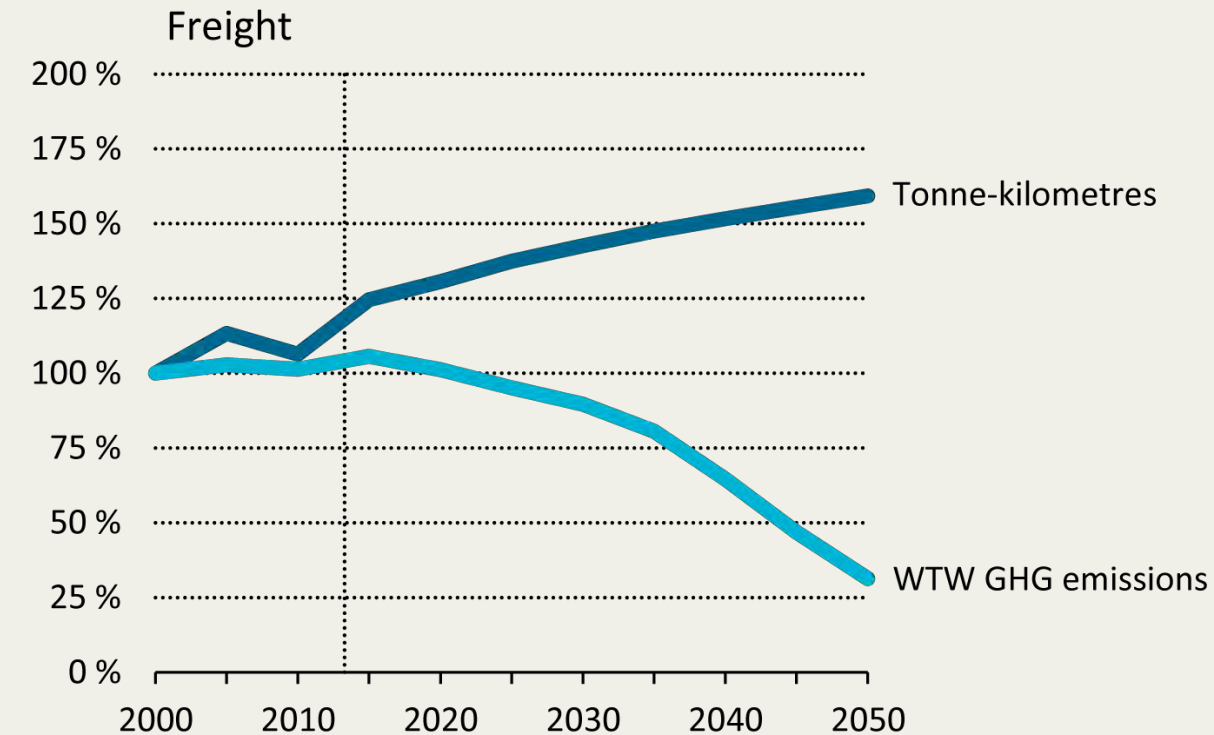
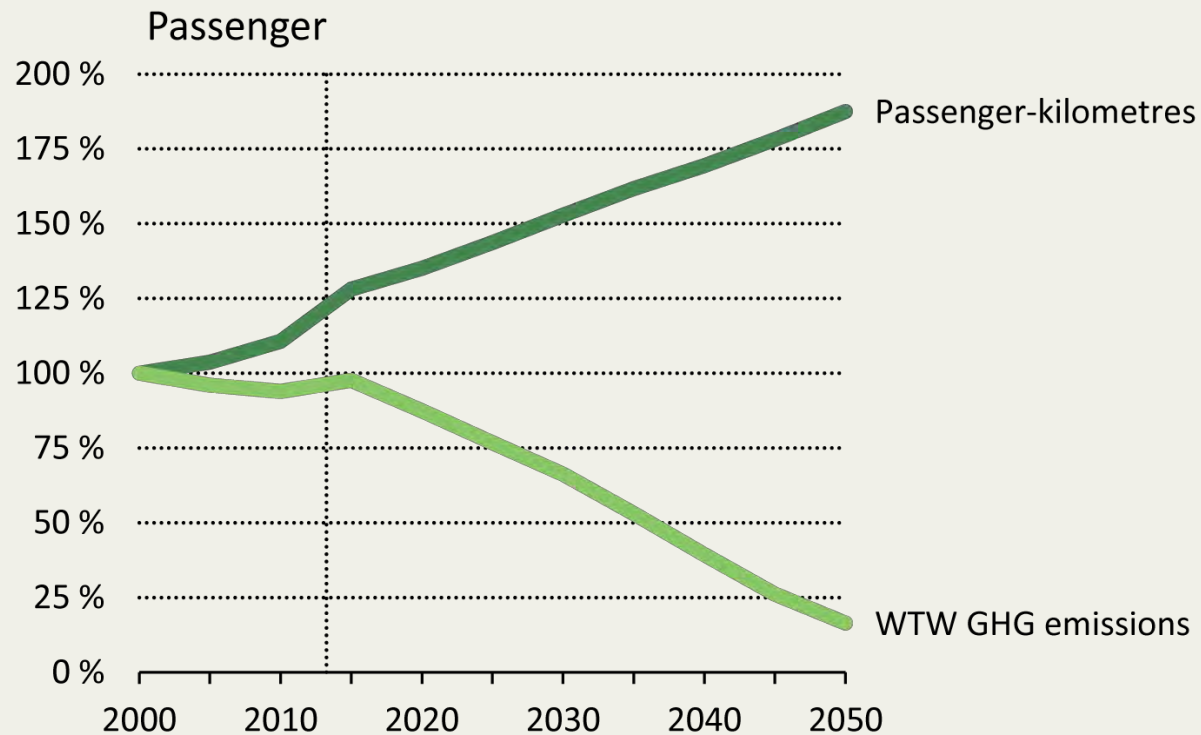
kWh/m<sup>2</sup> in 2015

2.2%

annual improvement,  
2013-2050



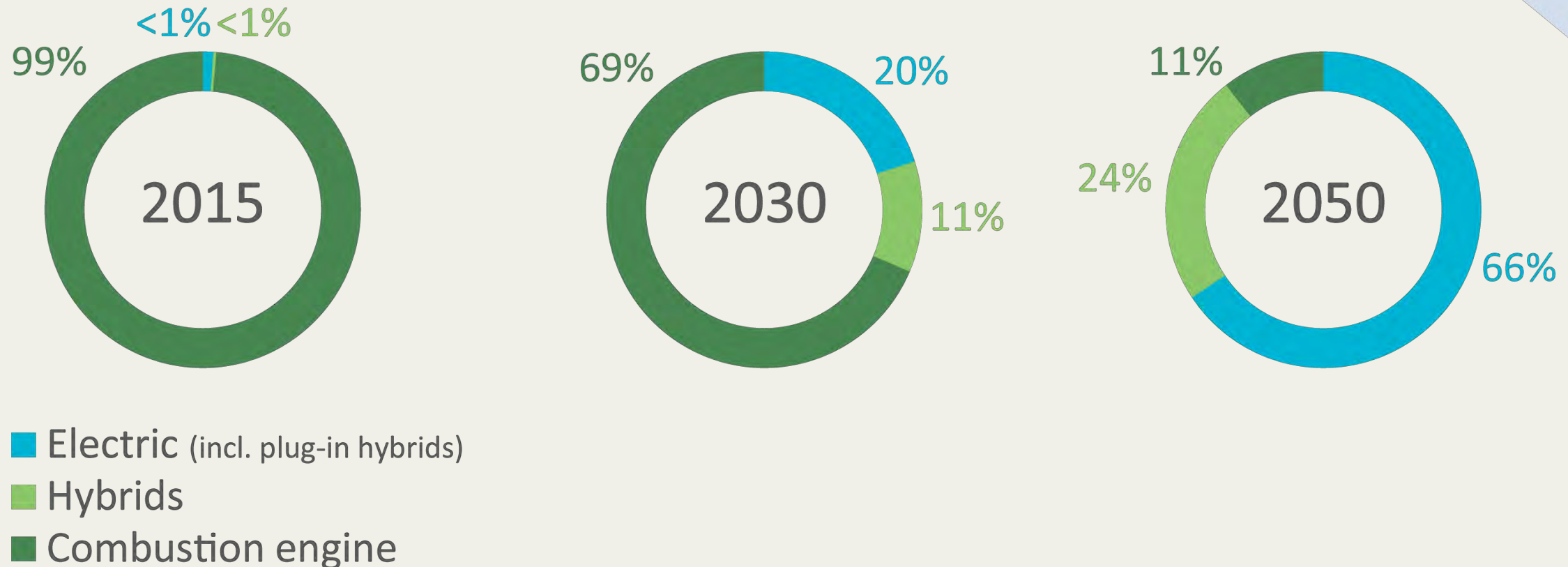
# Decoupling transport activity from emissions



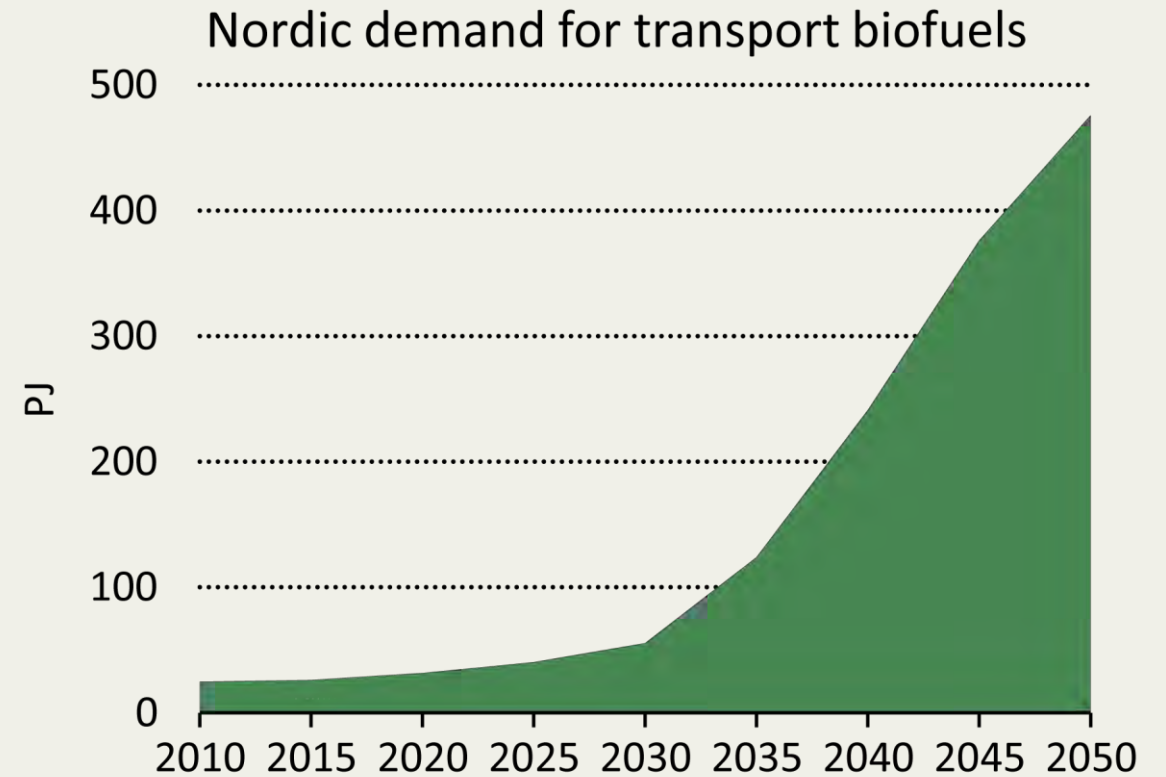
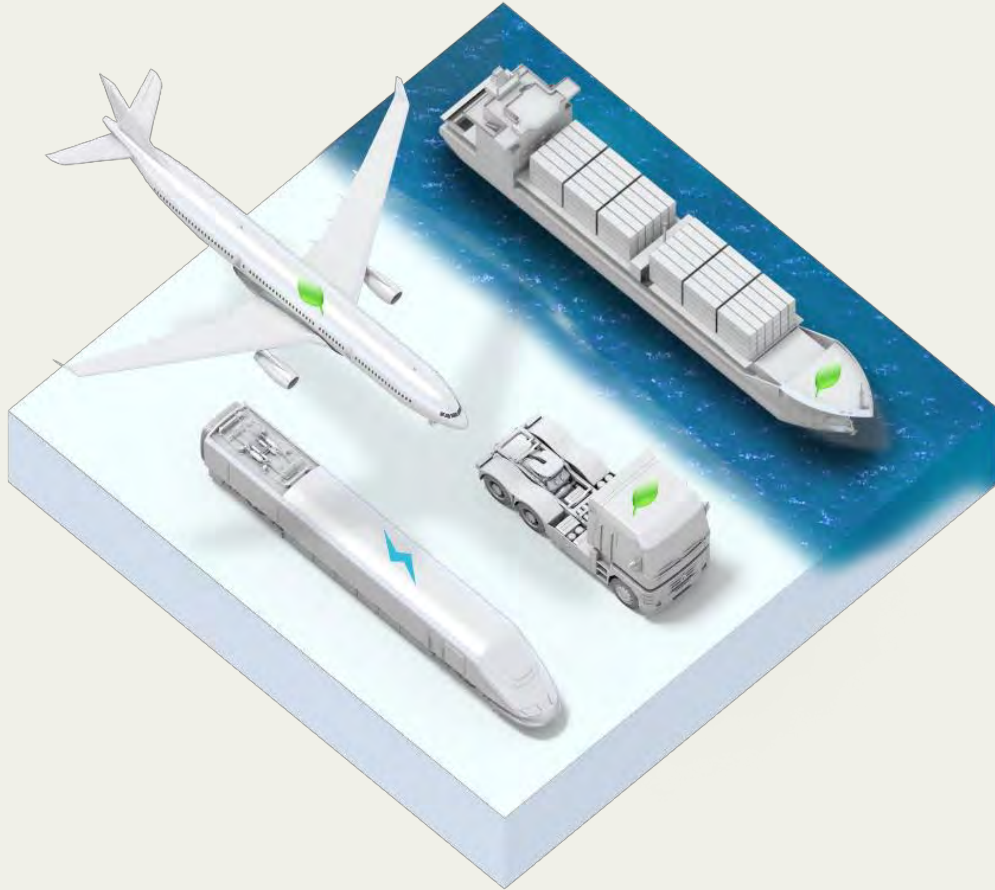


# Rapid electrification of transport

Nordic stock of cars and light commercial vehicles in the CNS



# Long-distance transport



# 15%

import dependency  
for biomass in 2050,  
up from 8% in 2013



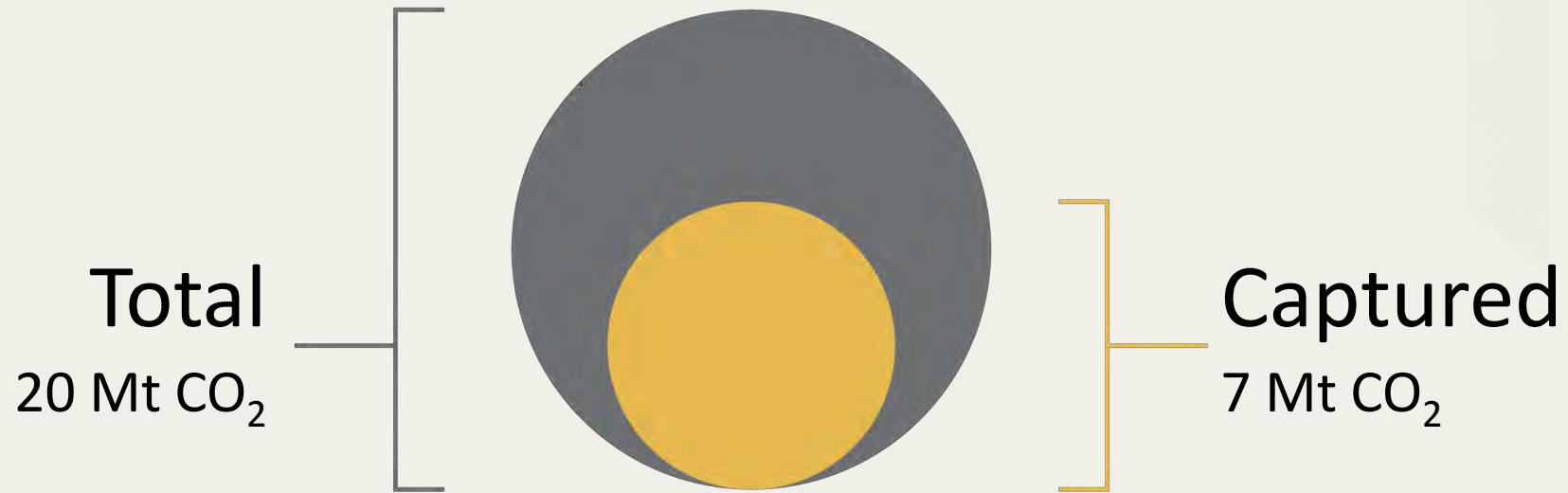


**R**



# CCS critical in industry

Nordic industrial emissions in 2050



# Policy recommendations

1. Strengthen incentives for flexibility
2. Nordic cooperation on grids and markets
3. Ramp up industrial innovation
4. Utilise proven policies in transport



# Nordic Energy Technology Perspectives 2016

Cities, flexibility and pathways to carbon-neutrality



Thank you

[www.NordicETP.org](http://www.NordicETP.org)

- Download figures, data and slides
- Order a free hard copy