Transport of CO_2 in pipelines to reduce overall costs on CAPEX and OPEX

CO2 Capture, Transportation and Reuse, May 17-18, 2022, Copenhagen

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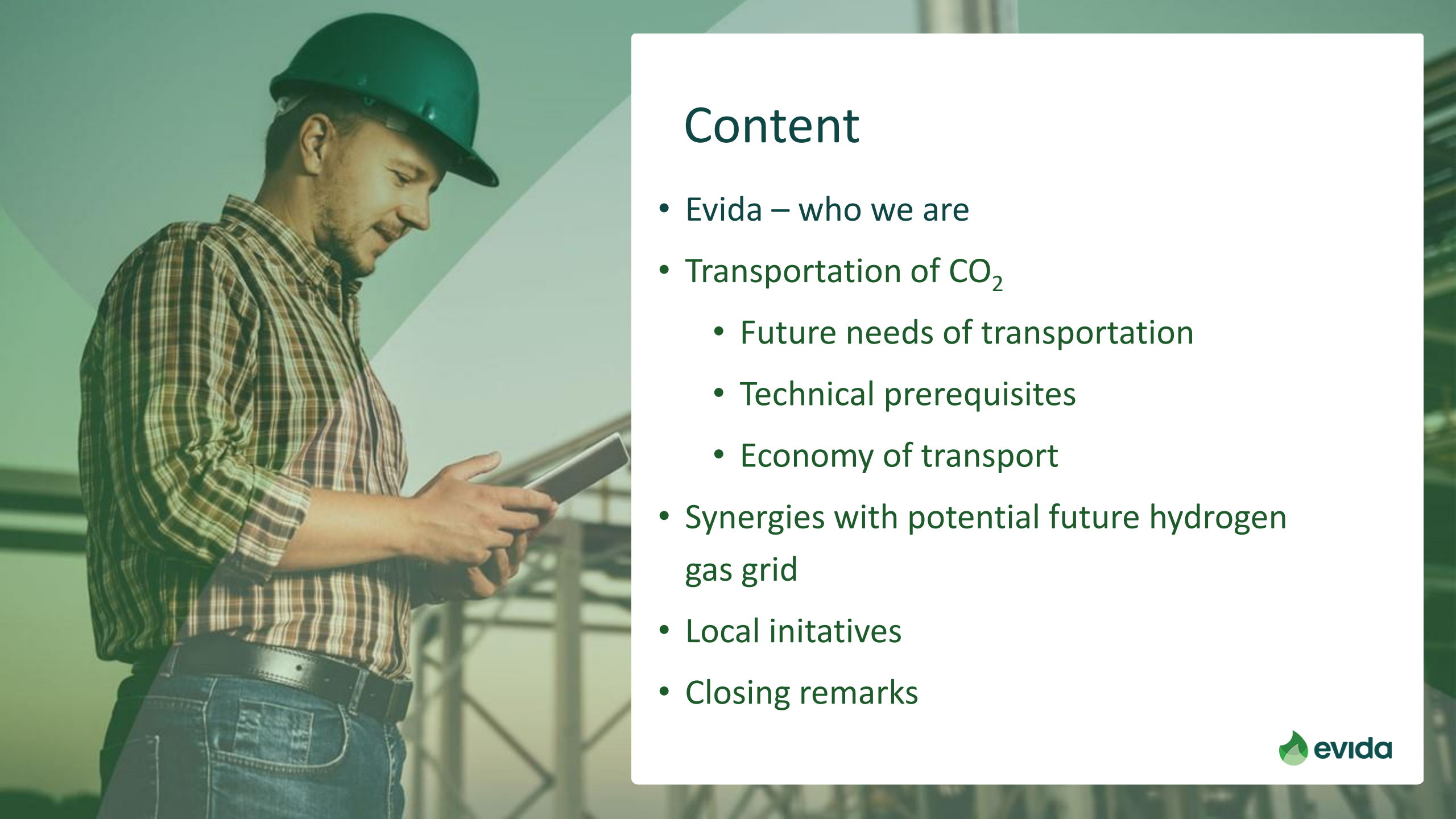

Content

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- Transportation of CO_2
  - Future needs of transportation
  - Technical prerequisites
  - Economy of transport
- Synergies with potential future hydrogen gas grid
- Local initatives
- Closing remarks

Evida

- who we are

Evida – the national gas distribution system operator (DSO)

- 18.000 km pipeline infrastructure
- Mix of natural gas and biogas
- 400.000 customers on grid
- Biogas = 25% of total gas consumption in 2021

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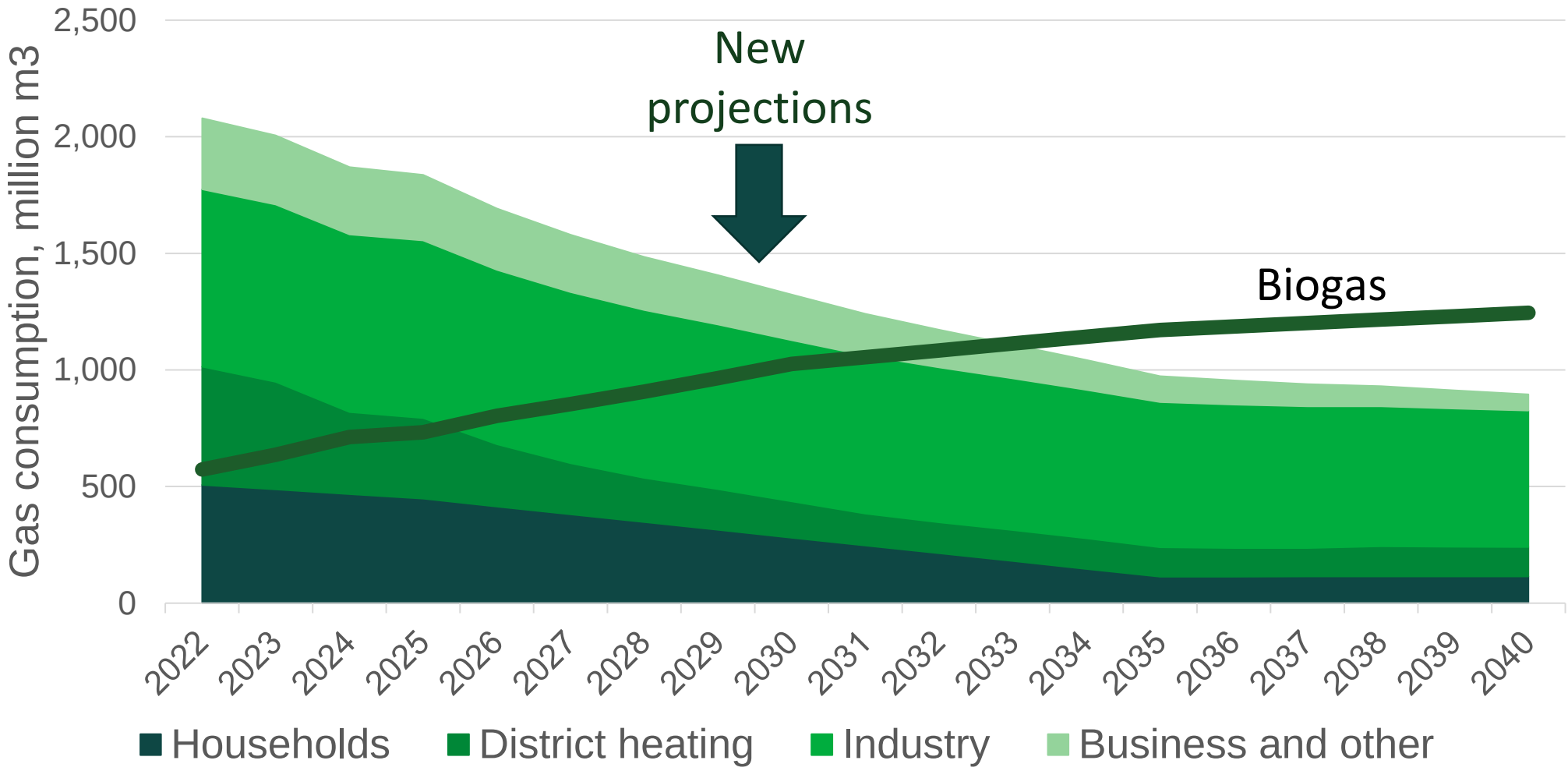
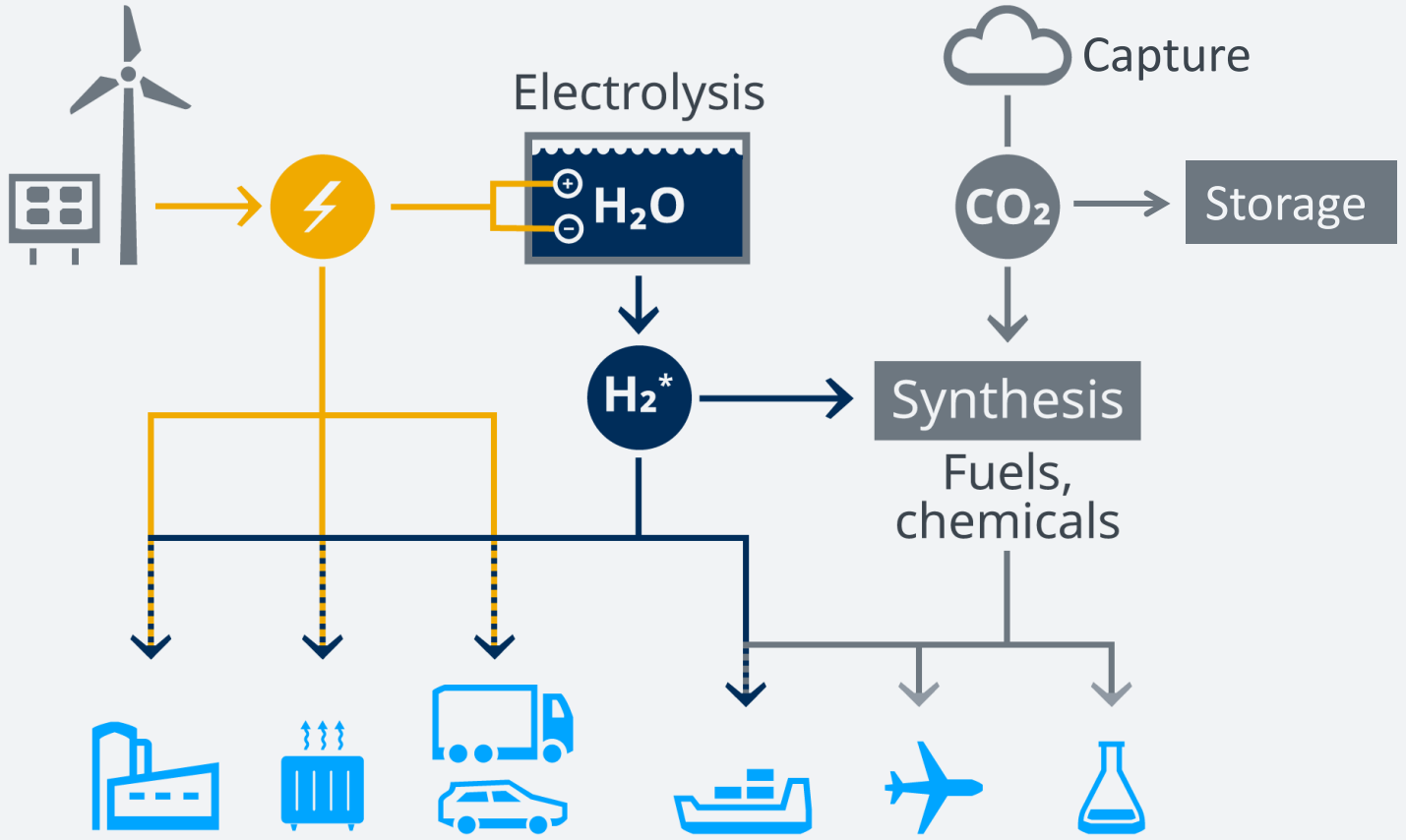
Projected future gas consumption and biogas production



Source: Analyseforudsætninger 2021

The future needs for transportation of CO_2

Power-to-x: carbon-neutral fuels

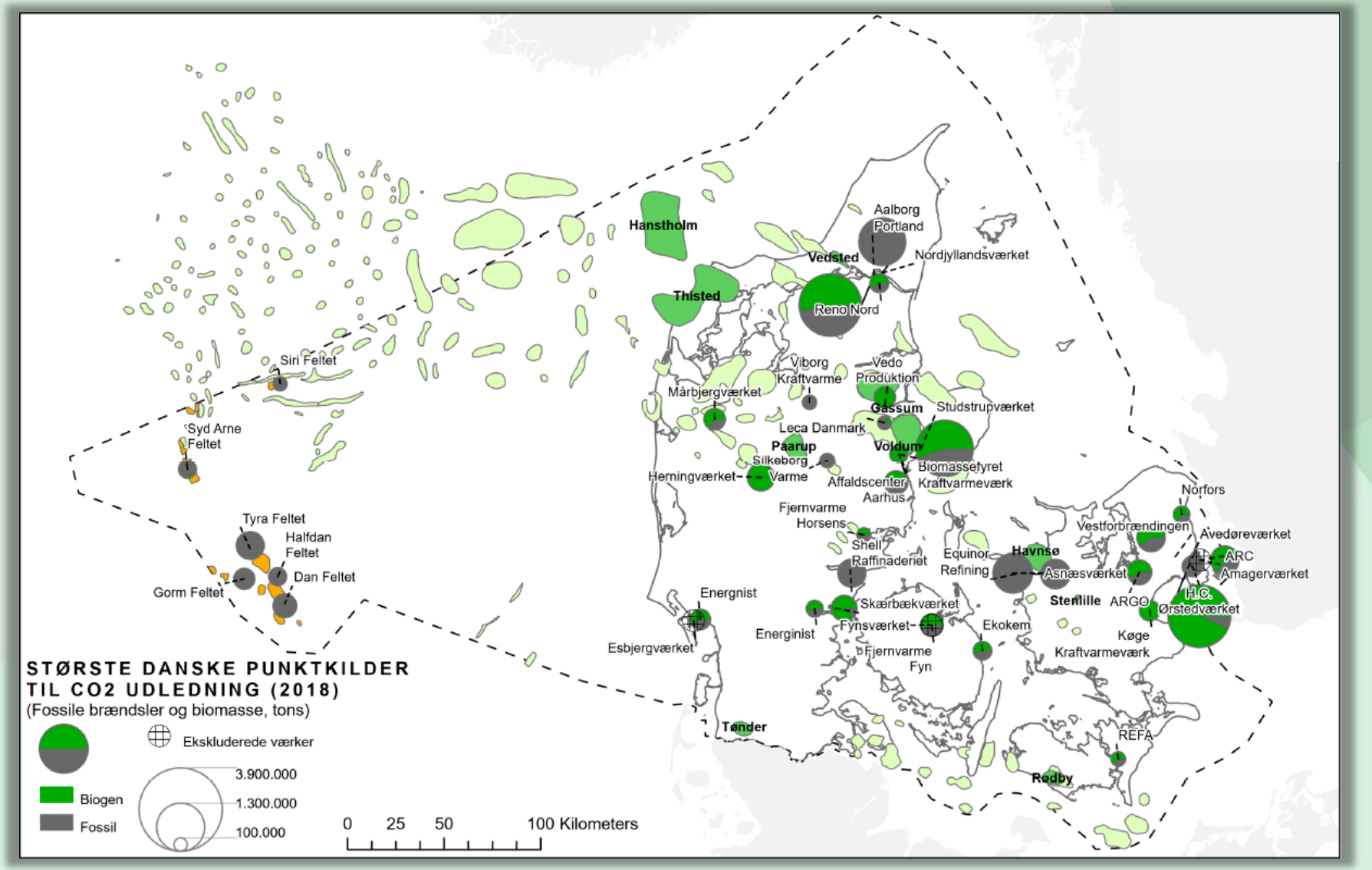


Adapted from DW

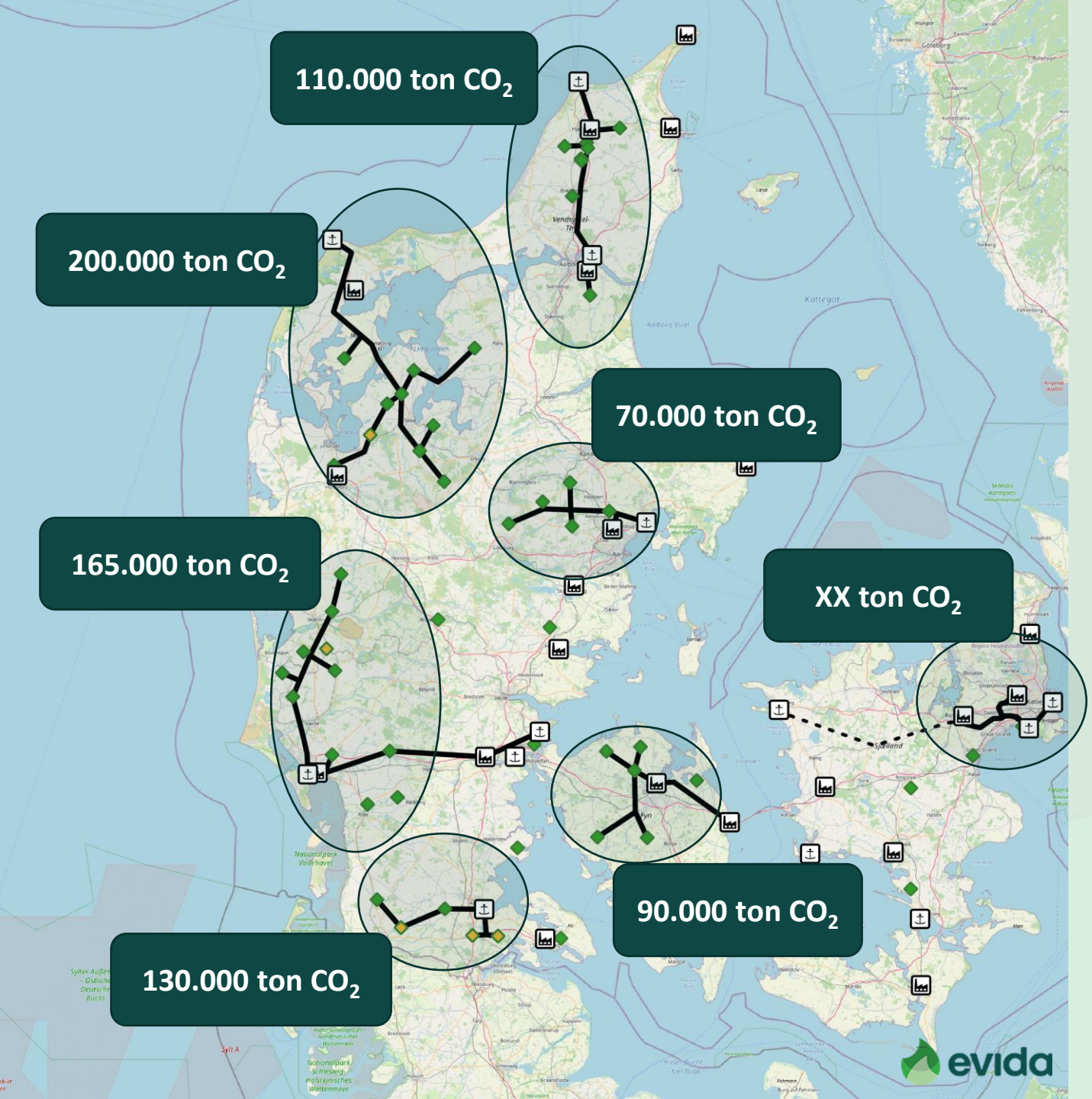
Key objectives of future CO_2 infrastructure

- Reliant, safe and open access to CO_2 from biogenic and fossile sources for CCUS
- Economically feasible and technically viable transportation
- Meet future demands considering both storage and utilization

Sources of CO_2 in Denmark



Source: Danish Energy Agency



Sources of biogenic CO_2

- Approx. 765.000 ton CO_2 from 36 biogas plants alone
- Additional CO_2 from biomass, waste incineration and industry
- Focus on transporting CO_2 from sources to ports for CCS or e-fuel production

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Technical prerequisites for transportation of CO_2 in pipelines

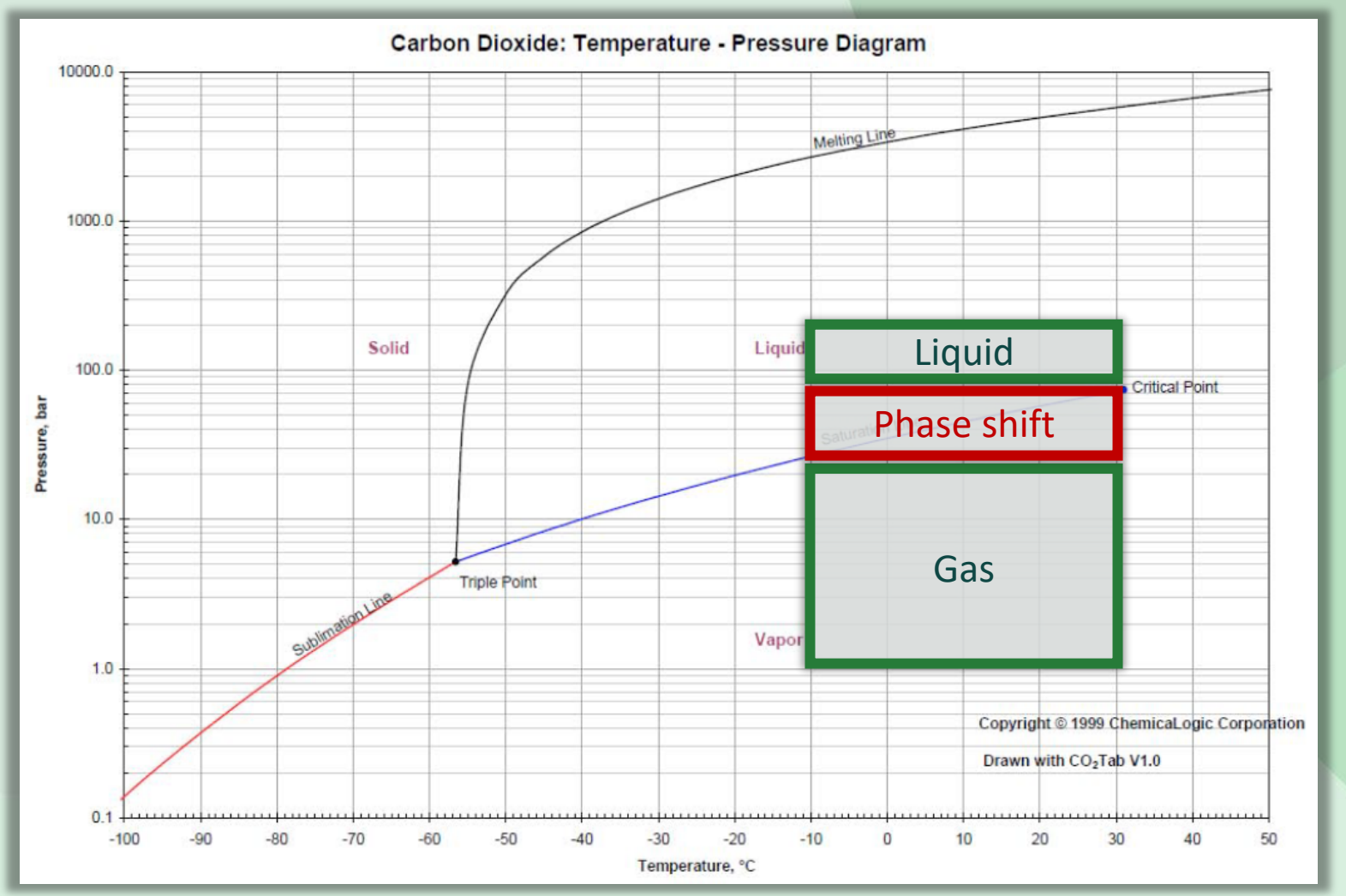
Considered stages for transportation

Liquid form

- Above 80 bar(g)
- Low temperature at around 15 barg

Gaseous form

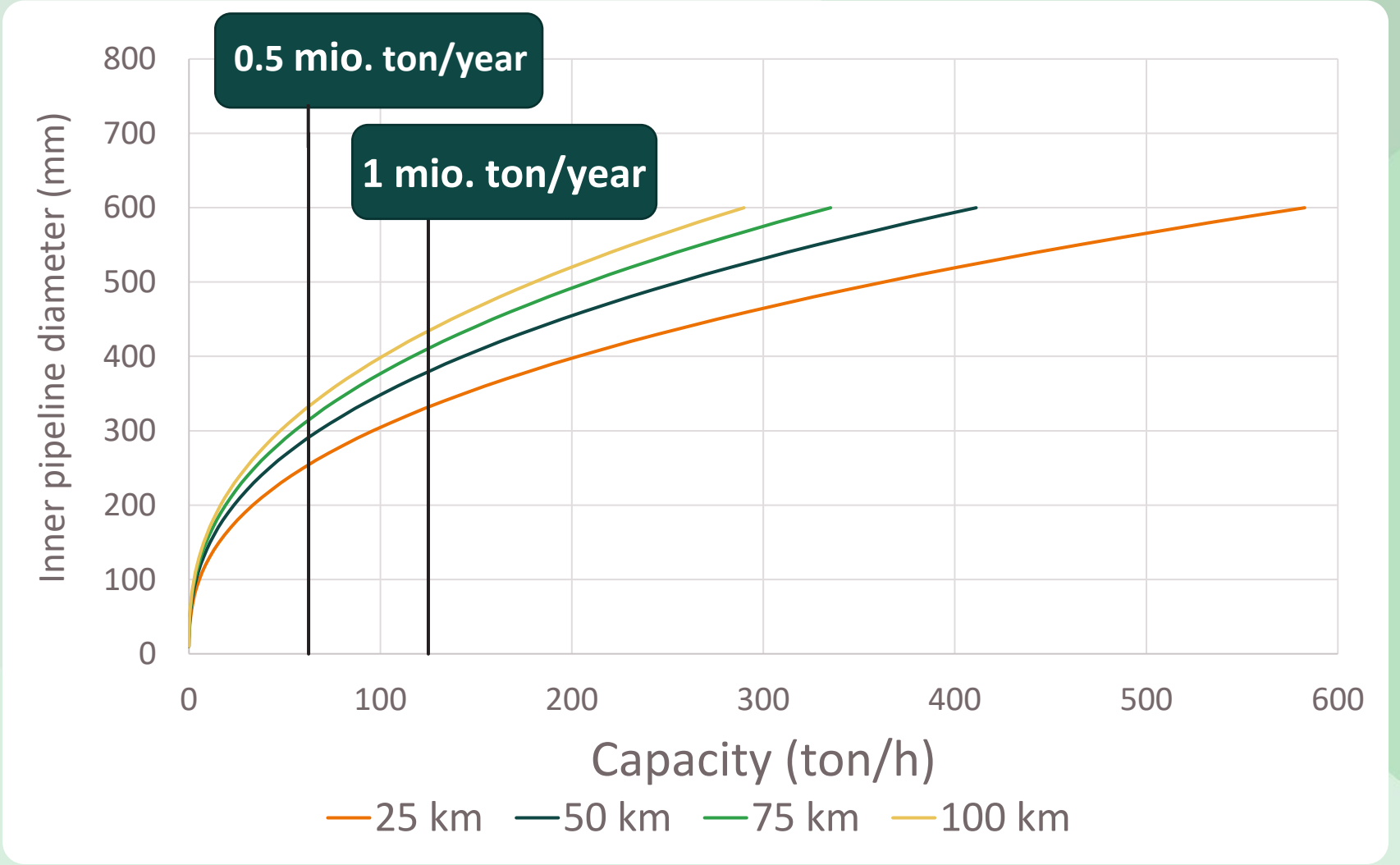
- Below 30 bar(g)



Low pressure CO_2 transport meets future demands

Gaseous form

- Entry pressure at 30 bar(g)
- ΔP: 15 bar

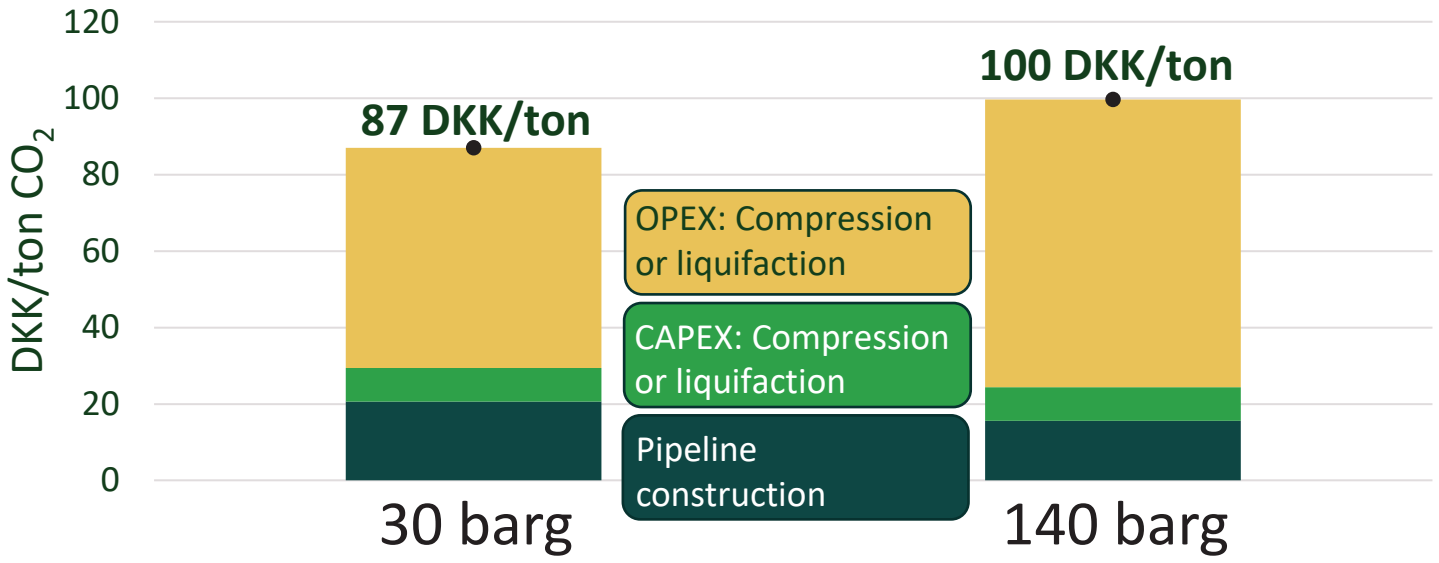


Economy of CO_2 transport

- Low vs. high pressure pipelines
- Pipelines vs. trucks

Low vs. high pressure pipelines

- **1 mio ton/year**
- **100 km distance**
- **Steel pipe**

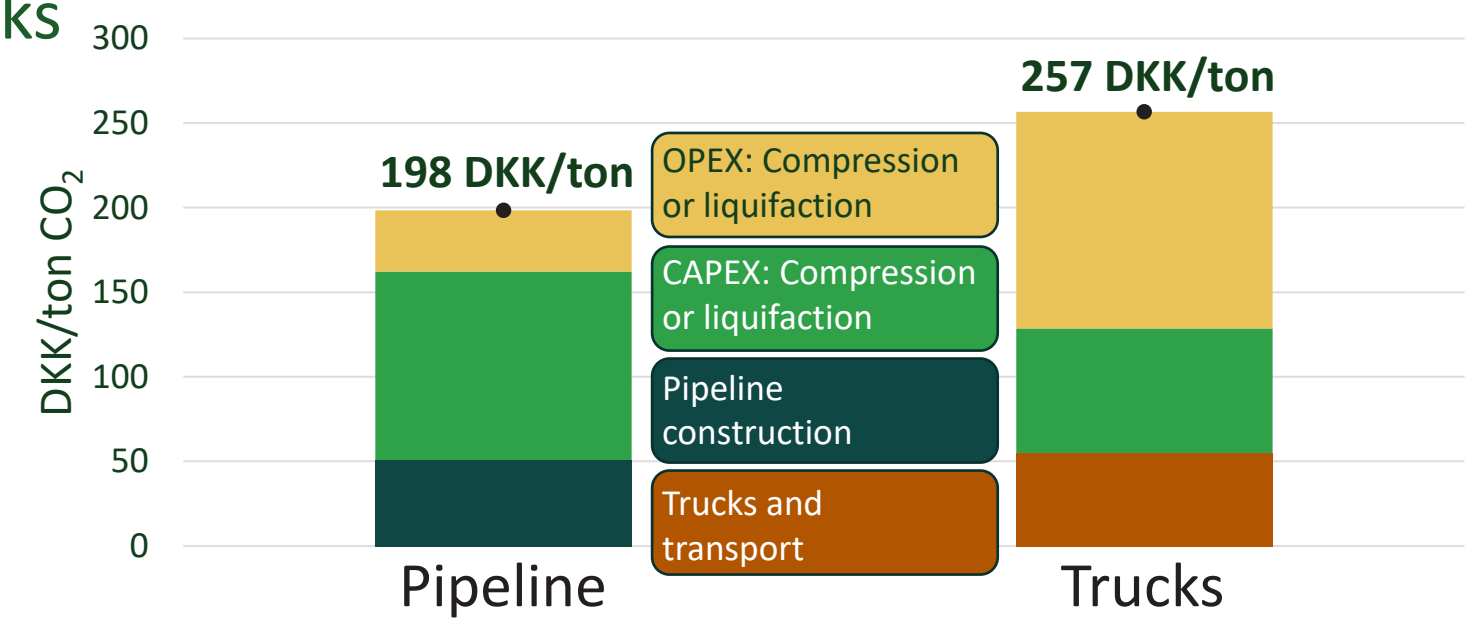


Low pressure pipelines vs. trucks

- **140.000 ton/year**
- **7 biogas plants**

Transportation

- **100 km plastic pipeline**
- **25 km trucking, on average**



Synergies with potential future hydrogen gas grid

The role of future hydrogen infrastructure

Nordjylland

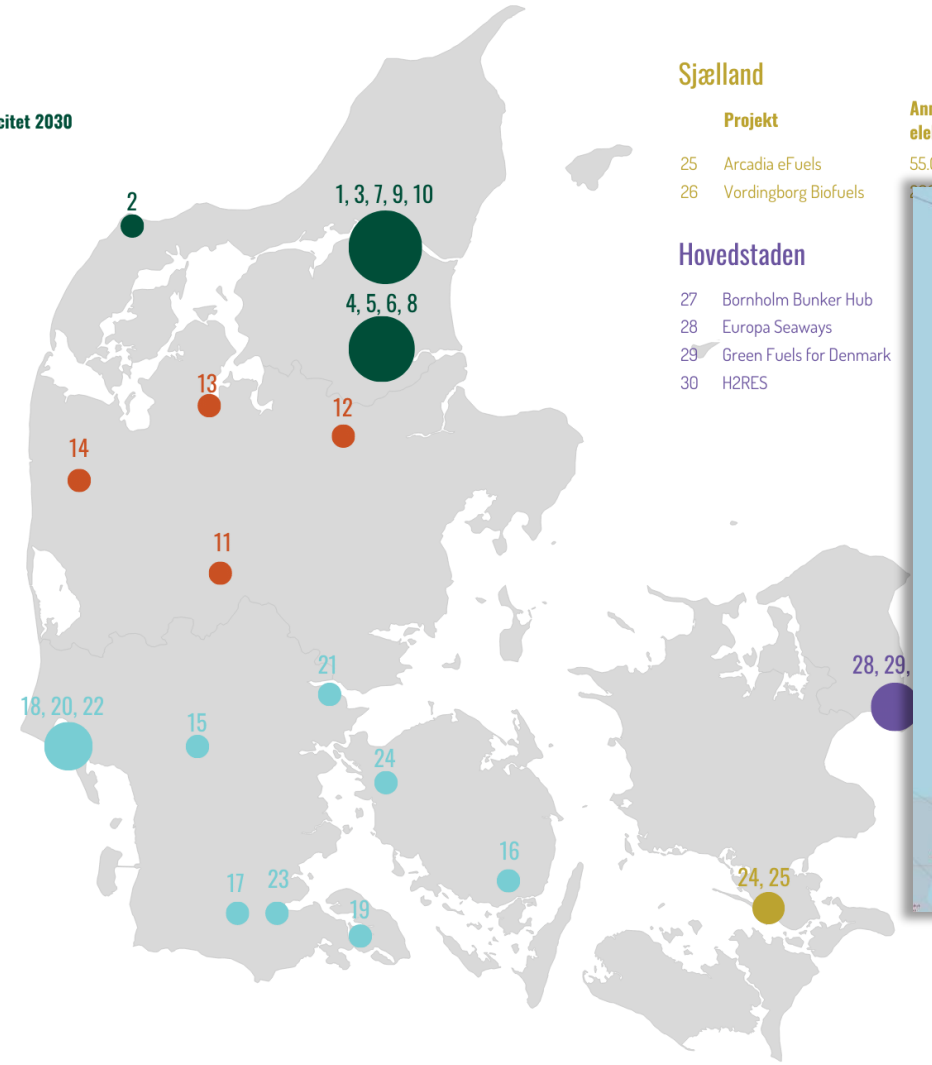
	Projekt	Annonceret elektrolysekapacitet 2030
1	Aalborg Havn - European Energy	120 MW
2	European Energy v Hanstholm Havn	tbd
3	Green Hub CCU Aalborg	tbd
4	Handest	50 MW
5	Hejring	35 MW
6	HFC Marine	0,5 MW
7	HRS Aalborg	0,3 MW
8	HyBalance	1,2 MW
9	Metanolprojekt v Nordjyllandsværket	300-400 MW
10	Power2Met	0,3 MW

Midtjylland

11	Brande - Flø Hydrogen	0,4 MW
12	Green Hydrogen Hub	1 GW
13	Greenlab Skive/GreenHyScale	400 MW
14	REDDAP	10 MW

Syddanmark

15	Biogas Holsted	20 MW
16	Estech	1t brint/dag
17	European Energy v. Kassø	50 MW
18	European Energy v. Måde	12 MW
19	Glansager	6 MW
20	H2 Energy Europe	1 GW
21	HySynergy	1 GW
22	HØST	1 GW
23	Linde - Aabenraa Havn	100 MW
24	Strandmøllen	0,5 MW

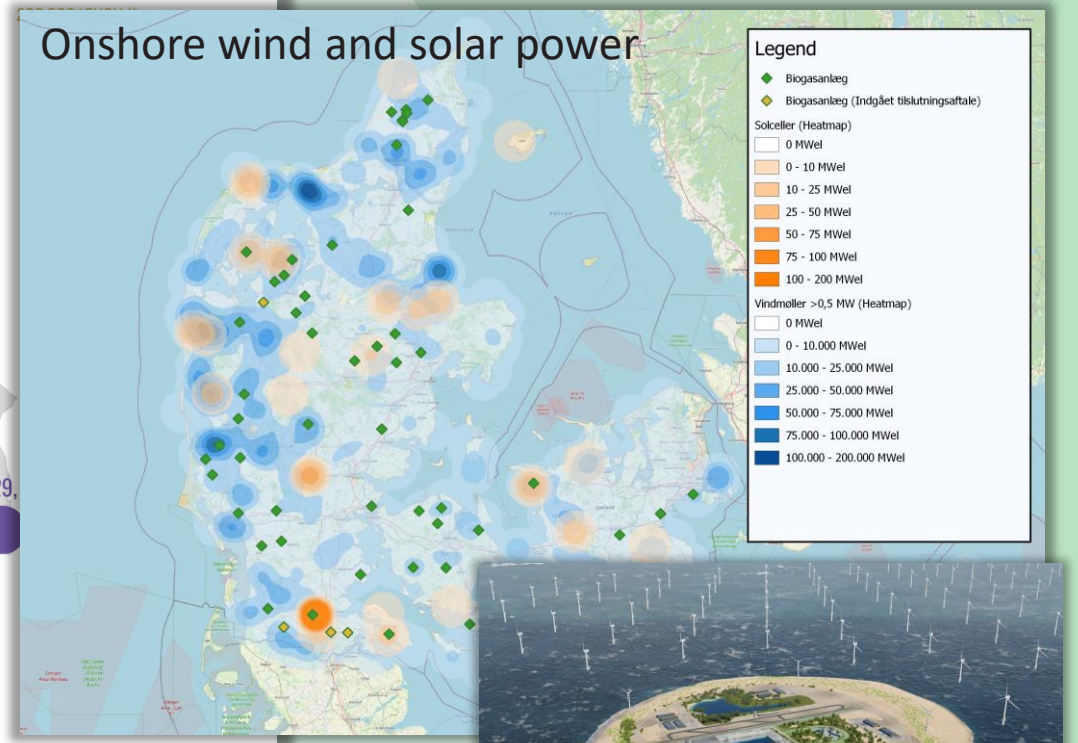


Sjælland

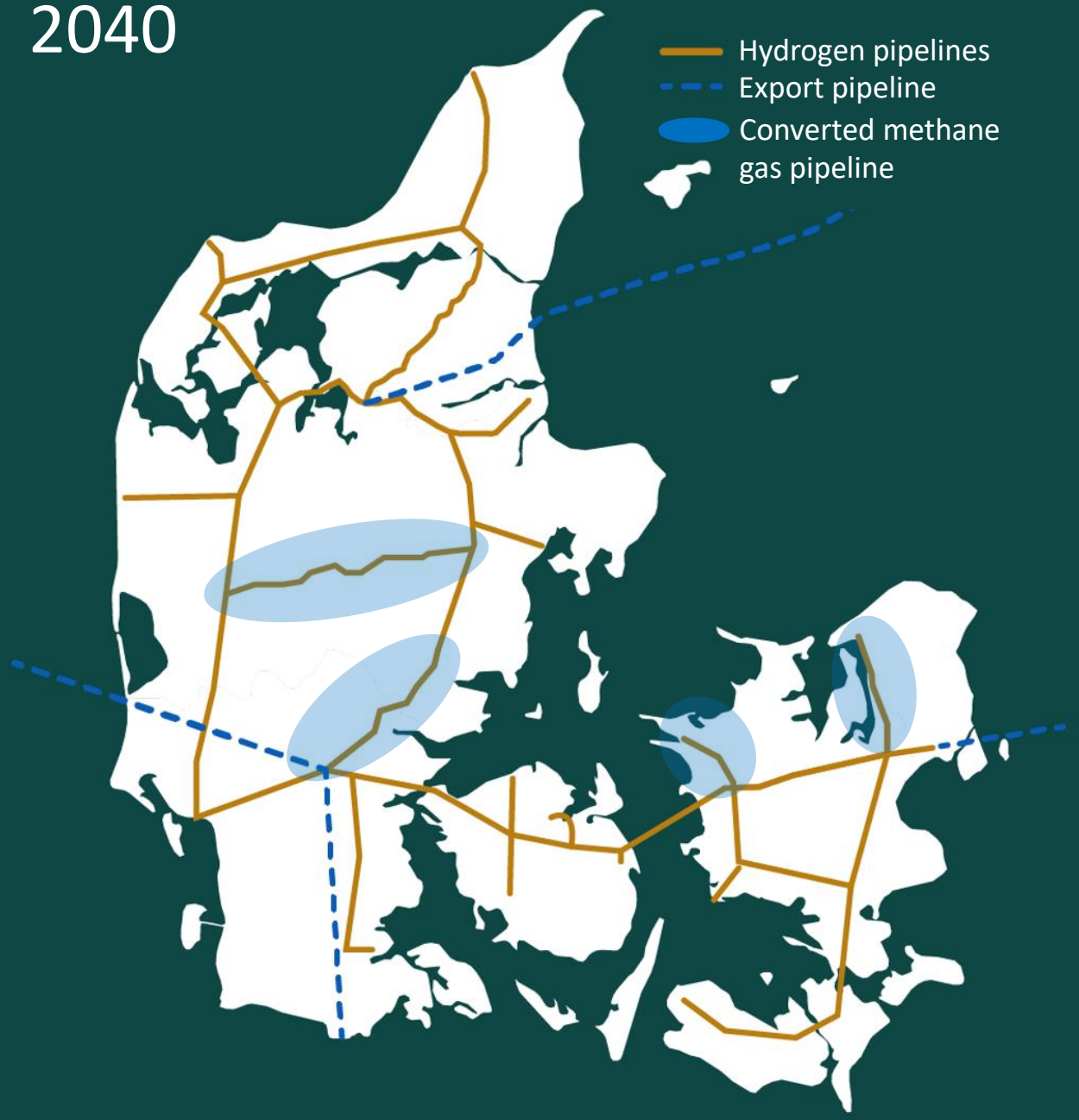
	Projekt	Annonceret elektrolysekapacitet 2030
25	Arcadia eFuels	55.000t eJet Fuel
26	Vordingborg Biofuels	

Hovedstaden

27	Bornholm Bunker Hub
28	Europa Seaways
29	Green Fuels for Denmark
30	H2RES



Brintbranchen



Potential future hydrogen infrastructure

- **Decentralised production** from the outset, supplying hydrogen at **approx. 35 barg**.
- **Decentralised consumption**, e.g. in a number of energy clusters
- **Organic development**, driven by producers and users
- **Two-way flow** following fluctuating energy production (solar, wind)
- Bringing CO_2 and hydrogen together for green fuel production

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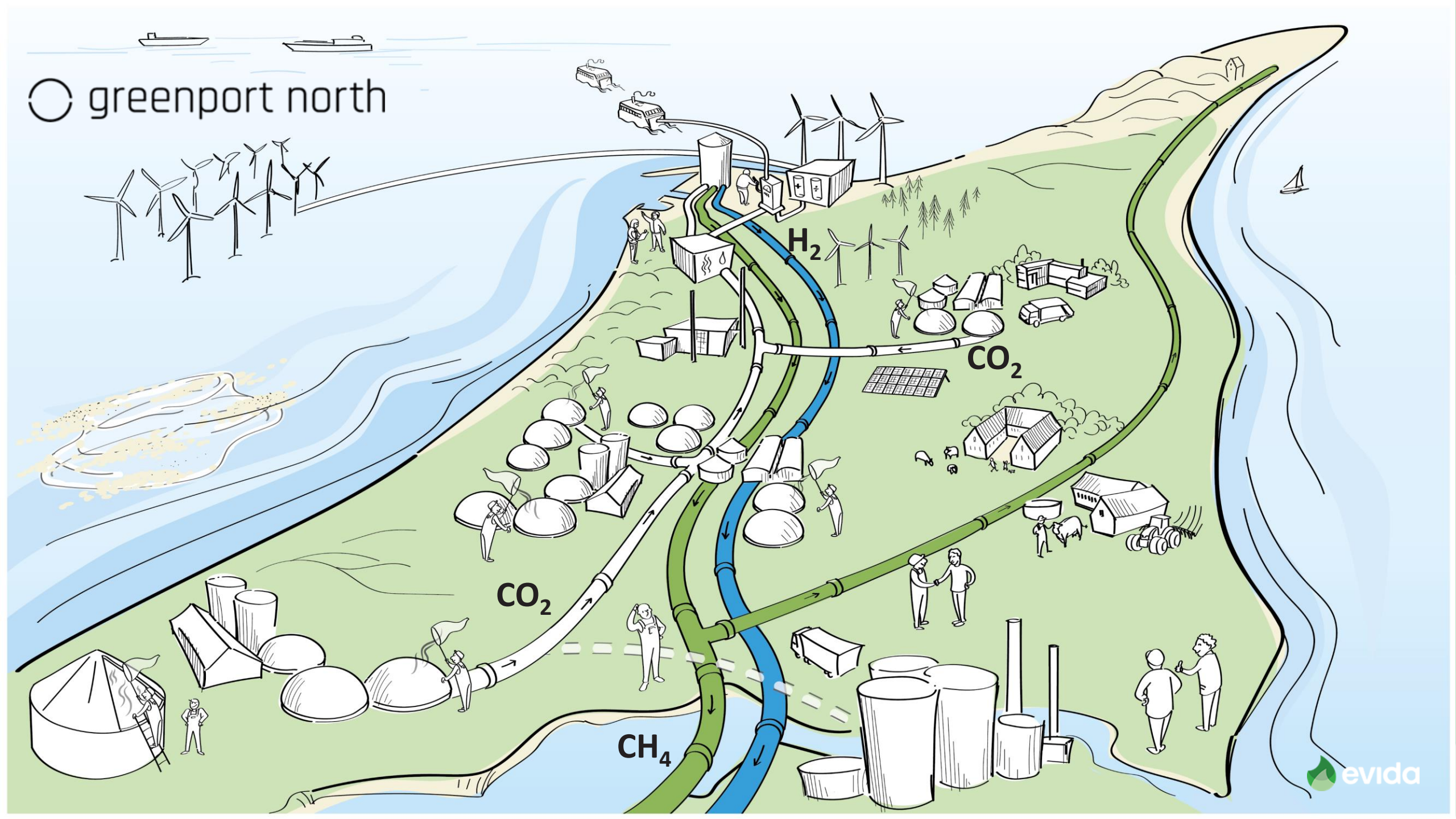
Sector coupling explored through local initatives


greenport north
H_2
CO_2
CO_2
CH_4
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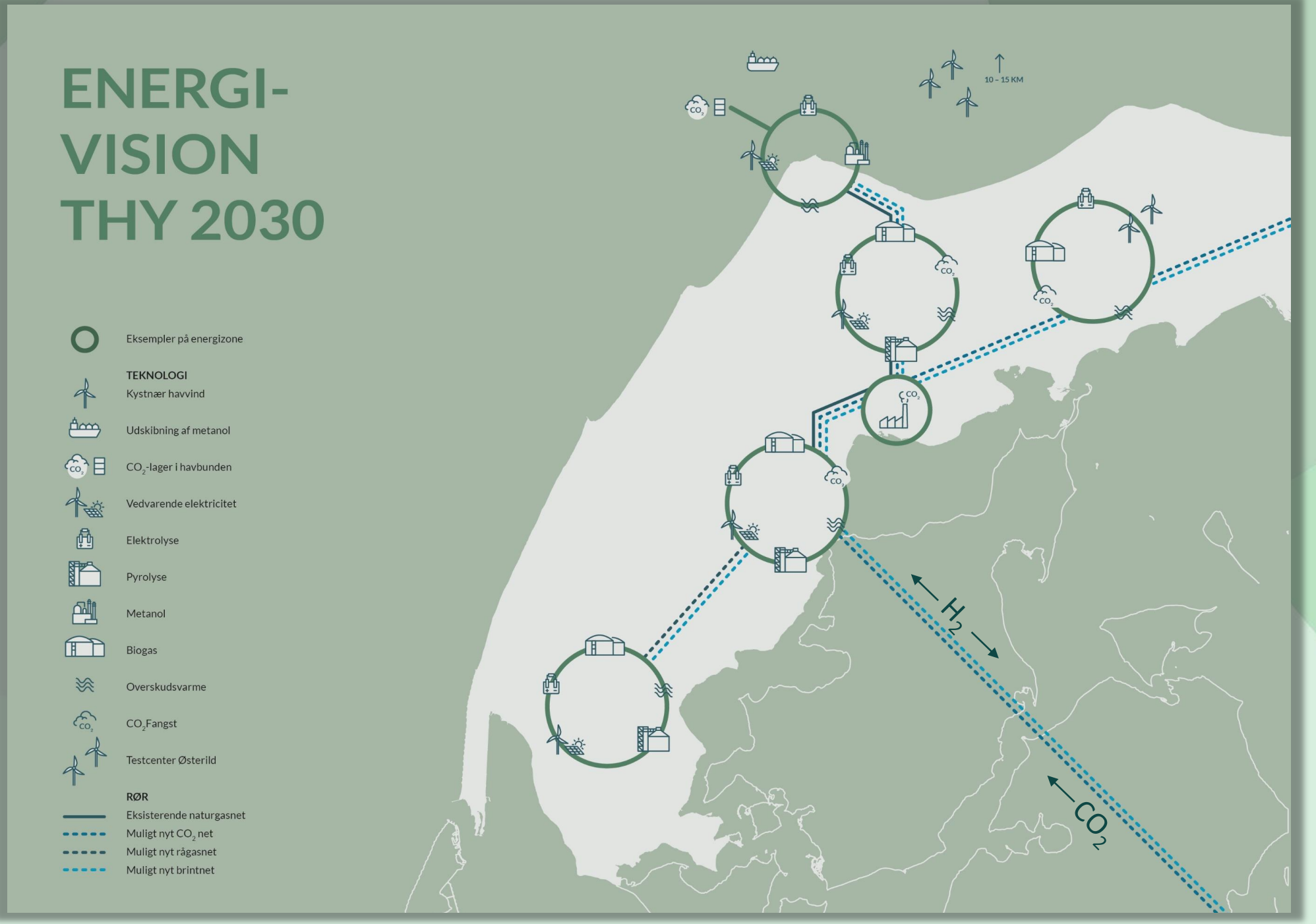
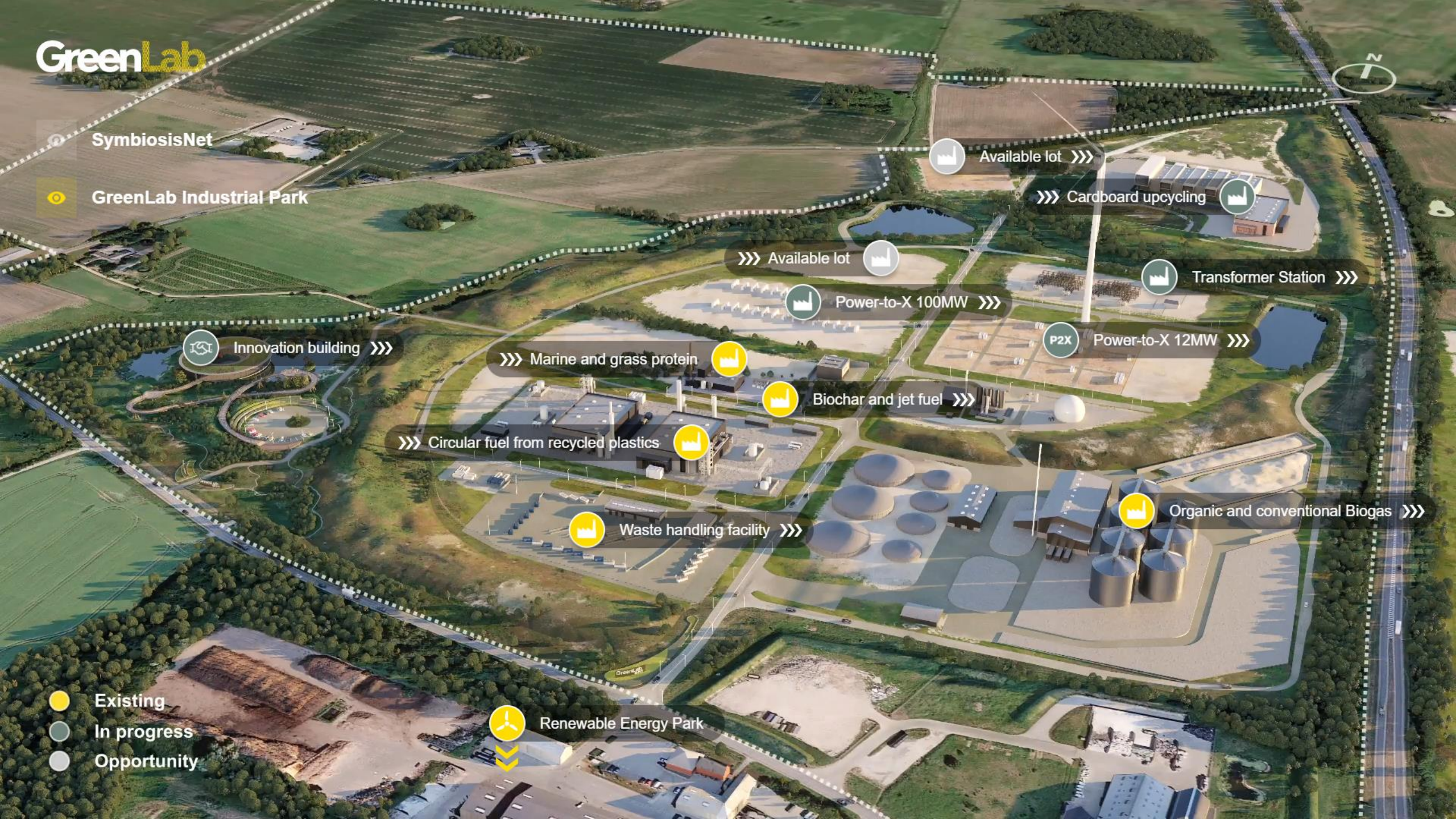
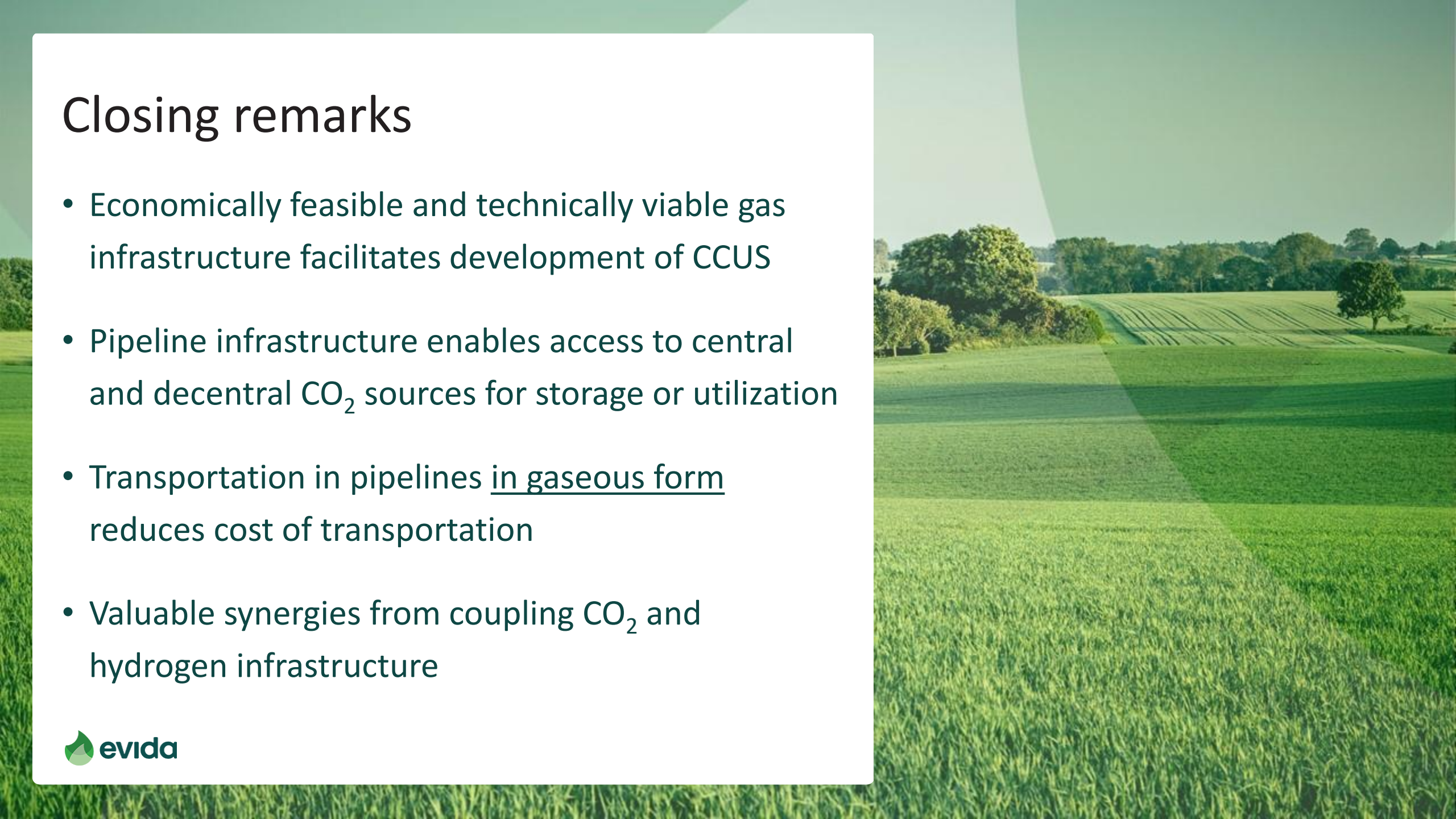
ENERGI-VISION THY 2030




GreenLab
SymbiosisNet
GreenLab Industrial Park
Available lot
Cardboard upcycling
Available lot
Transformer Station
Power-to-X 100MW
P2X
Power-to-X 12MW
Innovation building
Marine and grass protein
Biochar and jet fuel
Circular fuel from recycled plastics
Organic and conventional Biogas
Waste handling facility
Renewable Energy Park
Existing
In progress
Opportunity

Closing remarks

- Economically feasible and technically viable gas infrastructure facilitates development of CCUS
- Pipeline infrastructure enables access to central and decentral CO_2 sources for storage or utilization
- Transportation in pipelines in gaseous form reduces cost of transportation
- Valuable synergies from coupling CO_2 and hydrogen infrastructure



Thank you for your attention

- questions are most welcome

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