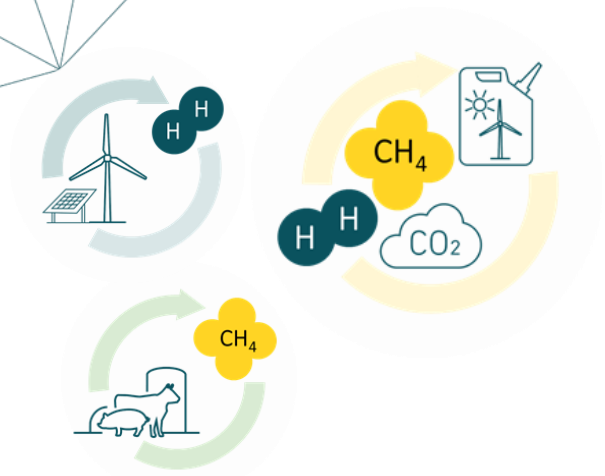
GAME CHANGERS FOR PTX & PTX-INFRASTRUCTURE

Towards a Sector Coupled Energy System

Tor Elmelund
MSc Eng, Gas System Innovation, **Energinet Gas TSO**

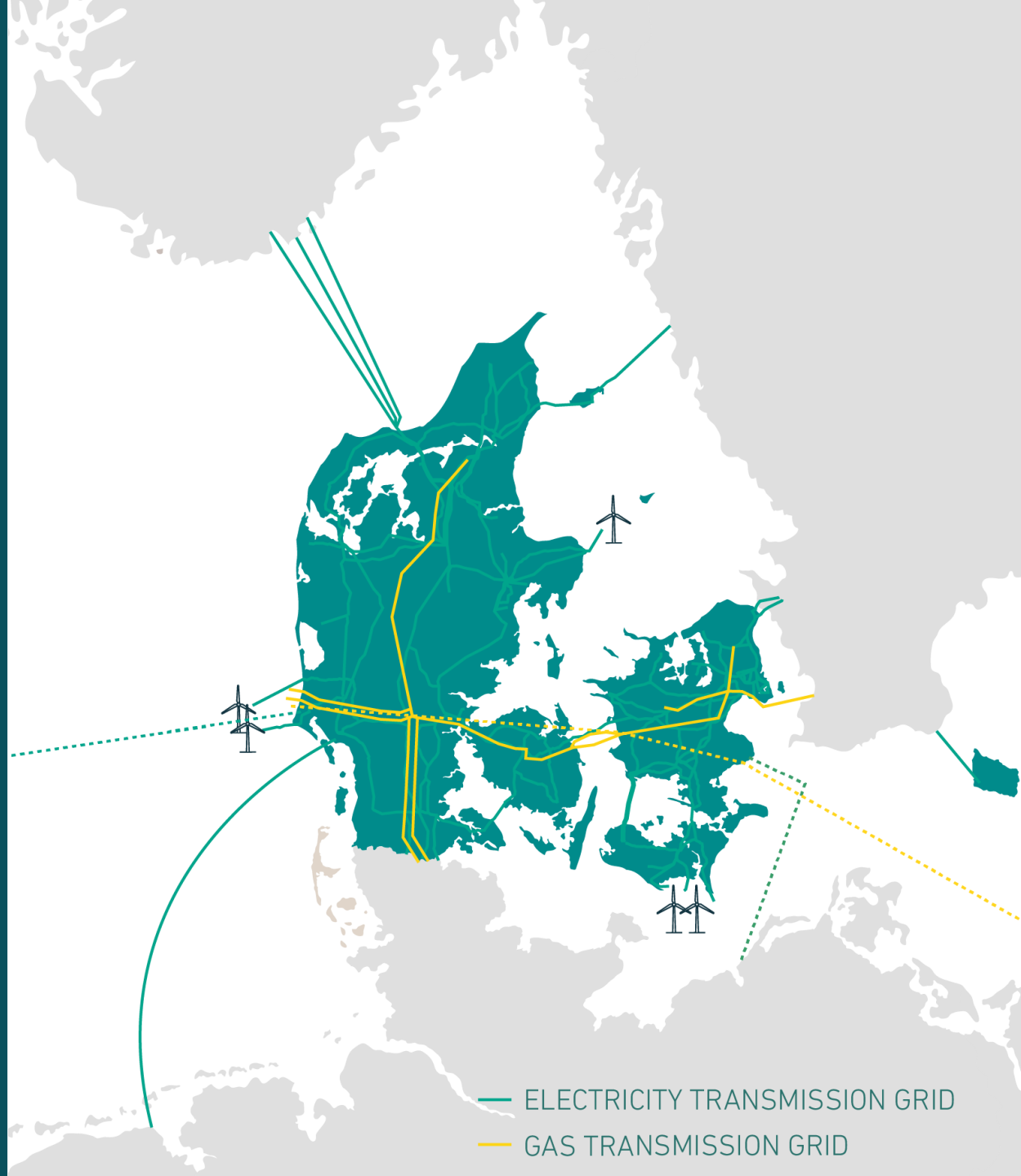


WE ARE WORKING FOR THE DANES

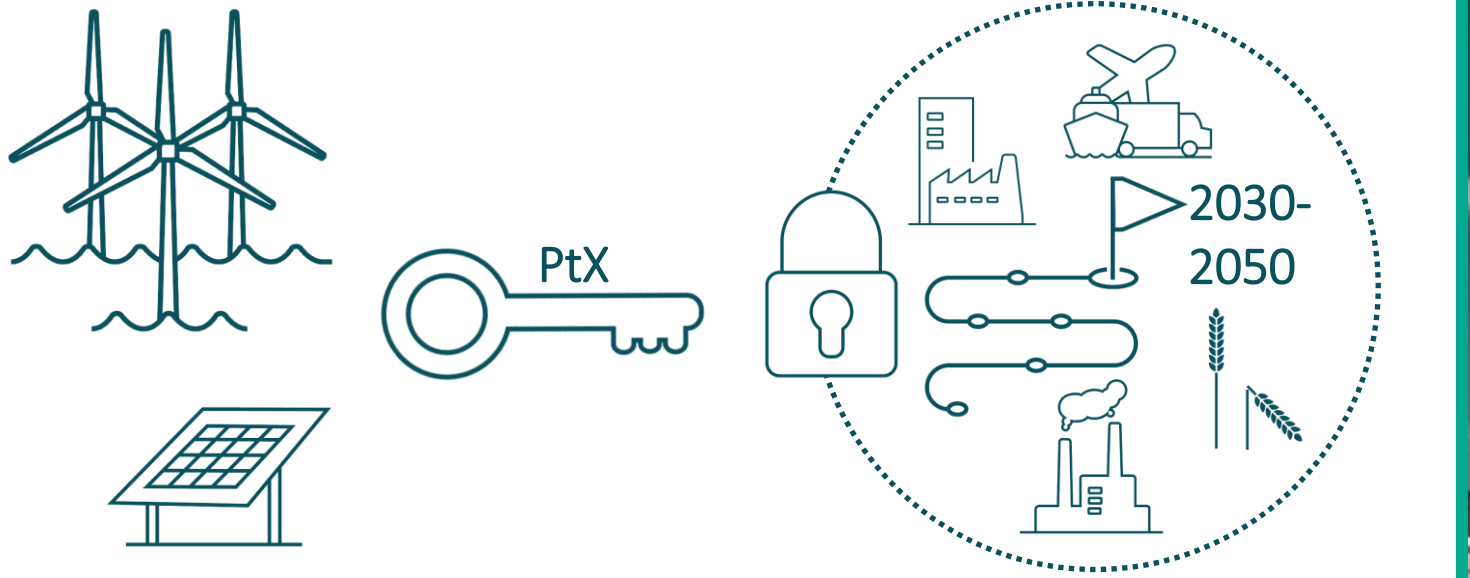
Energinet is responsible for the supply of gas and electricity in Denmark.

We safeguard society's interests as we move to a 100% green energy system.

We are a regulated TSO owned by the Danish Ministry of Climate, Energy and Utilities.



DANISH GREEN TRANSITION



STATUS (2019):

73% green electricity

35% green energy

13% green gasses

2030 TARGET:

100% green electricity

55% green energy

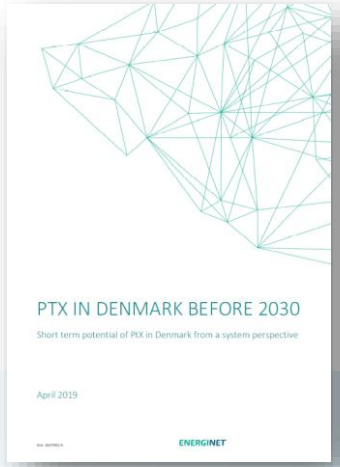
2050 TARGET:

100% green energy

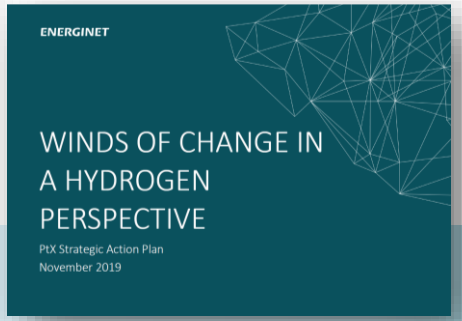
GOVERNMENT GOAL:

70% reduction in CO2-emissions by 2030

PTX AND HYDROGEN IS A STRATEGIC PRIORITY FOR ENERGINET



April 2019
Link



November 2019
Link

December 2019
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March 2020
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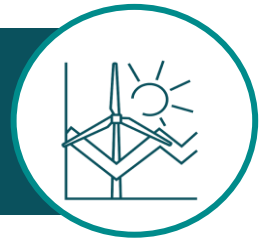
*Danish only

May 2020
Link

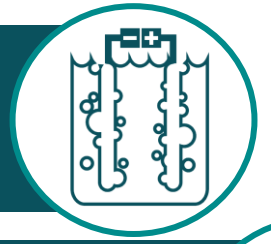
WHY CAN PTX MAKE ITS BREAKTHROUGH NOW?

What drives development?

Sharply falling costs for wind power and solar cells



Beginning large-scale industrialization of electrolysis technology

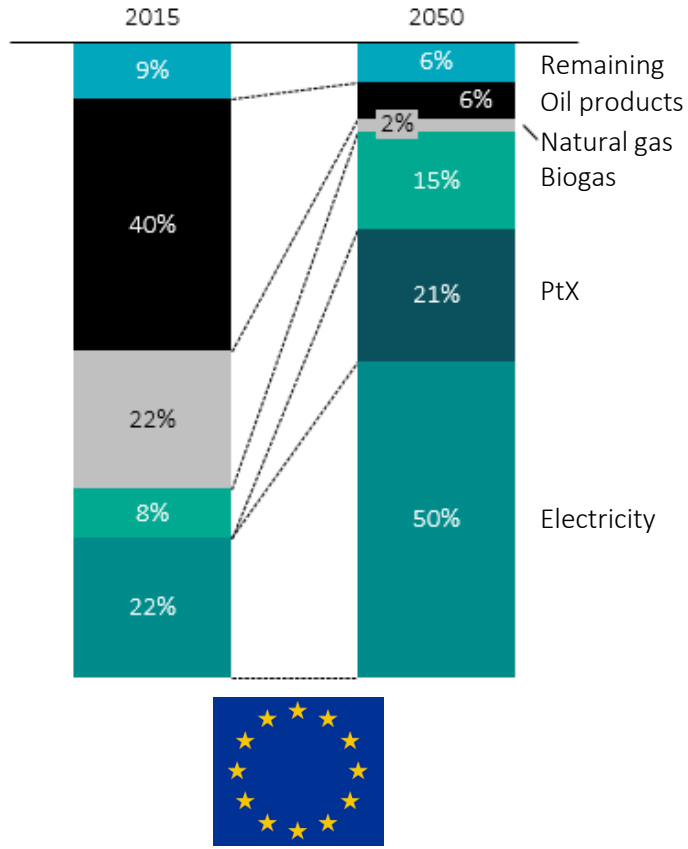


Increased demand and value of the green PtX product

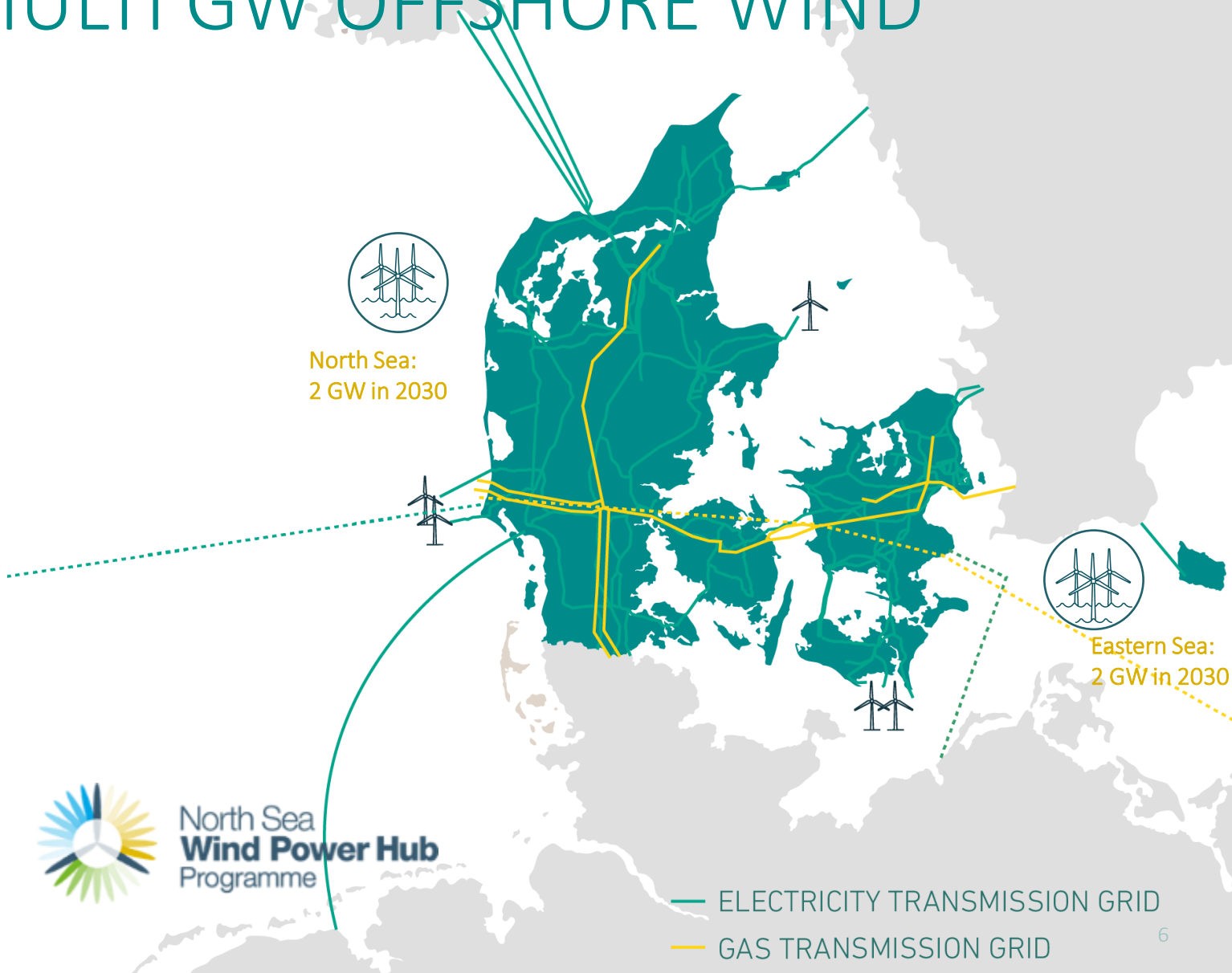
Increased focus on the integration of wind and solar in the electricity system

INTEGRATION OF MULTI GW OFFSHORE WIND REQUIRES PTX

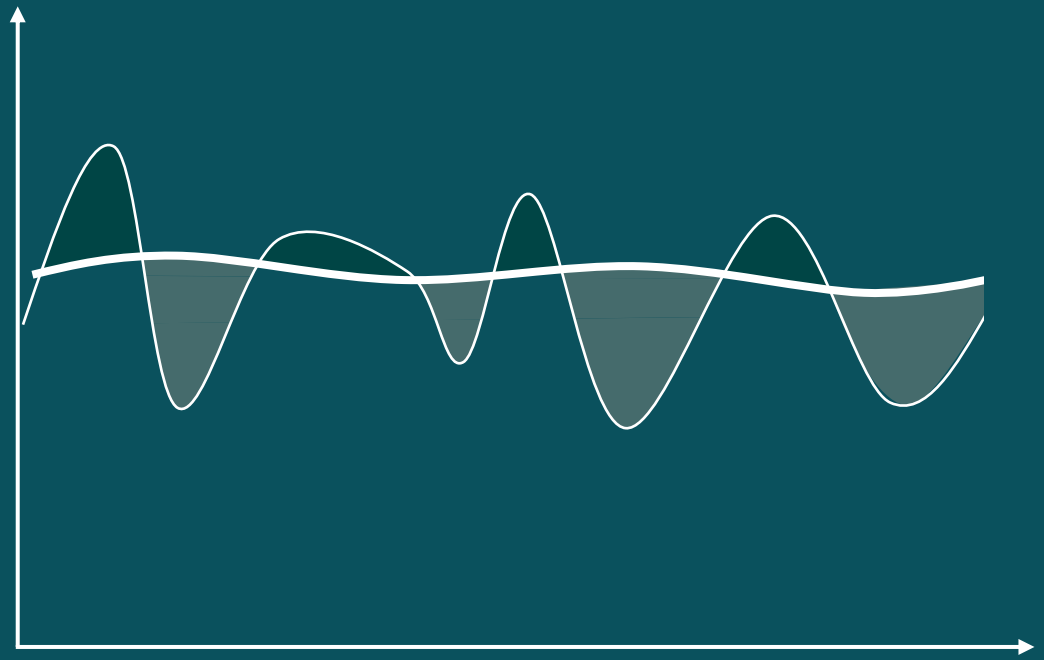
Endconsumption by energy type*



*) mean value for 1.5°C scenarios in 2050 from the EU Commission

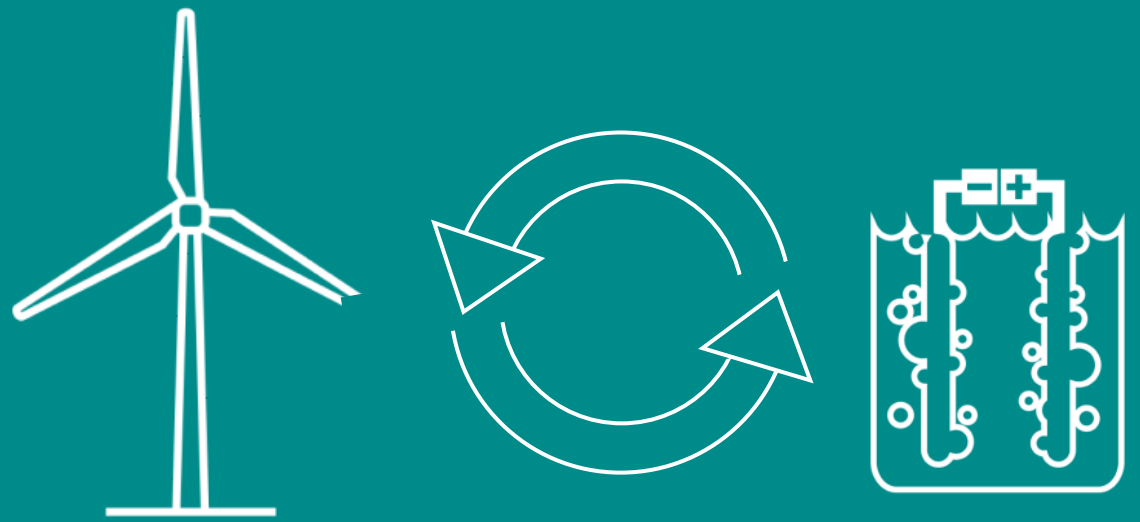


WIND CURTAILMENT



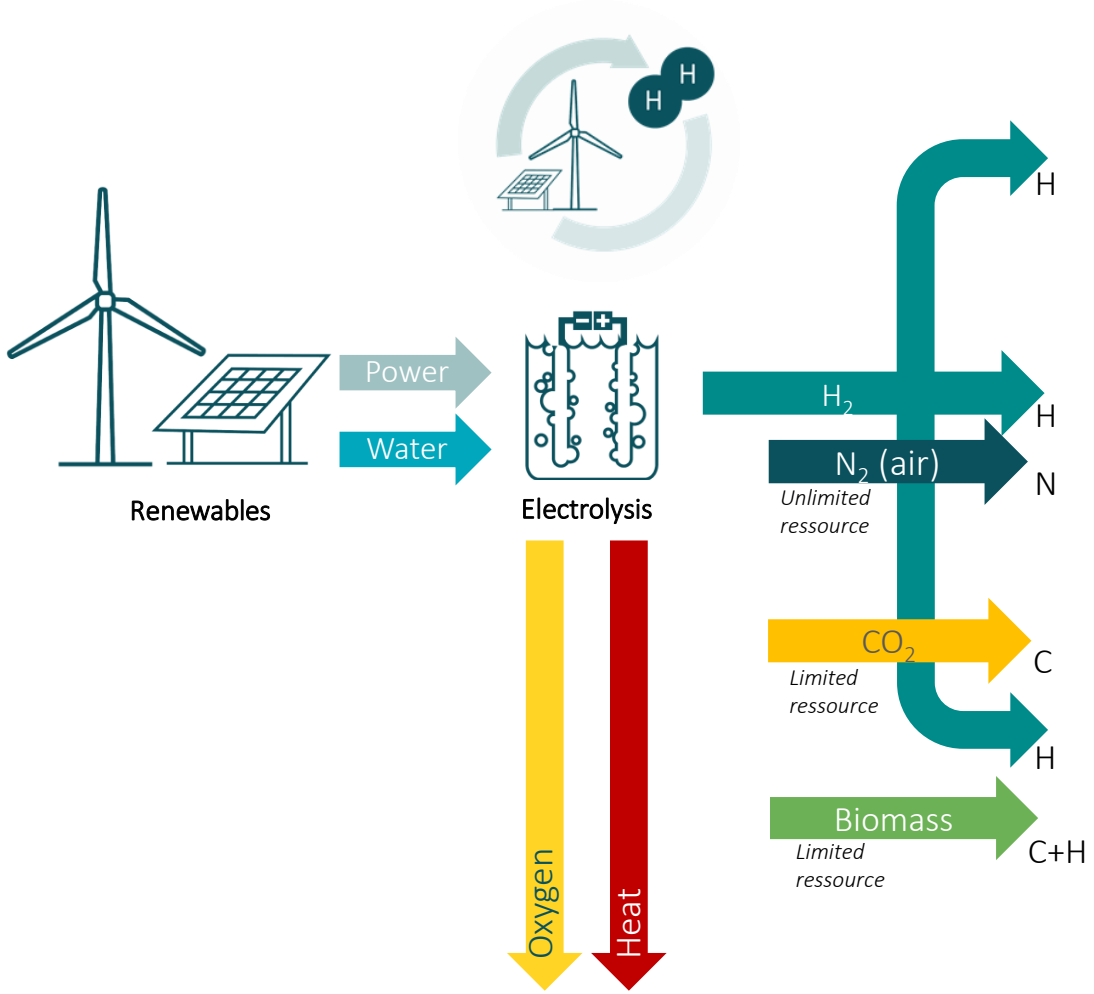
A ONE WAY STREET

WIND & ELECTROLYSIS



SYNERGY

THE X IN POWER-TO-X



Directe usage

Hydrogen

Eg.:
- (Heavy) Transport (FC)
- Refineries, steel
- Peak Power and Heat

Synthesis without carbon

Ammonia (NH_3)

E.g.:
- Fuel for shipping
- Fertilizers

Synthesis with carbon

Hydrocarbons (gas or liquids)

E.g.:
- Methanol, methane
- Jetfuel
- Petrol og diesel
- Ethylene, plastic products
- Wide range of other chemicals

Heat

ANALYSIS OF SUPPLY, INFRASTRUCTURE AND DEMAND SHOWS SCENARIOS FOR PTX

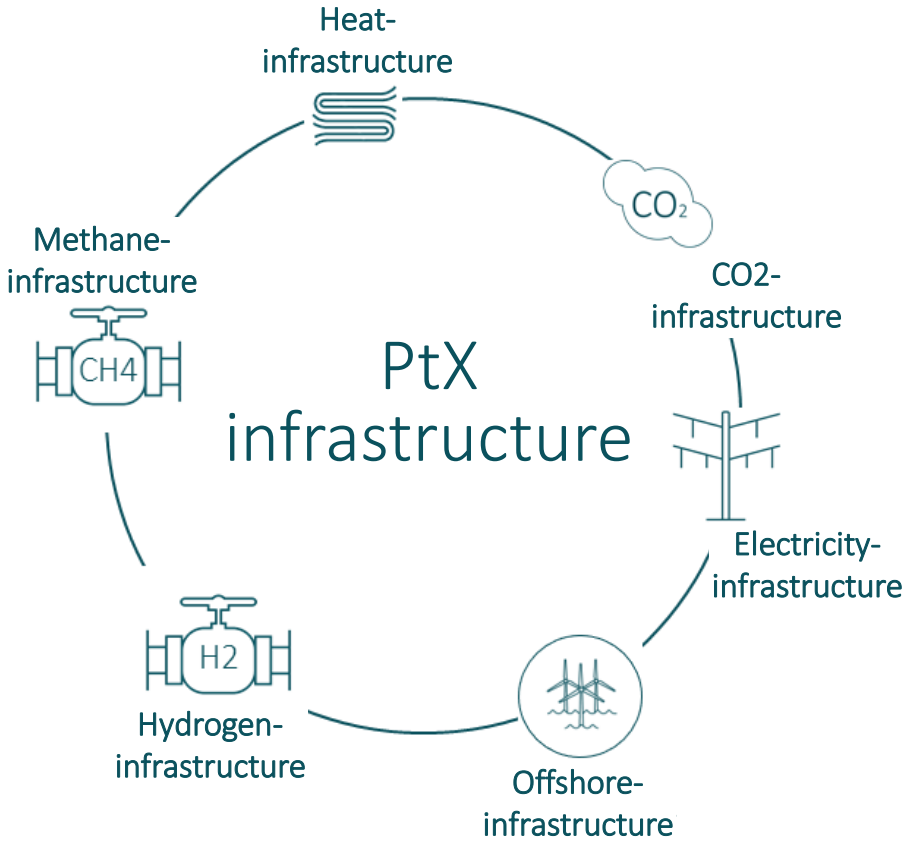
Supply (RE-ressources)

Wind and solar

Bio/waste

CO_2-point sources

Direct-Air-Capture



Demand

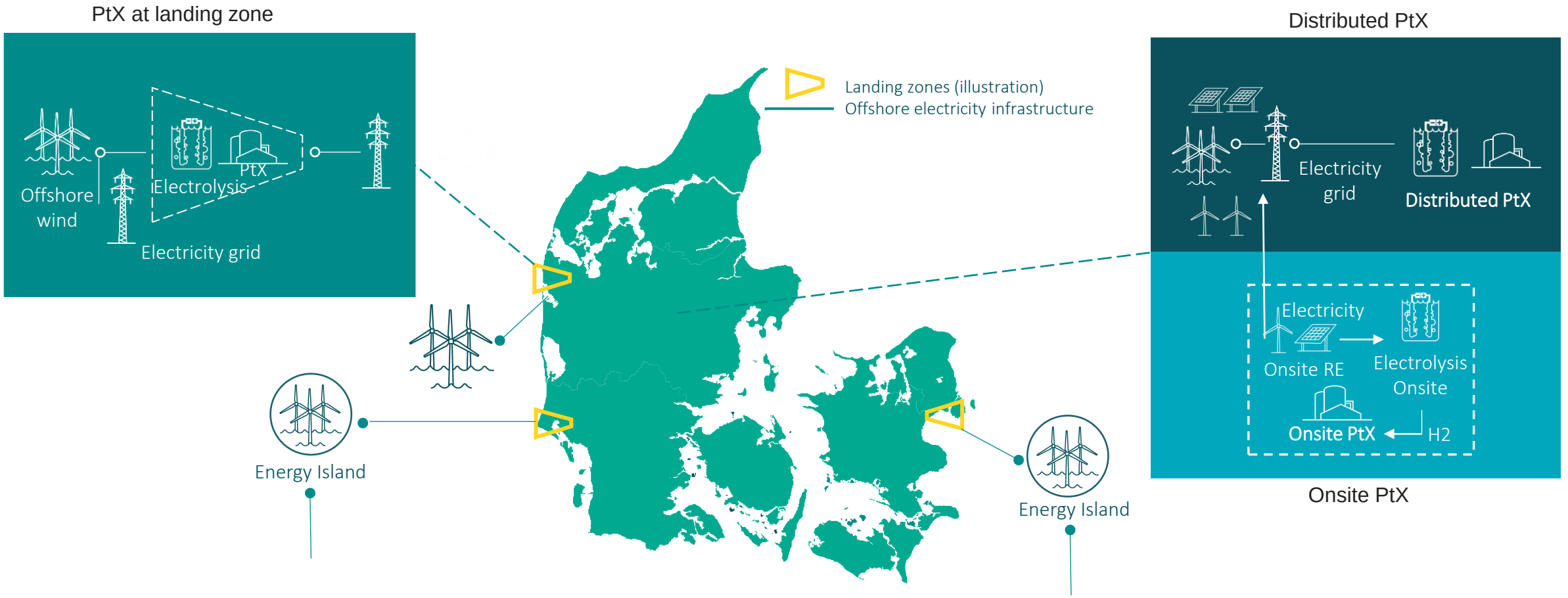
Heavy Transport

Industry

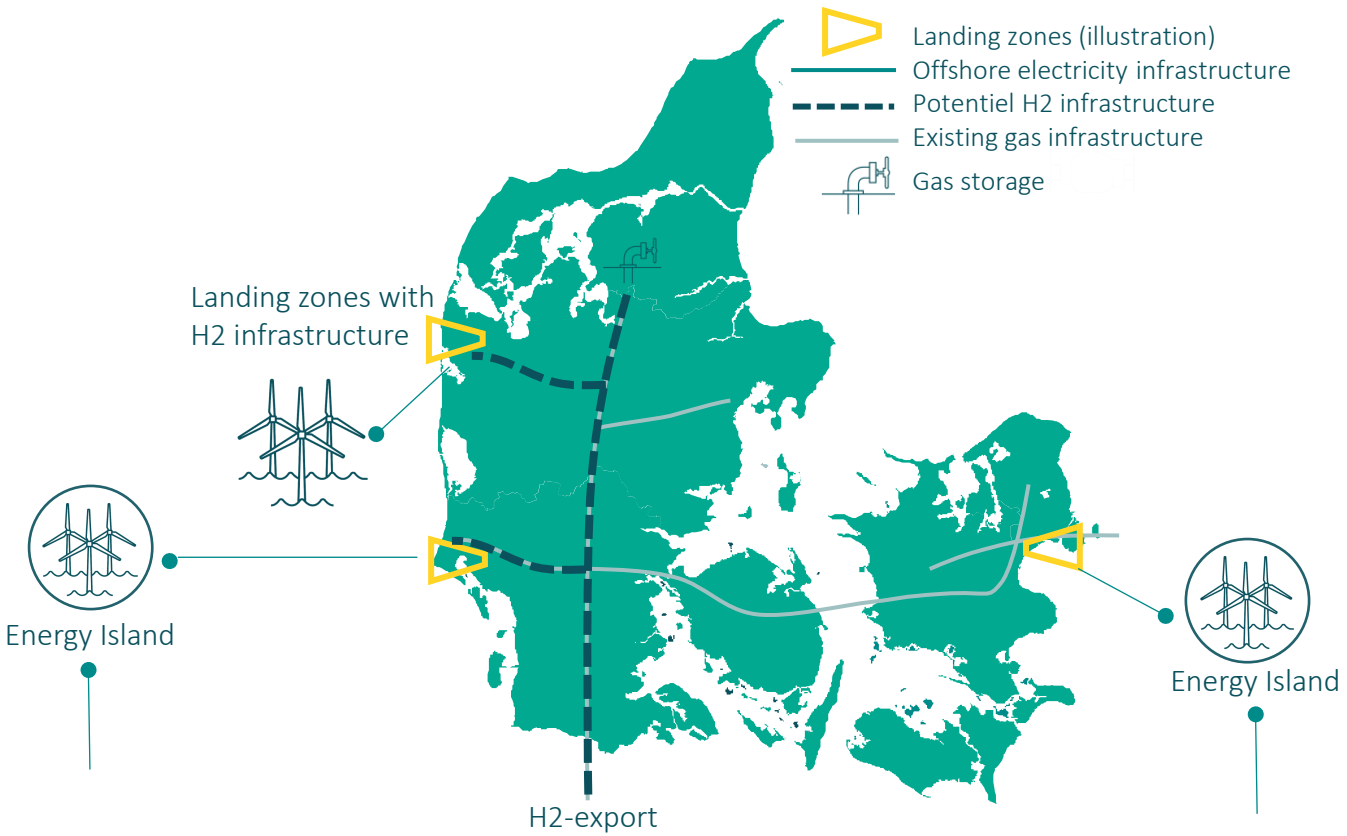
Peak power

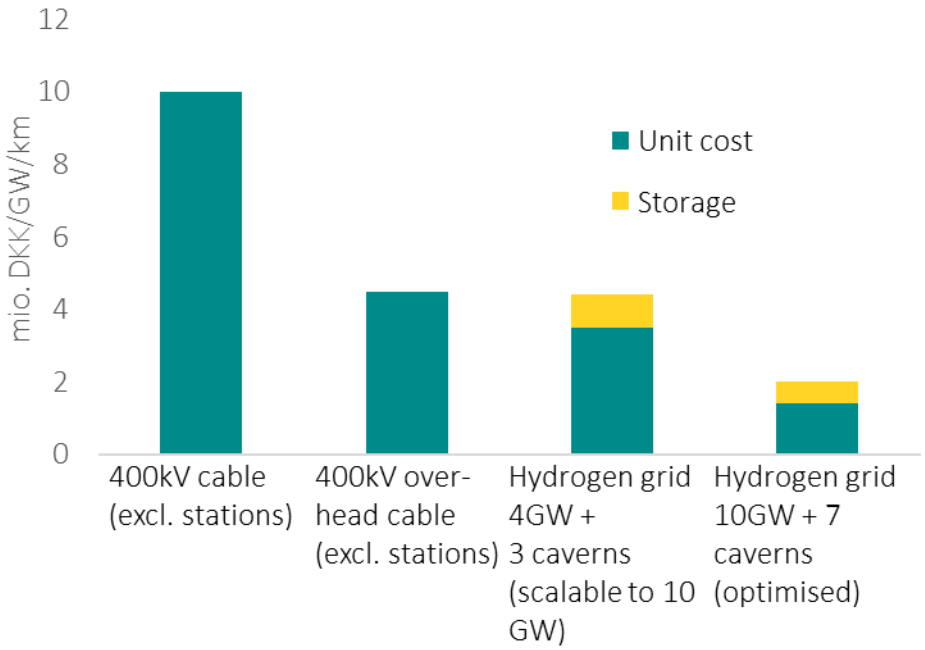
Agriculture

LOCATION AND FLEXIBILITY OF PTX PRODUCTION IS CRUCIAL FOR THE FUTURE ELECTRICITY GRID



H2-INFRASTRUCTURE OPTIMISES VALUE CHAINS





EUROPEAN HYDROGEN BACKBONE

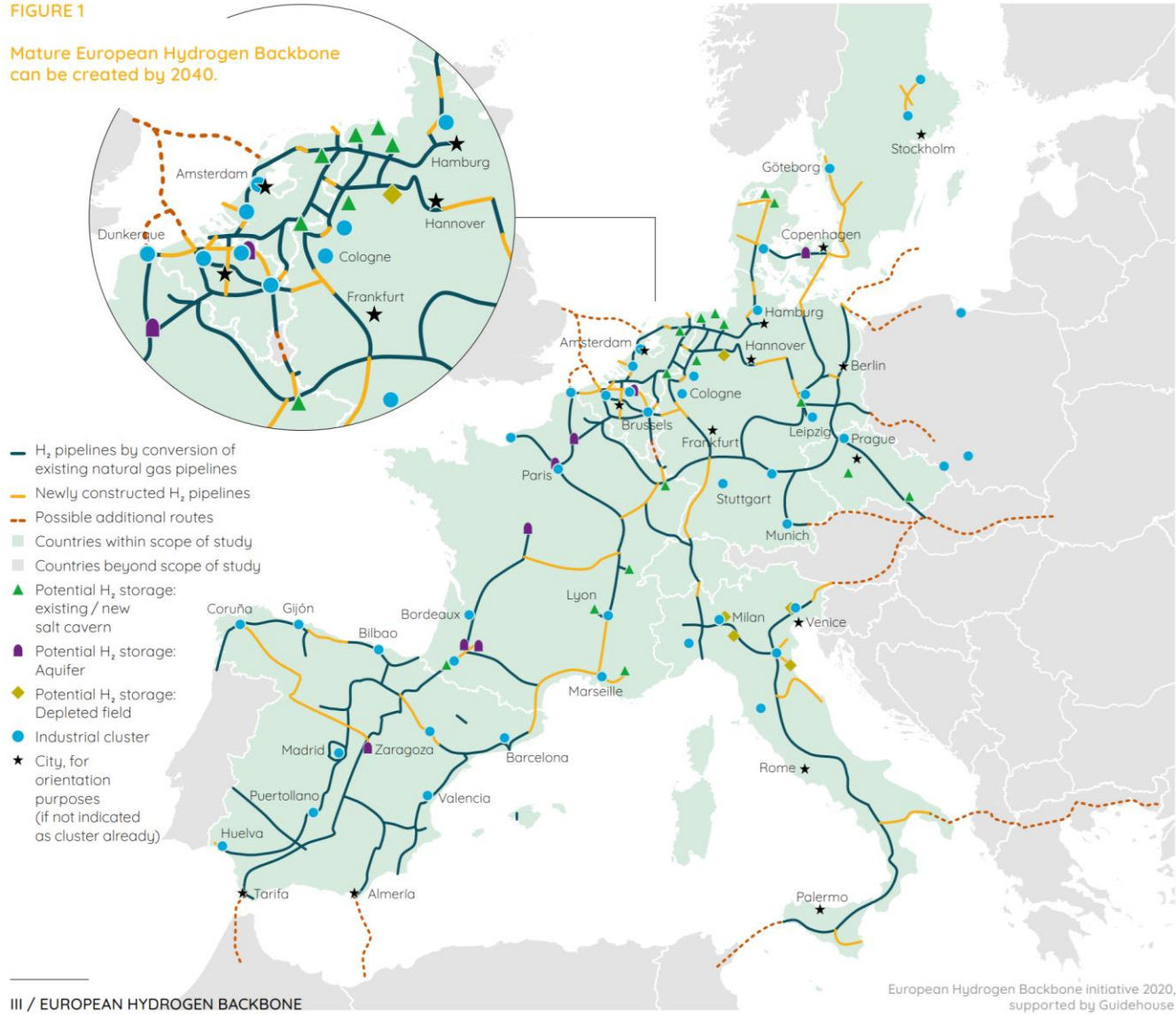
European Gas TSOs have made a first map for European hydrogen backbone

Participants: Enagás, Energinet, Fluxys Belgium, Gasunie, GRTgaz, NET4GAS, OGE, ONTRAS, Snam, Swedegas, Teréga

Link

FIGURE 1

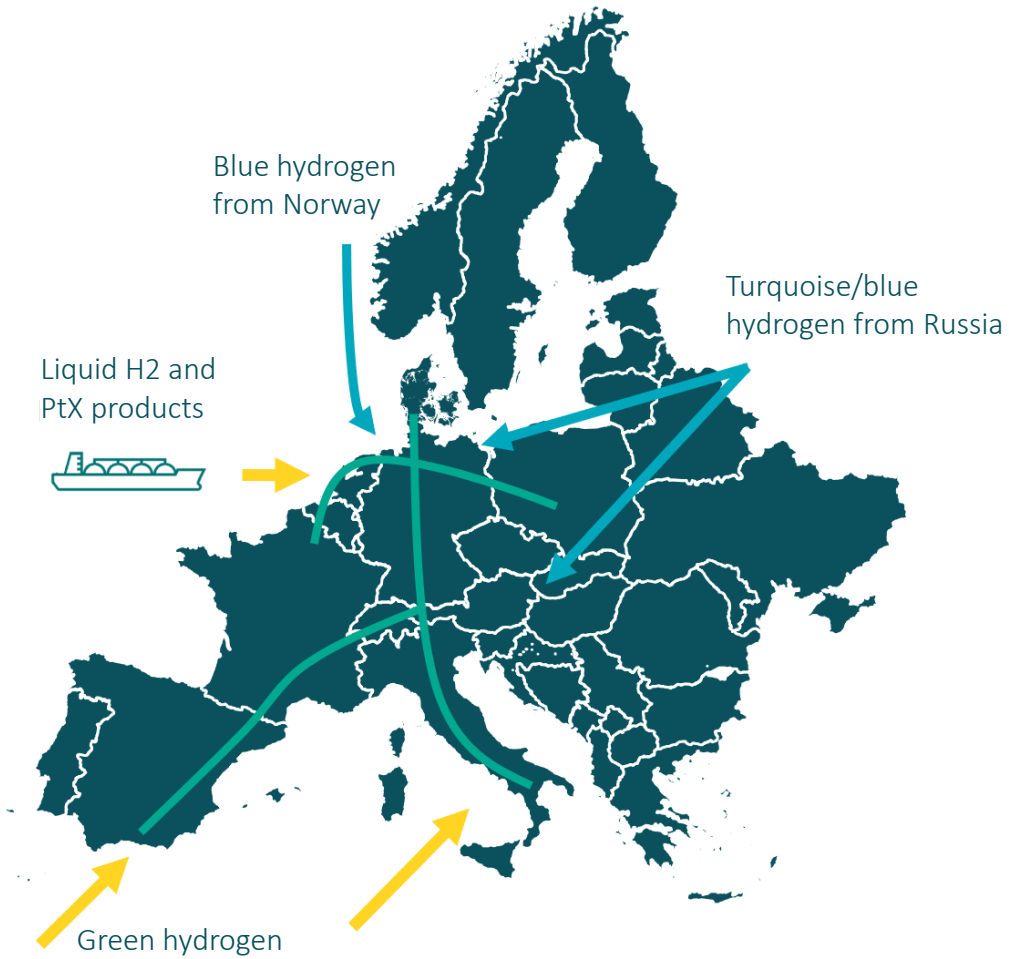
Mature European Hydrogen Backbone can be created by 2040.

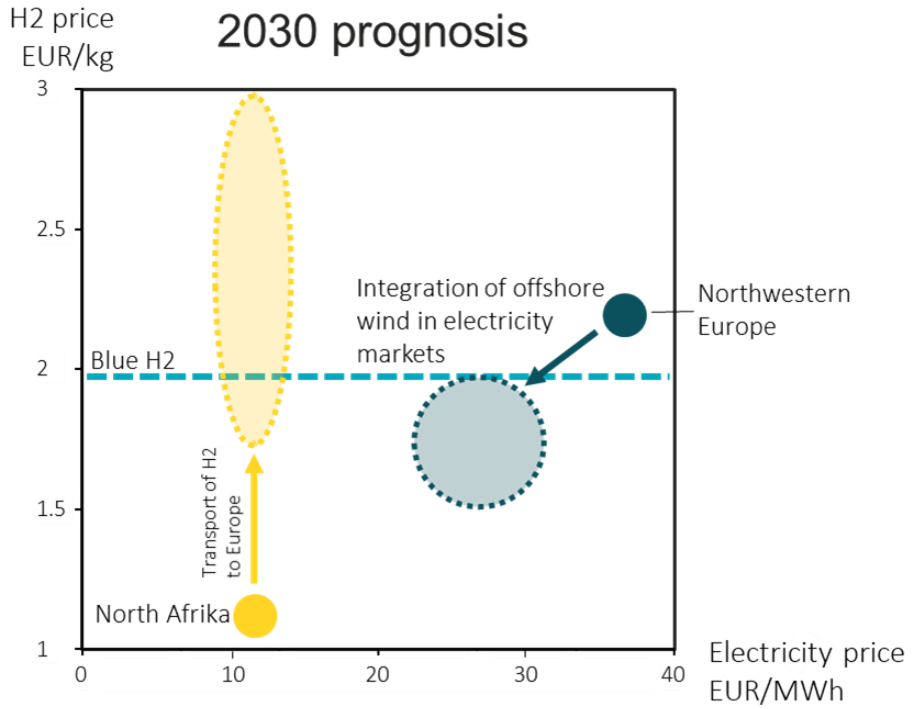


III / EUROPEAN HYDROGEN BACKBONE

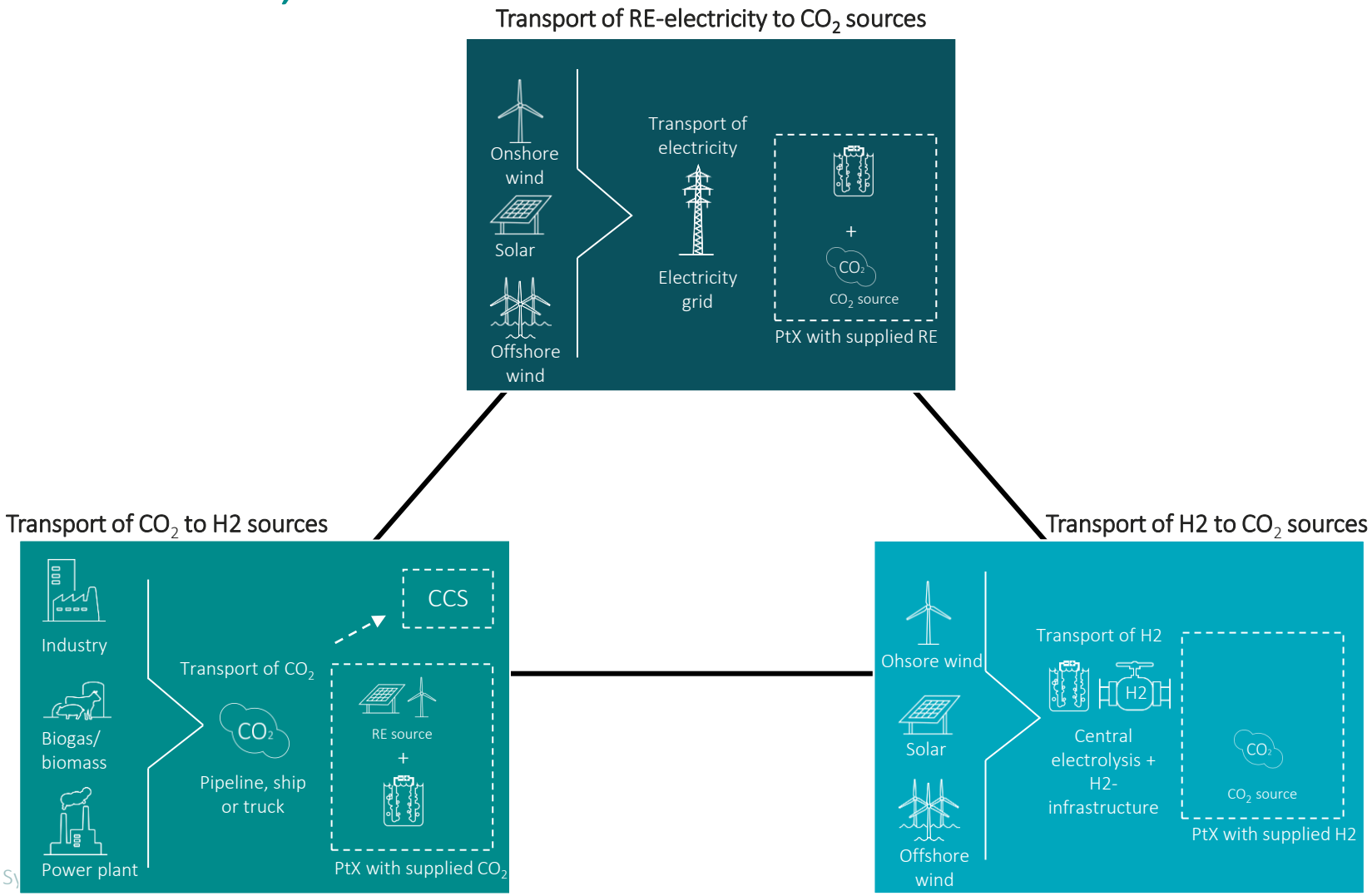
European Hydrogen Backbone initiative 2020, supported by Guidehouse

THE COMPETITIVENESS OF PTX IN EUROPE

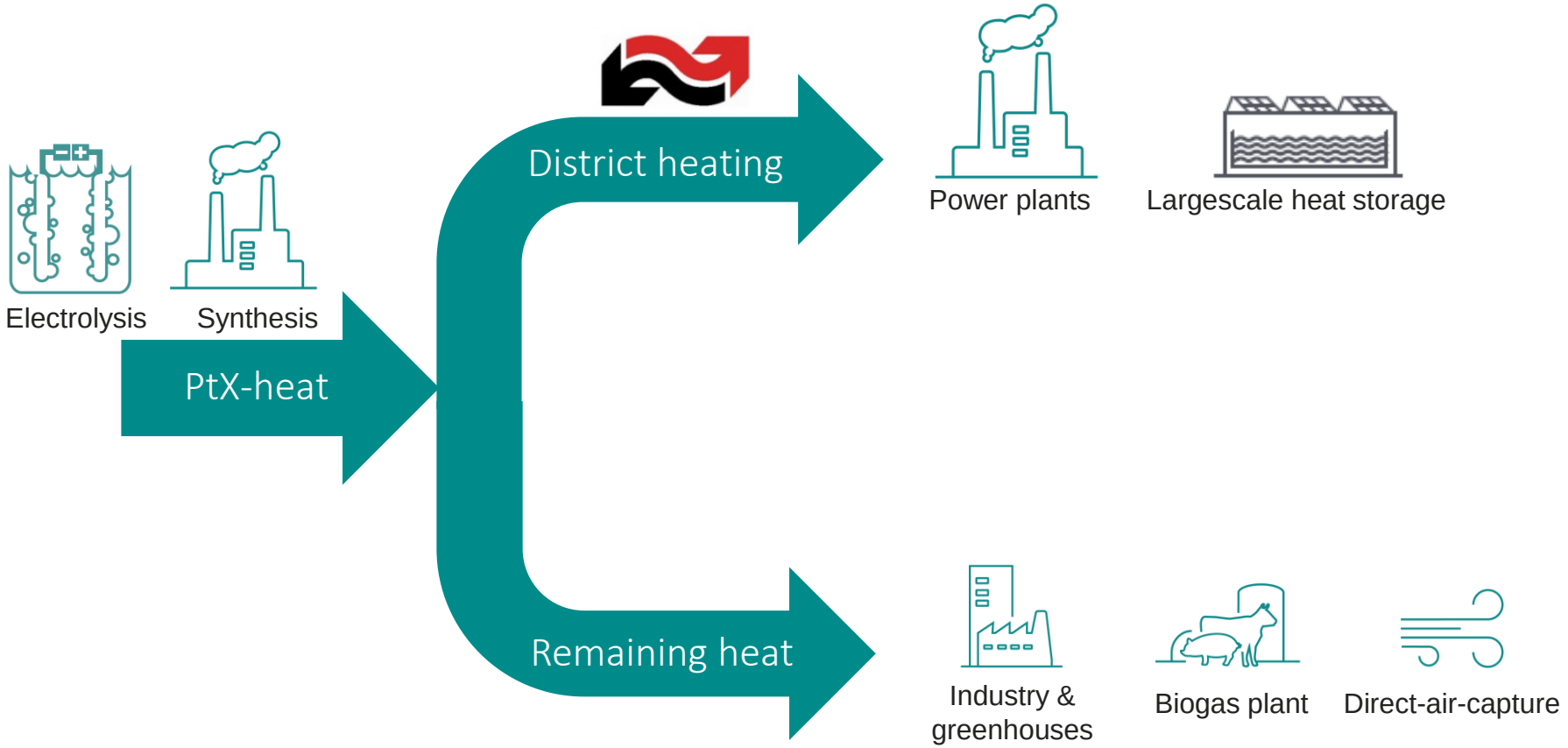




SHOULD CO2, ELECTRICITY OR H2 BE MOVED?



EXCESS HEAT FROM PTX CAN BE USED FOR DISTRICT HEATING AND OTHER PURPOSES



KEY MESSAGES

PtX & Sectorcoupled infrastructure

- We can decarbonize 100% using PtX
- Wind & PtX synergy is much more than just simply curtailment
- Integrated planning infrastructure – team up!

- *Denmark has enough renewable energy and carbon resources to produce large amounts of PtX products*
- *The development of PtX will have significant consequences for the need for Danish energy infrastructure*

Tor Elmelund, MSc Eng
Energinet, Gas System Innovation
tel@energinet.dk