

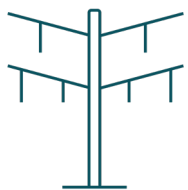
NET ZERO PLANNING IN DENMARK / ENTSO-E

IWERN Meeting – 08/09 April 2024

Antje Orths

THE ENERGY BACKBONE

Now with hydrogen infrastructure



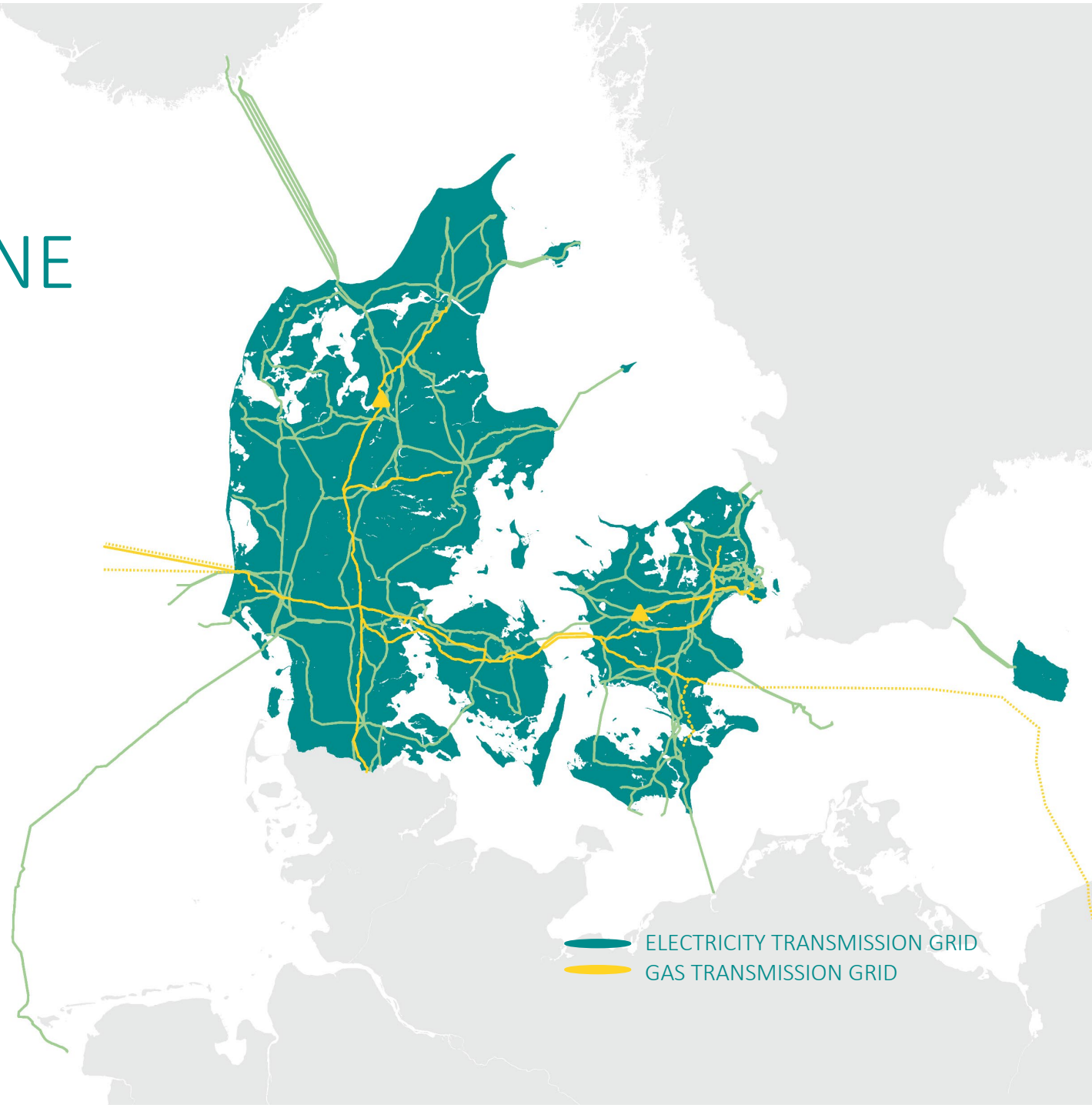
8400
km electricity grid



1250
km gas grid

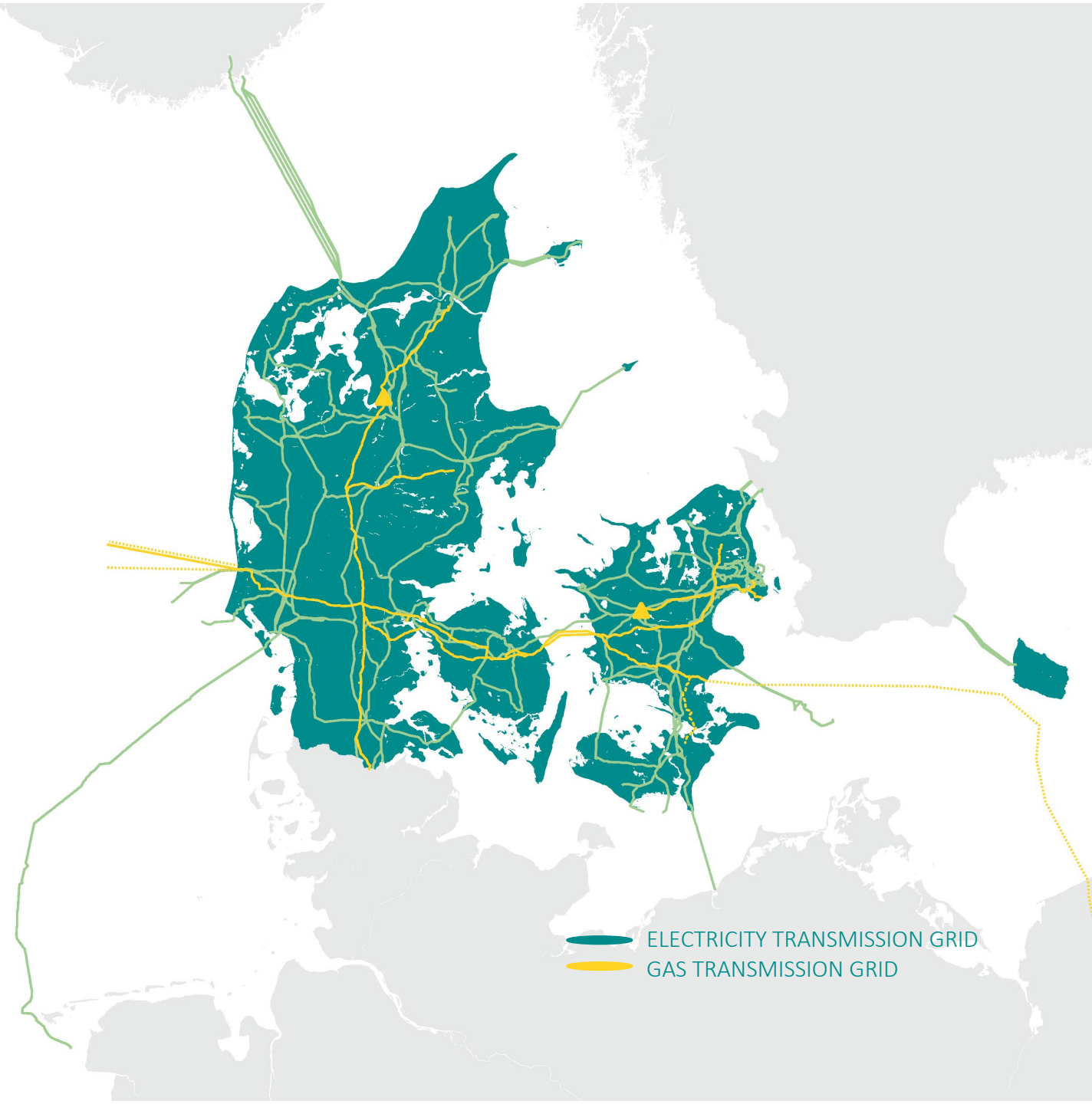
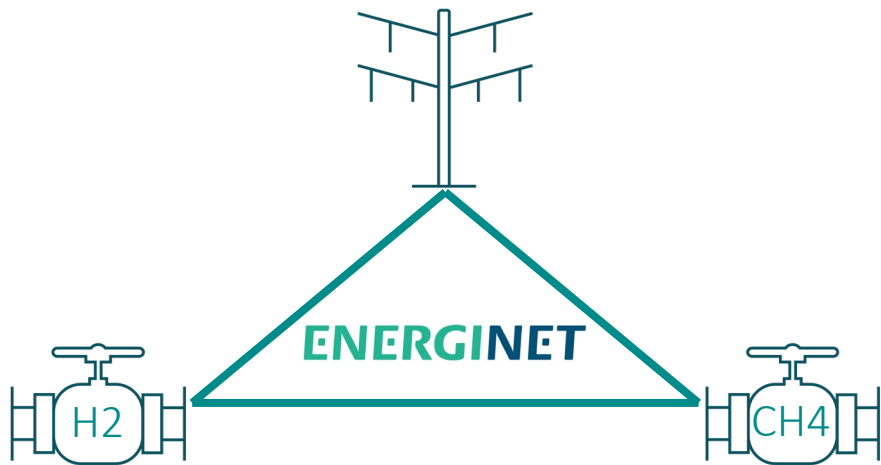


Hydrogen infrastructure



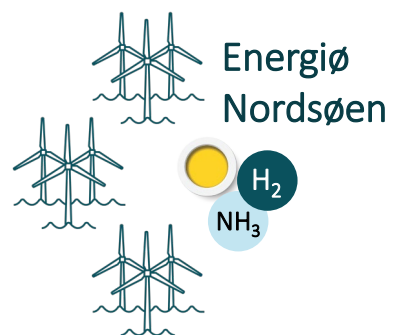
MOVING ENERGY EFFICIENTLY

System operation with three parts












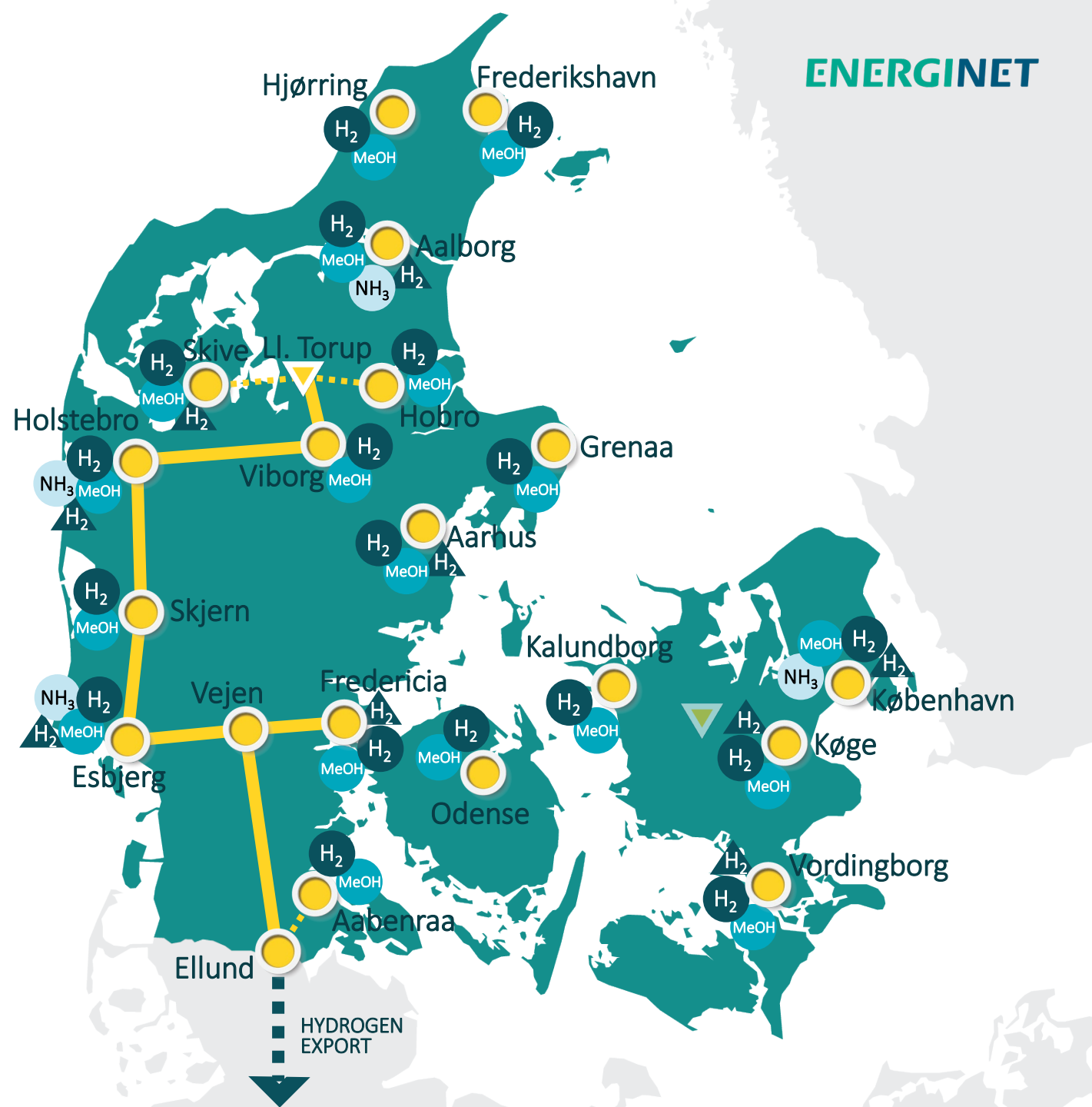
POTENTIAL HYDROGEN INFRASTRUCTURE DANISH BACKBONE WEST

ENERGINET



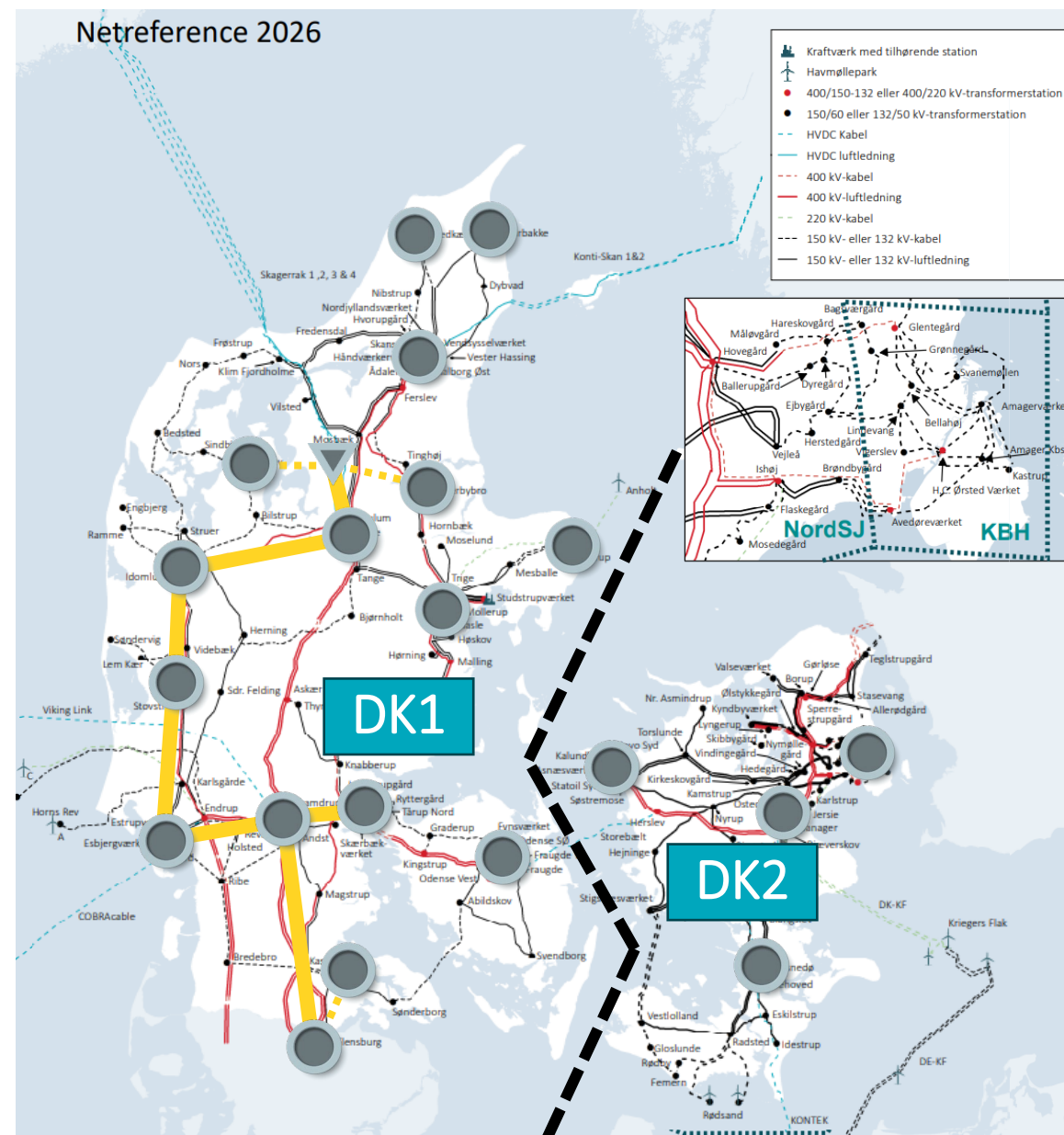
LEGEND

-  PtX hub/node
-  H₂ Exogenous electrolysis capacity
-  MeOH Endogenous methanol production capacity
-  NH₃ Endogenous ammonia production capacity
-  Endogenous hydrogen cavern storage capacity
-  Exogenous hydrogen infrastructure capacity
-  Exogenous hydrogen distribution infrastructure capacity
-  Endogenous hydrogen export
-  H₂ Exogenous hydrogen consumption



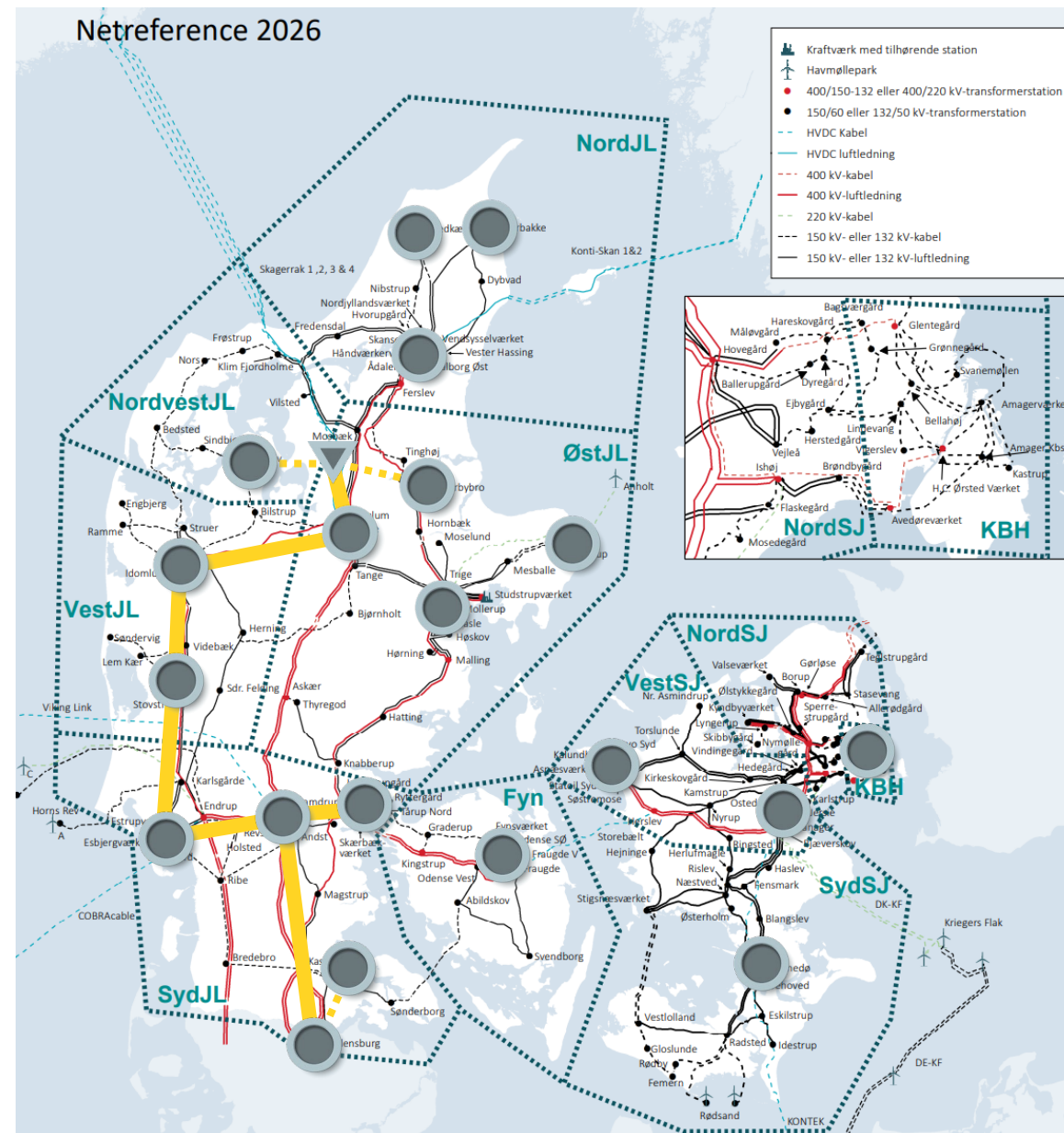
MARKET AND PHYSICS

- Understanding the relationship between electricity and hydrogen infrastructure
- Market modelling with a higher resolution of electricity bidding zones
- Hydrogen infrastructure reduces the need for electricity infrastructure

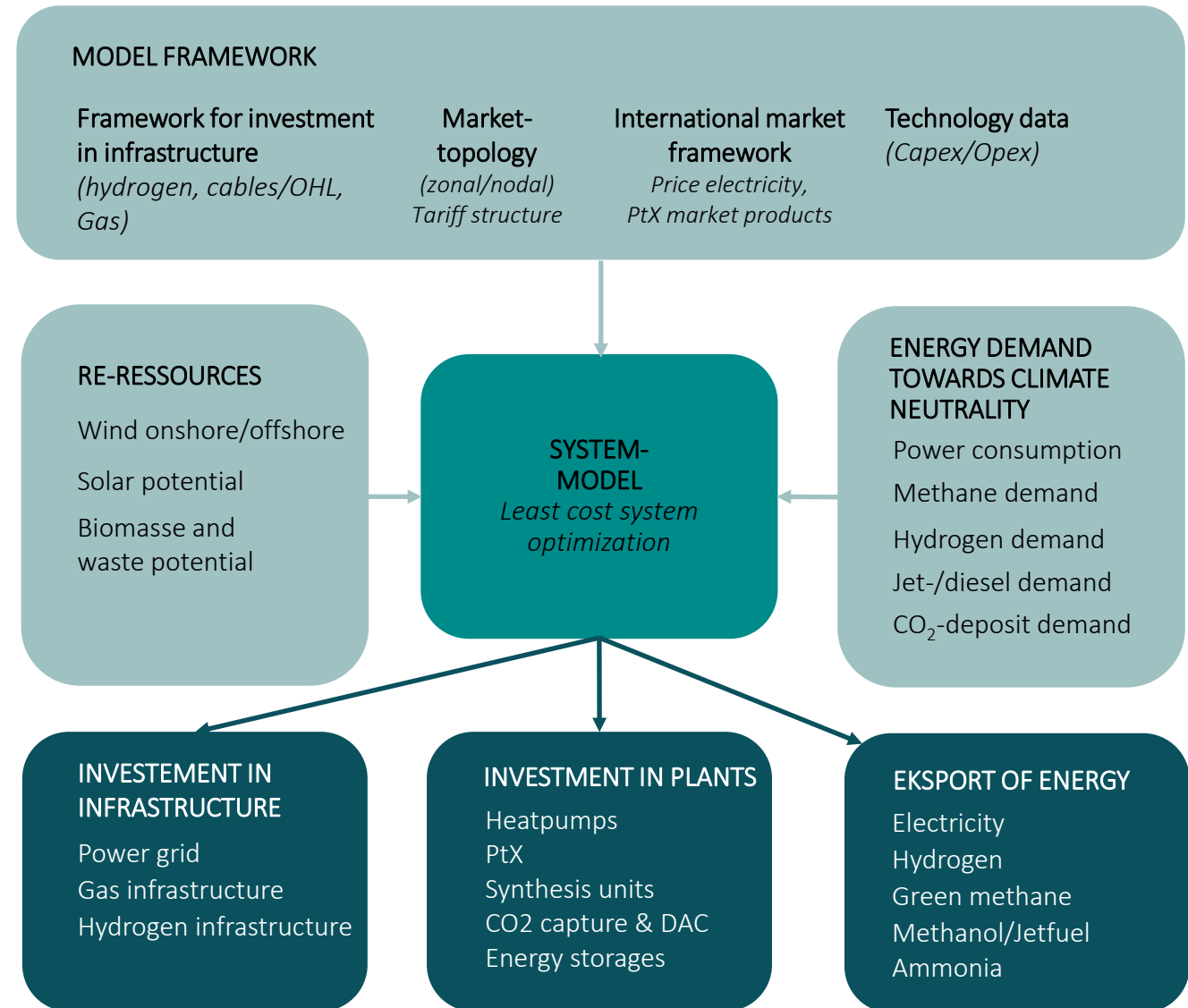


MARKET AND PHYSICS

- Understanding the relationship between electricity and hydrogen infrastructure
- Market modelling with a higher resolution of electricity bidding zones
- Hydrogen infrastructure reduces the need for electricity infrastructure



MODEL CONCEPT



MODELLING PROCESS

Exogenous
parameter

Endogenous
parameter

PRODUCTION

ELECTRICITY



Existing and
planned solar
and wind
capacity

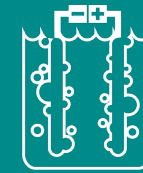
Potential wind &
solar capacity

Potential
radial offshore

Existing and
planned CHP

Potential
"hub based wind

Hydrogen



Potential
onshore
electrolysis

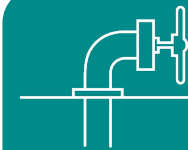
Potential
offshore
electrolysis

INFRASTRUCTURE



Existing and
planned
infrastructure

Potential power
grid



H2 storage

H2 transport via
truck/ship

H2 transport via
infrastructure

Consumption



Conventional
electricity
consumption

Electricity
consumption
for PtX

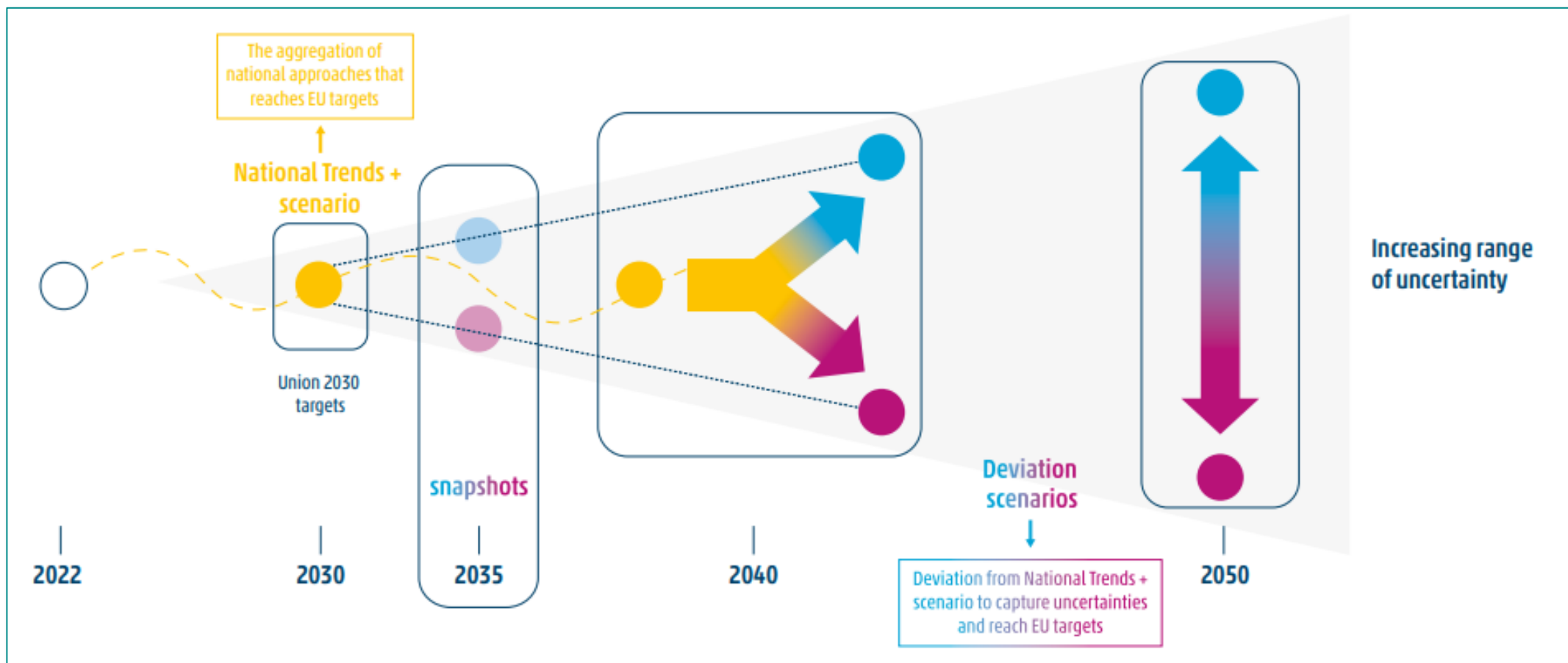


NH3 & MeOH
synthesis

Hydrogen export
via truck/ship

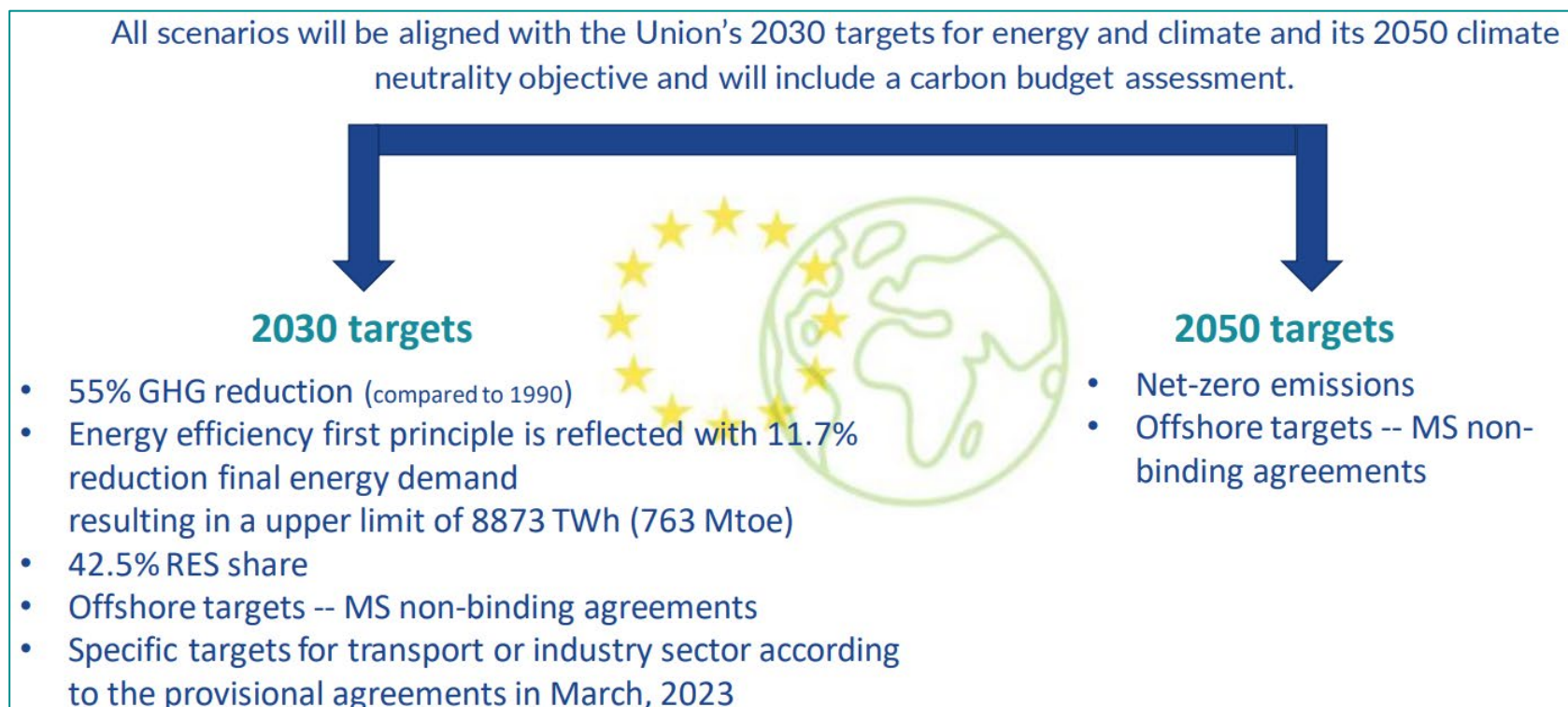
H2 export via
infrastructure

THE ENTSOS' TYNDP24 SCENARIOS

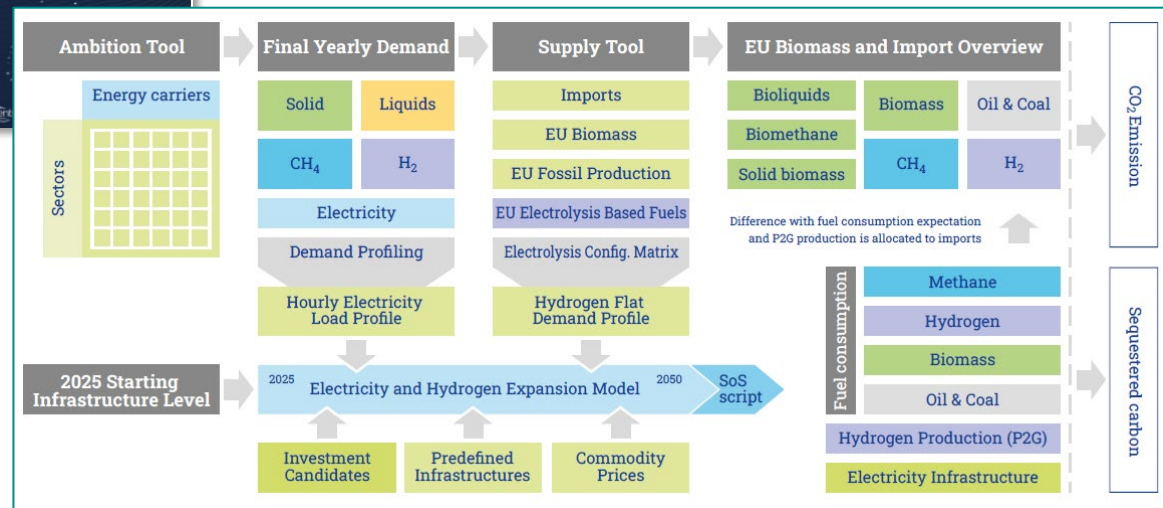


ENTSOS' TYNDP24 SCENARIOS

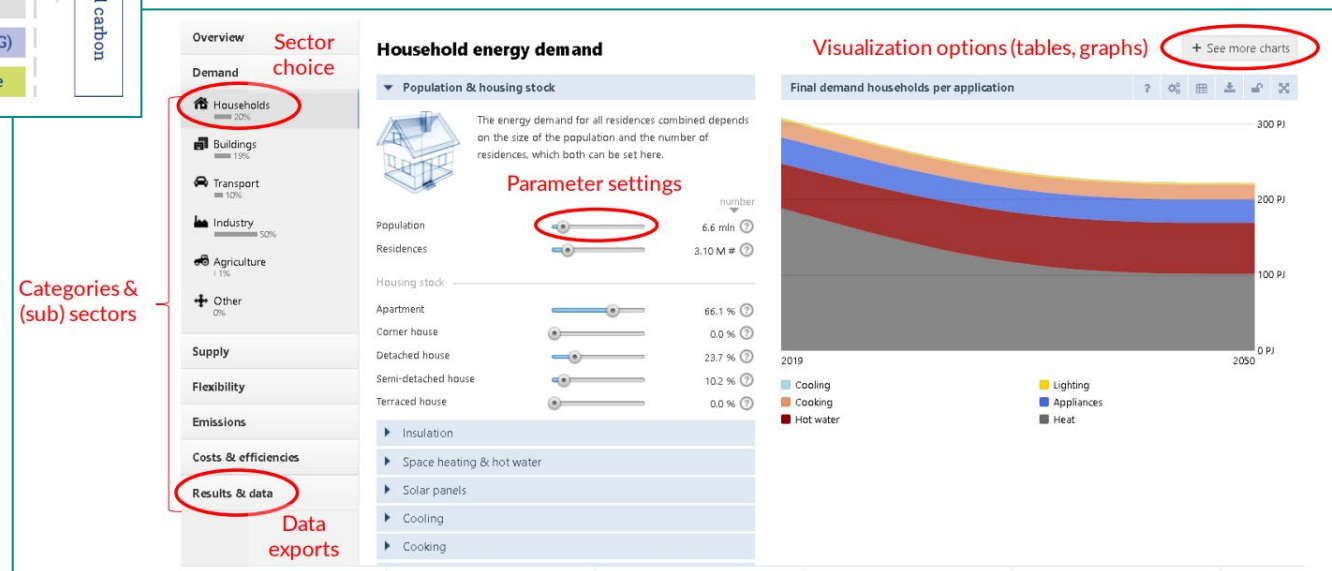
Compliance with EU Energy and Climate Targets



BUILDING BLOCKS FOR TOP-DOWN SCENARIOS



In the 2024 Scenario edition, the top-down scenarios have been built in an open source tool – the Energy Transition Model – starting from Eurostat and TYNDP22 data



ENTSOS' 2024 SCENARIO INNOVATIONS

Hydrogen Modelling

1

H₂ zones modelled considering a market and dedicated production.



Domestic production of synthetic fuels.
Explicit hydrogen to power modelling.

EV Modelling

2

Improvement of 2022 scenarios.
Transport modelling will include demand side shifting and Vehicle to grid.

Expansion Modelling

5

New approach that enhances run times over previous cycle, and allows for a larger model to be run



Heat Modelling

4

Hybrid heat pumps as heating that use energy produced by three carriers (electricity, hydrogen and methane).

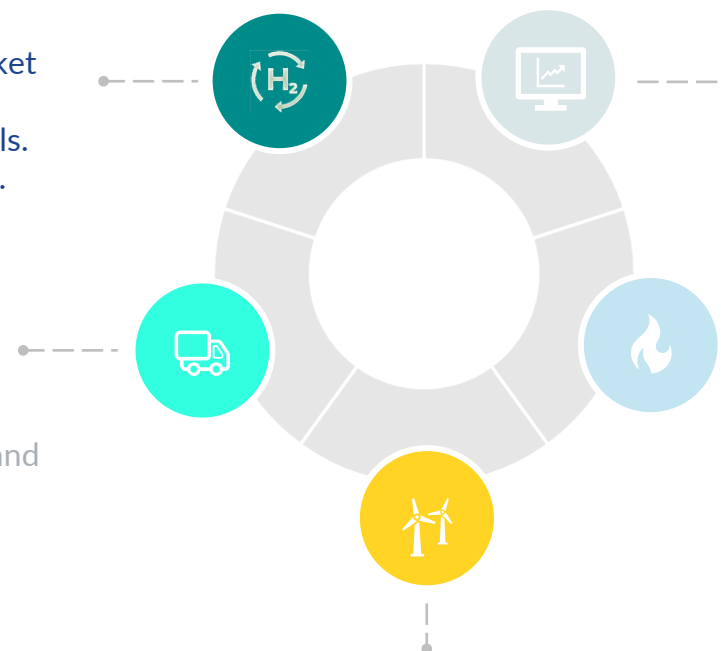


Offshore Modelling

3

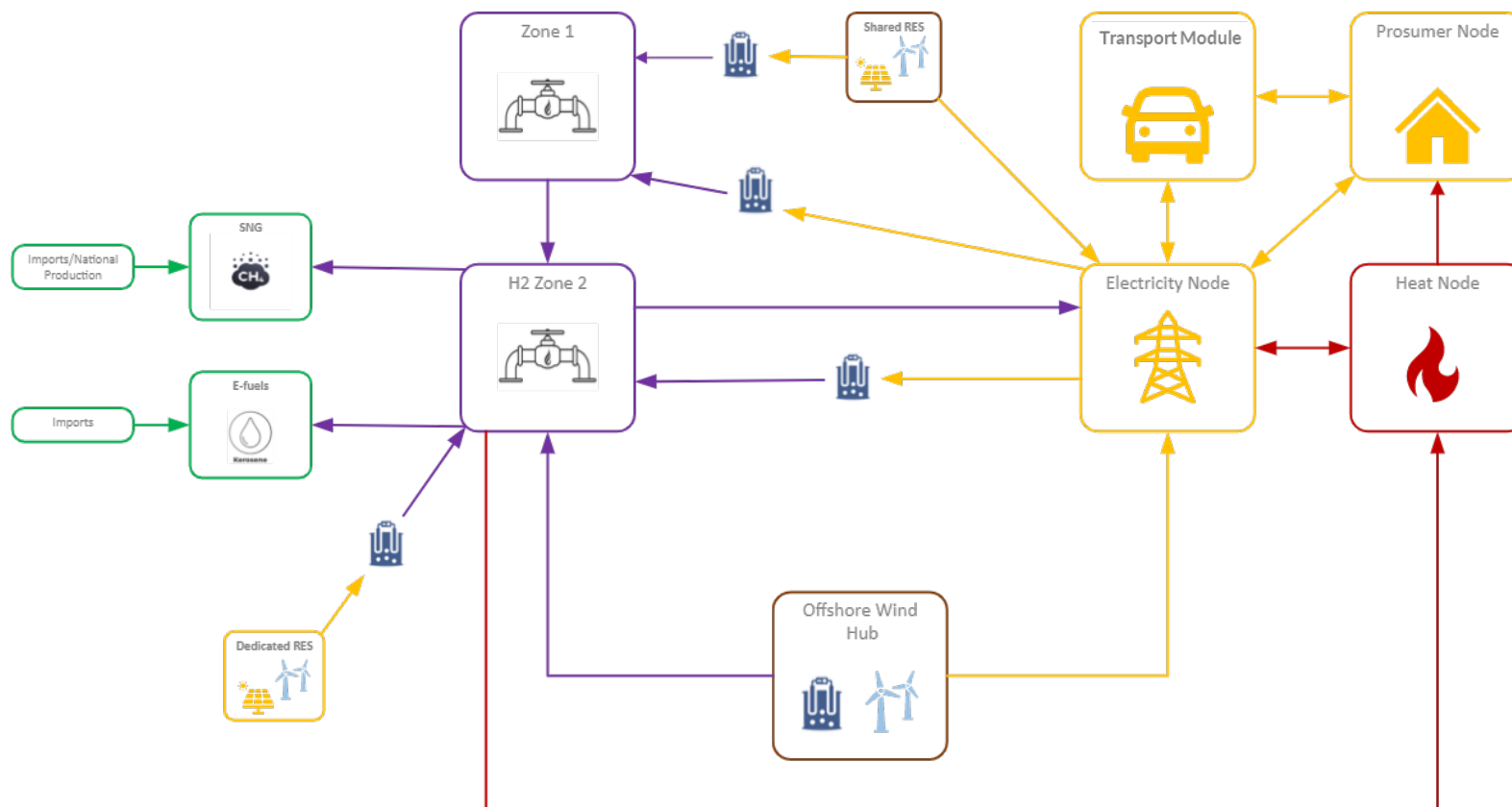


Hub modelling wind farms, electricity grid, hydrogen pipelines and electrolysers.
Hubs interconnect with each other and mainland Europe.

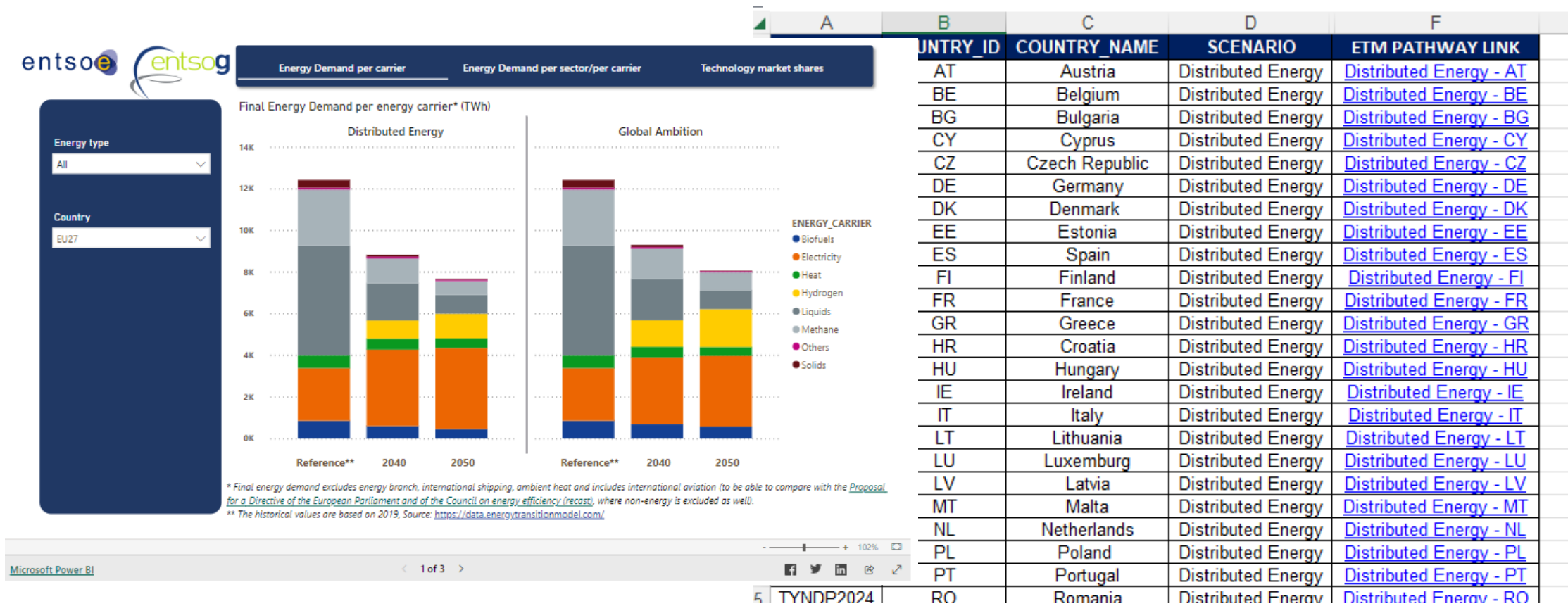


4 out of the 5 innovation areas involved sector integration

TYNDP24 – MODELLING OF SECTOR INTEGRATION



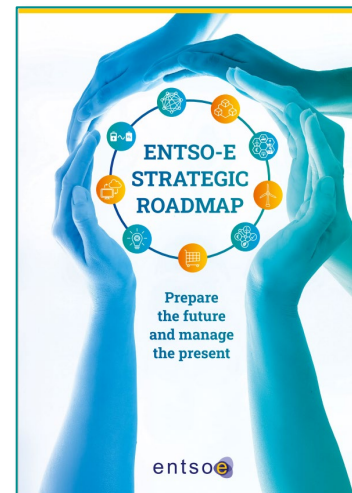
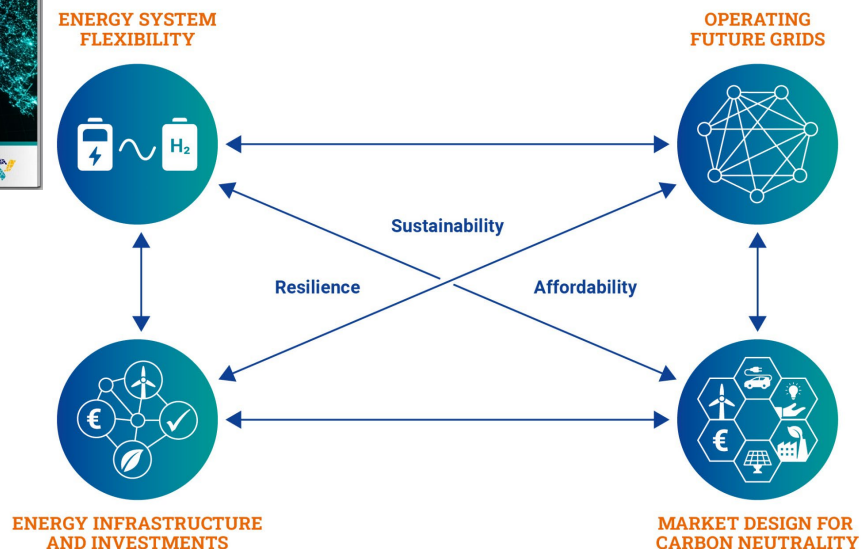
SCENARIO CONSULTATION FEEDBACK ON INPUT DATA AND METHODOLOGY FROM SUMMER 2023



scenarios (see: <https://2024.entsos-tyndp-scenarios.eu/>
<https://2024.entsos-tyndp-scenarios.eu/download/>)

ENTSO-E'S VISION FOR A CARBON NEUTRAL EU

builds on 4 building blocks ..



Or two intertwined pillars



THANK YOU!

ano@energinet.dk