Energy Islands in Denmark

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The green transition in Denmark

Targets for 2030 and 2050

50%
RE from wind and solar in the electricity production

99.996%
Security of supply

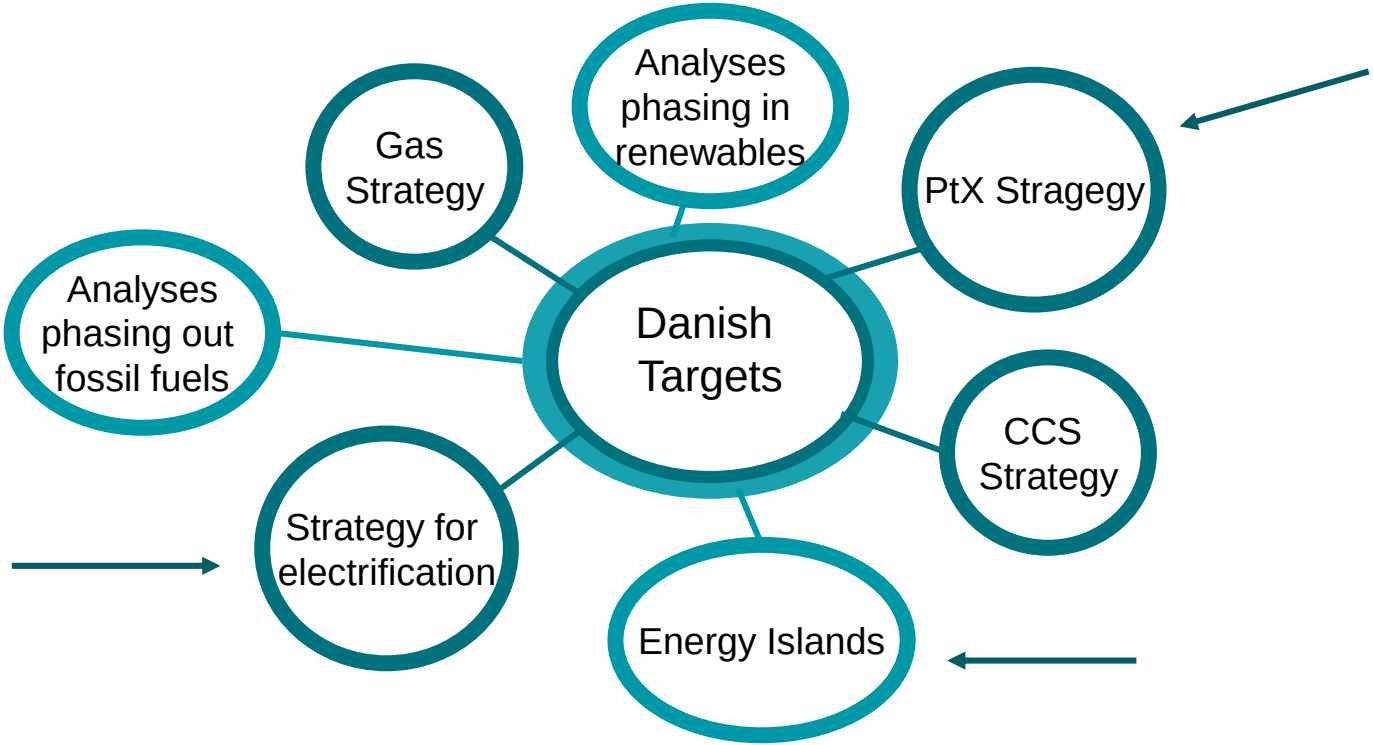
70%
CO_2 reduction in 2030 compared to 1990

100%
Green electricity by 2030

100%
Independence from fossil fuels by 2050

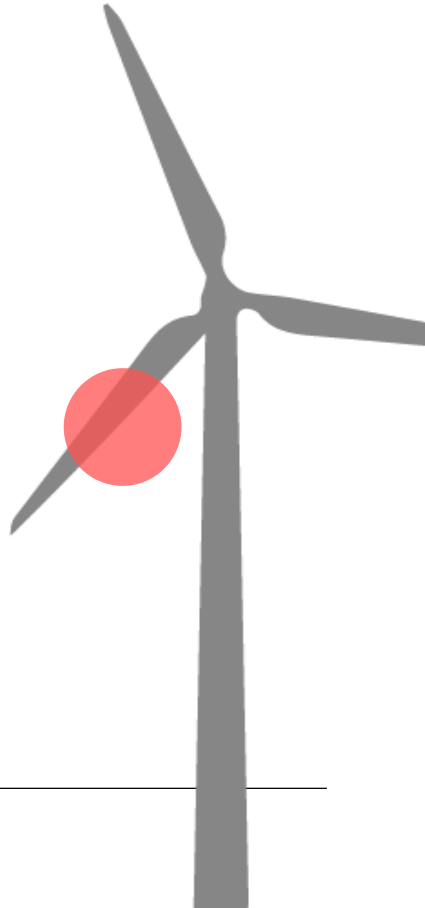
Rethinking the energy system to reach the Danish targets

Several analyses are in process to analyse sectors and sector coupling



Key Danish political ambitions in the offshore wind sector

- *Offshore wind to play a key role in Danish decarbonisation and renewable energy targets*
- *EU targets for decarbonisation and renewable energy to be supported by scaled-up regional offshore wind projects*
- *Regulatory frameworks in favor of innovation and efficiency*
- *A larger share of responsibilities and costs borne by OWF developers as technology matures*



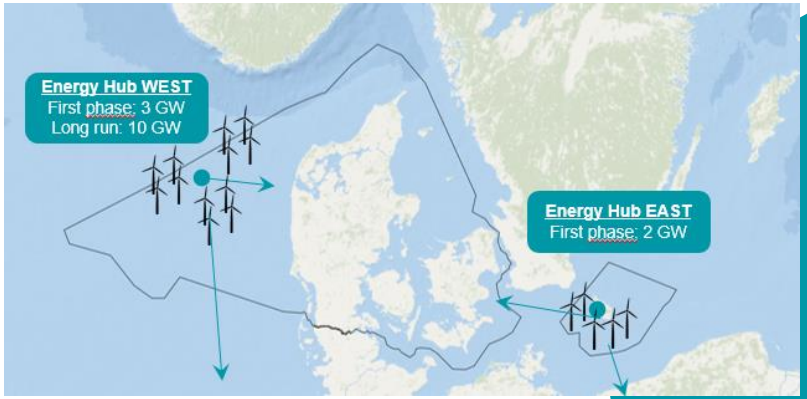
Energy Hubs / Energy Islands

The new trends

- Purpose: Gain access to the vast wind power potentials in the North Sea and distribute the power to the European electricity market.
- The renewable electricity from the energy hubs will contribute to the large scale green transition in Denmark and Europe.
- Energy Hub EAST: The island of Bornholm
- Energy Hub WEST: Artificial island constructed in the North Sea approximately 80 km from the Danish shore.

First phase:

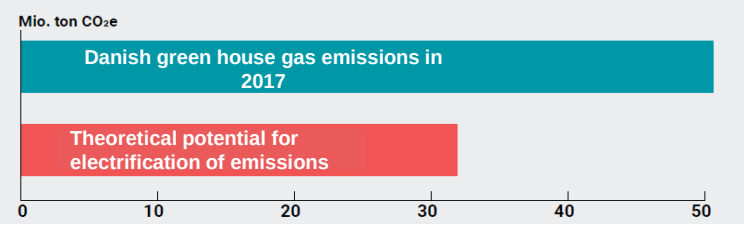
- 5 GW wind turbines ≈ 23 TWh per year.
- By comparison Denmark consumed 35 TWh in 2019.
- Ambition: Constructed by 2030.
- Estimated costs: DKK 95-100 bln. (≈ € 13 bln.)

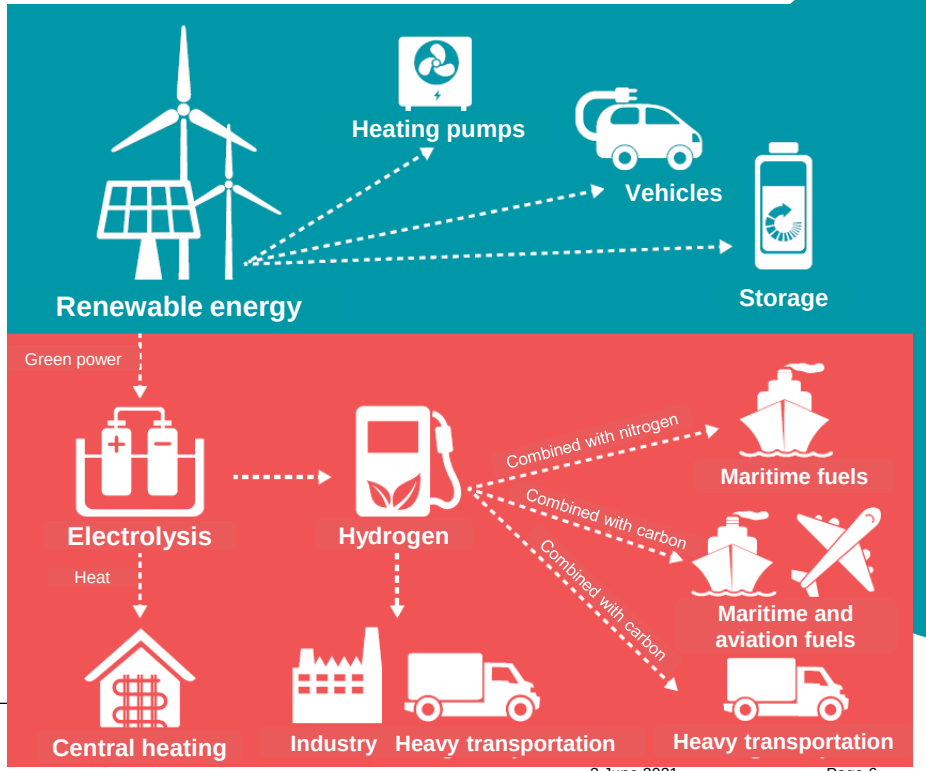


Electrification

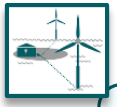
The new trends

- Electrification is a central pillar in the green transition, converting energy processes from being based on fossil combustion to be based electricity.
- When an energy process is electrified, the process will be climate neutral, as long as the electricity is produced through renewables.
- Theoretically ≈ 60 pct. of Danish emissions can be electrified.
- However, widespread electrification requires strategic investments, further technological developments, sector integration and timely implementation.
- Therefore, the Danish government will present a **Strategy for electrification of Denmark** later this year.





Power-to-X – a solution for the sectors where electrification is not possible



Direct applications of 1 GW offshore wind…

Vs.

Applications for conversion via PtX ..

Power-to-X

Heating	Heating of ~ 750,000 households with heat pumps	Heating of ~ 100,000 households via methanized gas
Light road transport	Supply of ~ 1,500,000 electric cars with electricity	Supply of ~ 500,000 cars with green hydrogen
Heavy road transport	✕	Supply of ~ 5,000 trucks with RE fuel
Maritime	✕	Supply of ~ 5 of Maersk's Triple E container vessels with e-ammonia
Aviation	✕	Supply of ~ 4 times Danish domestic aviation
Industry (high temp. heat)	✕	~ 50% of industry energy consumption for high temperature heat with methanized gas

Note: The figures are rough estimates and are subject to considerable uncertainty. The purpose here is merely to illustrate a size ratio

The Danish Power-to-X strategy

The new trends

Key questions:

- *What is the market potential of hydrogen and hydrogen derivatives both in Denmark and abroad?*
- *Where and how big is current and future demand for these fuels?*
- *How quick can PtX-technologies be upscaled?*
- *How can we secure a balance between national reductions and export potential?*
- *What role will state and private actors play in the development and upscaling of PtX?*

1. Analyses

2. Political process

3. Strategy

Key areas of focus, which the strategy is expected to address:

- Technologies' role in the achievement of 2030- and 2050-goals
- Infrastructure development
- Potential for technology- and energy-export
- Synergies with the rest of the energy system (incl. energy islands)
- Regulatory framework
- Financing opportunities and solutions
- International cooperation

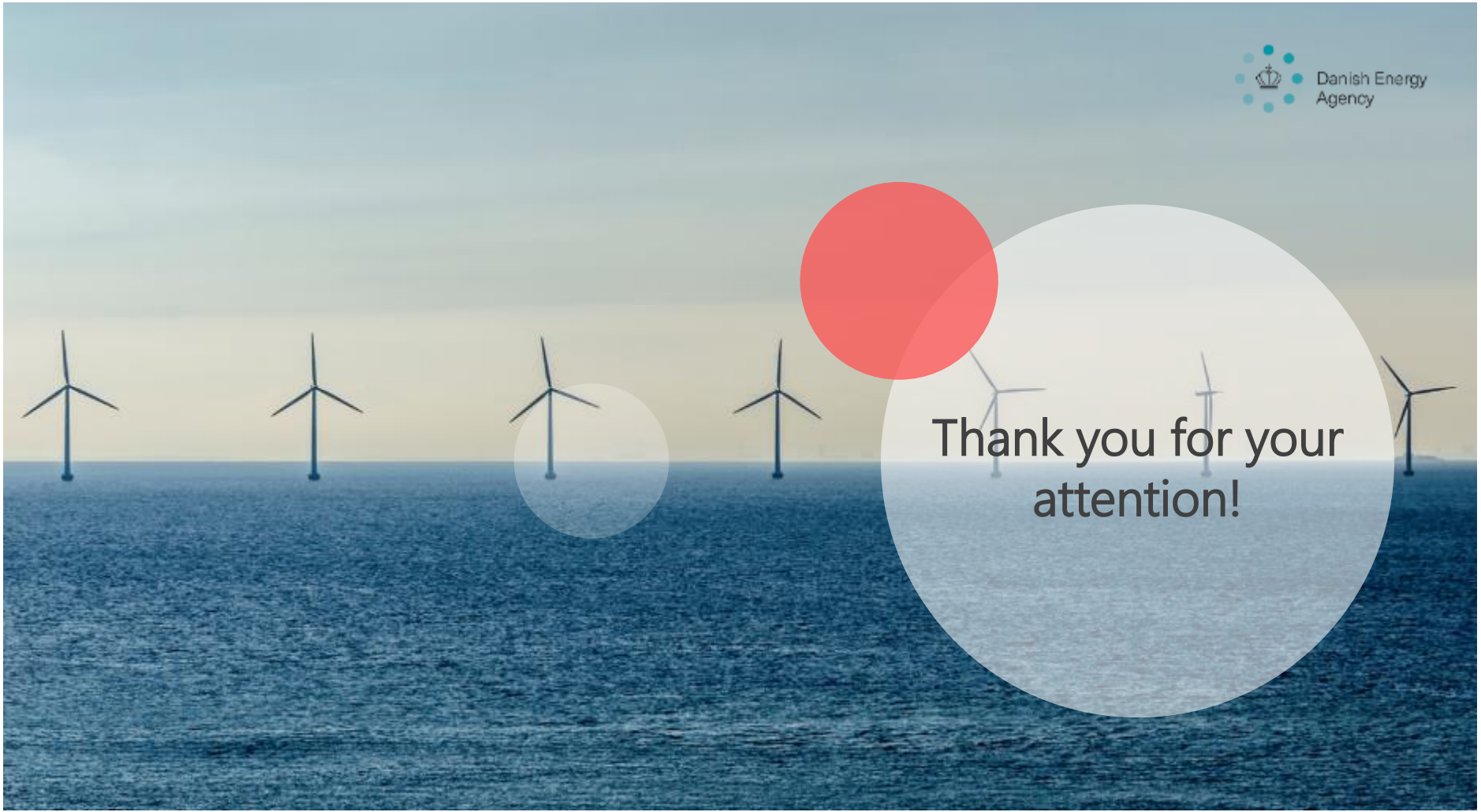
Denmark can supply Europe with renewable energy and e-fuels

Offshore wind
+ 40 GW offshore wind potential

Energy islands
Offshore wind and power-to-x

Danish electricity is green
- 62% renewable energy in 2018
- 100% renewable energy in 2027

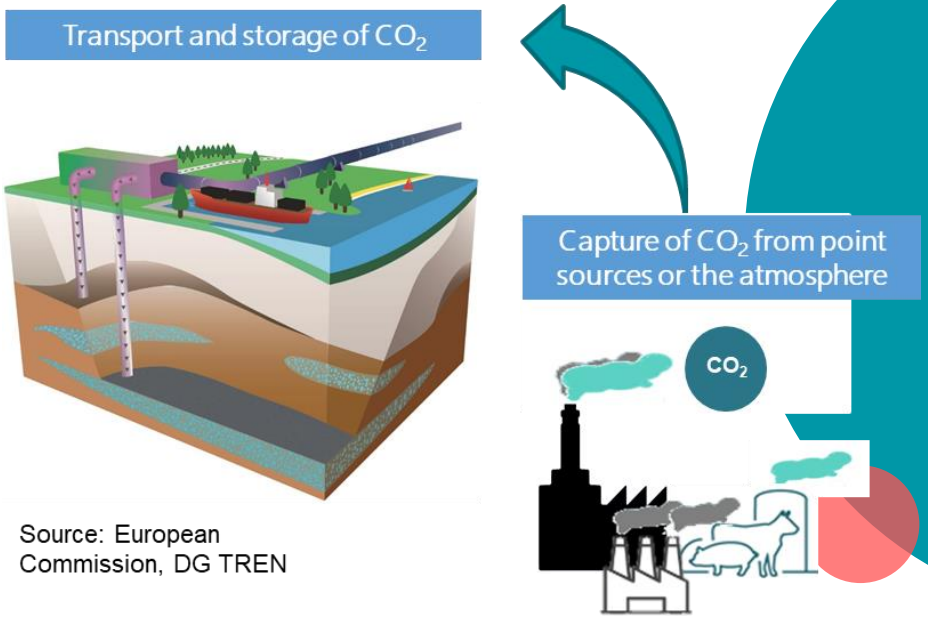
Green hydrogen from Denmark will be green!


Danish Energy Agency
Thank you for your attention!

Carbon Capture and Storage (CCS)

The new trends

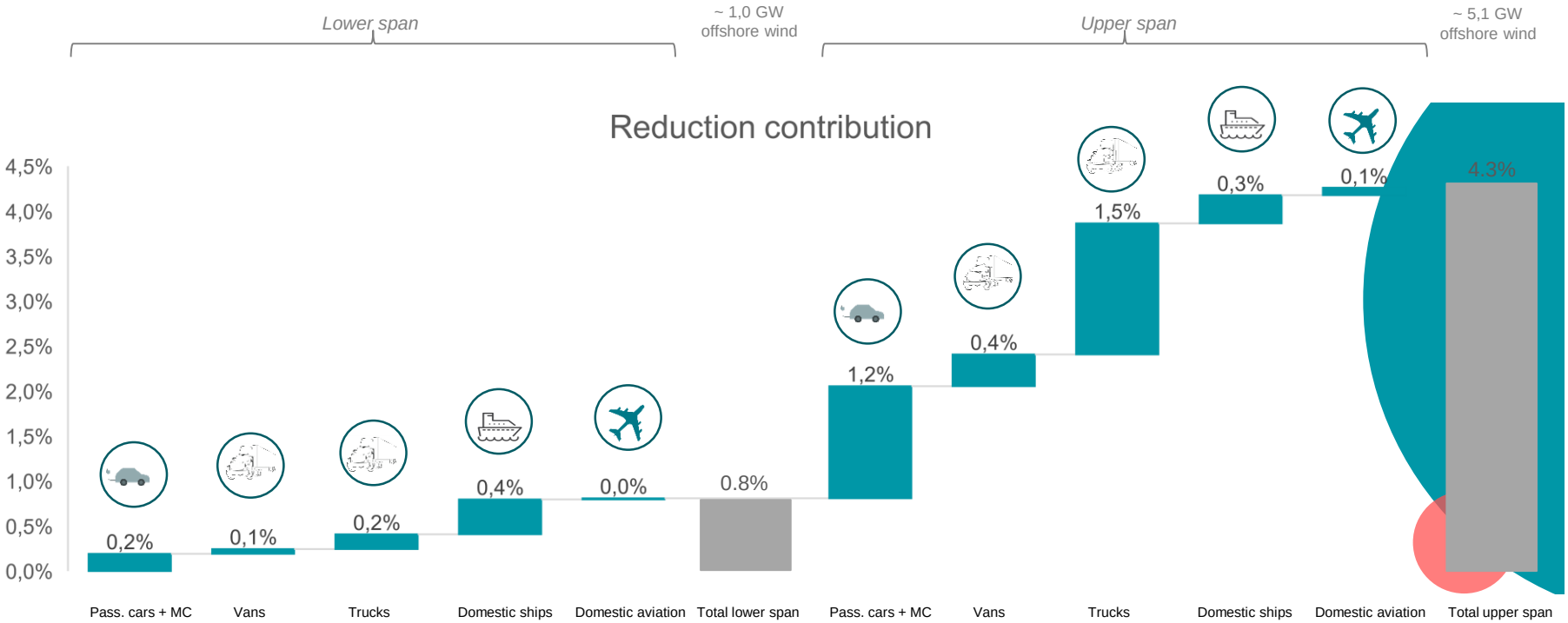
- The Danish Climate Agreement for Energy and Industry from 2020
- CCS strategy this summer
- Subsidy scheme for CCS-projects
  - Approximately 2 billion Euro
- Large potential for storing CO2
- Projects demonstrating CCS



Source: European Commission, DG TREN

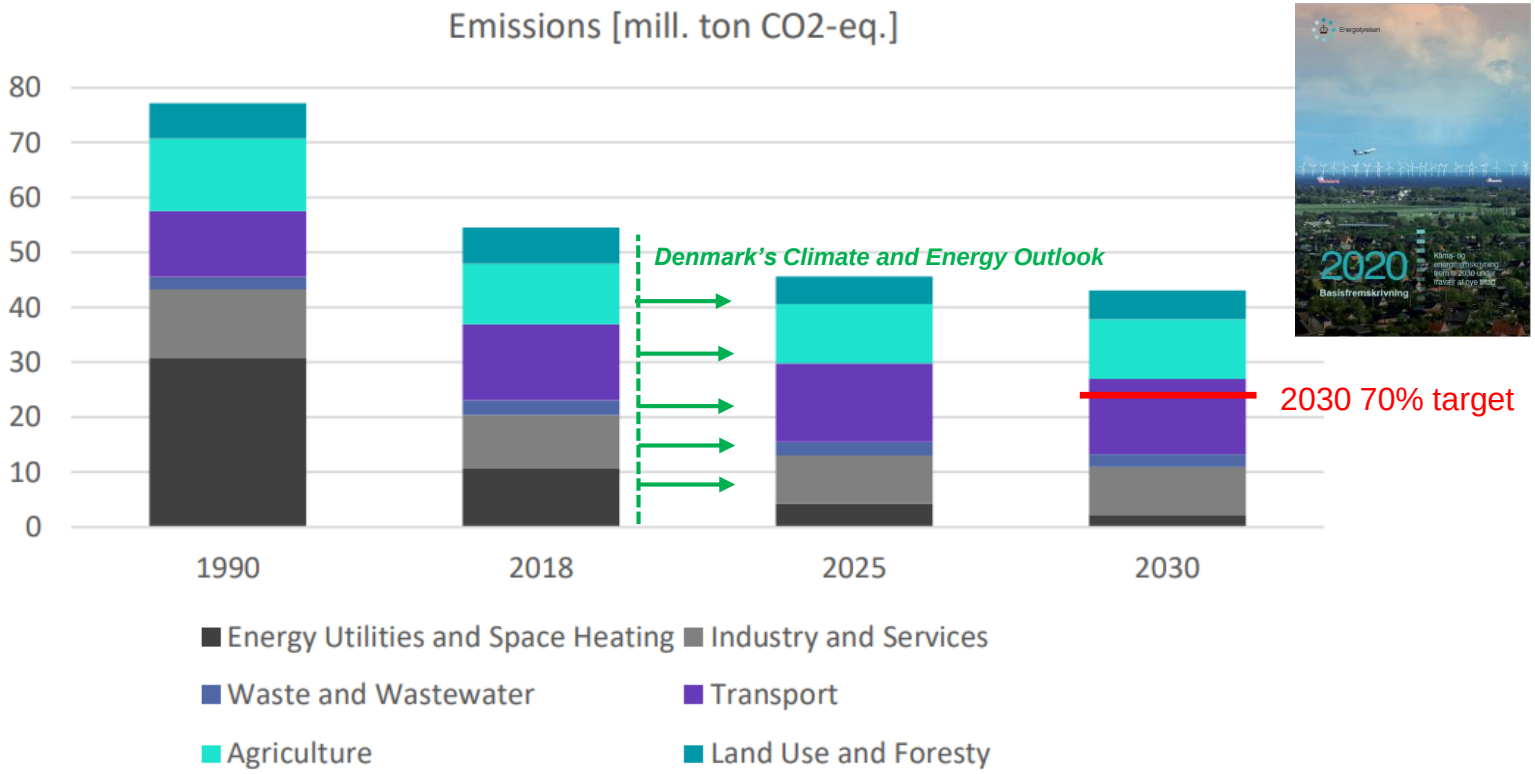
Power-to-X can reduce CO2-emissions from transport

Estimated CO2-reductions by 2030



Challenges relative to the 2030 target

Sectors where reductions are difficult to achieve



Source: Danish Energy Agency, Danish Energy and Climate Outlook 2020: https://ens.dk/sites/ens.dk/files/Basisfremskrivning/basisfremskrivning_2020-webtilg.pdf