

The Government's strategy for Power-to-X

03.03.2022

Status on Power-to-X in Denmark

The Climate Agreement for Energy and Industry 2020:

- *Agreement of the Folketing to prepare a Danish strategy for Power-to-X (PtX) and utilisation of carbonaceous products (Carbon Capture and Utilisation - CCU).*
- The Government's strategy for Power-to-X – December 2021.
- The strategy is based on more than 20 analysis and 500 pages.
- Simultaneously the PtX agenda has accelerated.
- More than 20 Power-to-X projects has been announced in Denmark.
- Governmental ambition to have green domestic aviation in 2030 and the first green domestic route in 2025.
- Ongoing political negotiations concerning the PtX strategy.



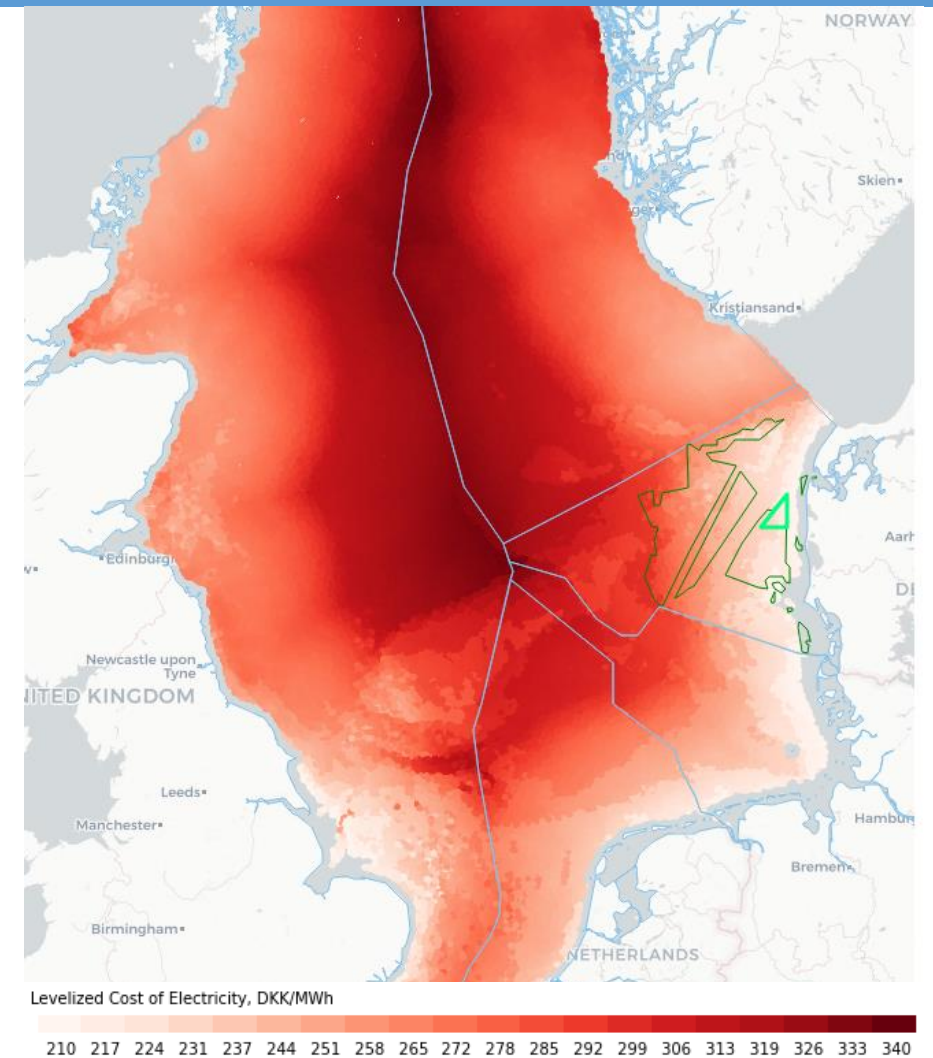
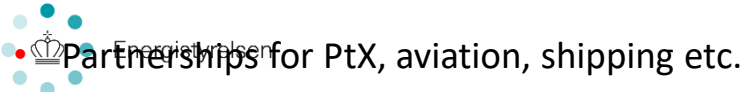
Why Power-to-X in Denmark?

Energy system in Denmark and PtX:

- Increasing share of the electricity consumption is based on renewable energy. In 2019 65 pct. from RE.
- Substantial offshore wind resources is with competitive electricity costs and a well developed and functioning electricity grid with.
- Flexible PtX plants located near RE resources enables lower demand for grid expansions.
- High security of supply (appx. 20 minutes interruption/year).
- Developed district heating grid supplying 45 pct. of the heat demand in households in DK (2019). Enables utilization of excess heat from PtX.

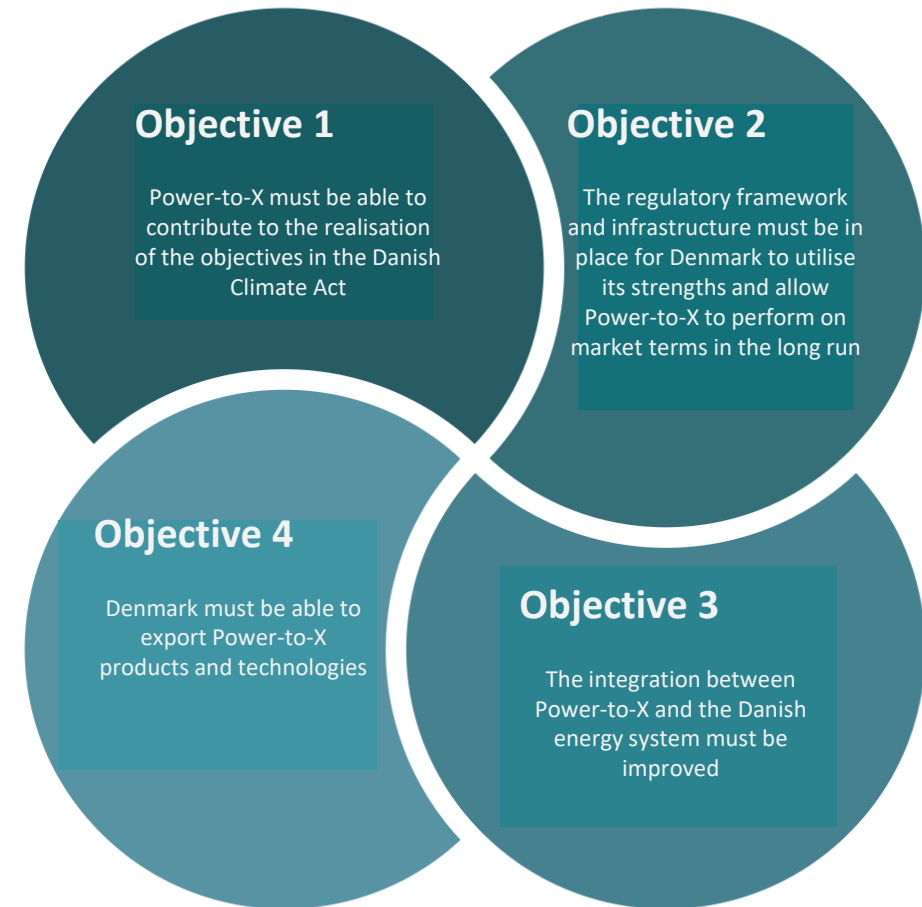
Know-how and partnerships:

- Know-how in all of the value chain



Objectives in the strategy for PtX

- In the PtX strategy four objectives are presented.
- The objectives show the direction forward promoting development and broaden use of hydrogen and other Power-to-X fuels in short and long term.
- The objectives contribute to an holistic effort with development of a new green utility sector in Denmark, providing green solutions that benefit Danish consumers and the other countries.



Specific initiatives in the Government's strategy for PtX

Tender of support for PtX - The Climate Agreement for Energy and Industry 2020

- *“a tender to support [...] Power-to-X plants should contribute to reduce production costs of green hydrogen”.*
- 1,25 billion DKK. funded from sales of renewable energy shares to the Netherlands.
- The specific design of the tender should be agreed by coalitions parties.
- State aid rules do not allow demand for use of PtX products in Denmark when have received state aid.

Competitive tender of support of production

- Operational support for Danish production of PtX products.
- Fixed price premium for up to 10 years.
- Competition on support for quantity of hydrogen – no matter the end product.
- Contributing to industrialize and reduce the costs of PtX technology and PtX products.



Biogas and coming PtX plant: GreenLab Skive

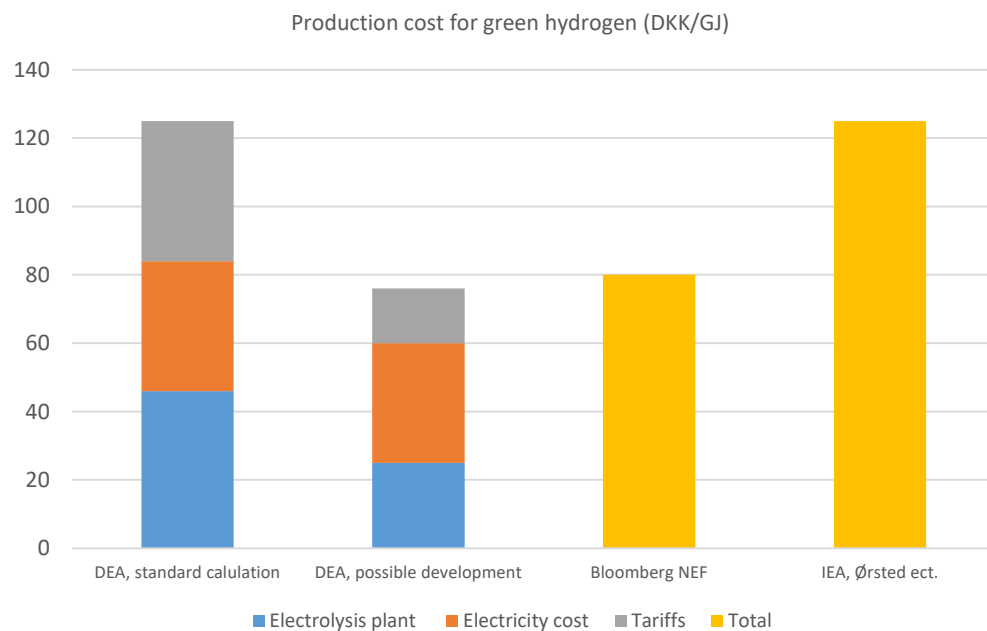
- Contribution to the 70 pct. objective is unknown.

Specific initiatives in the Government's strategy for PtX

Initiatives for cost reductions and competitiveness

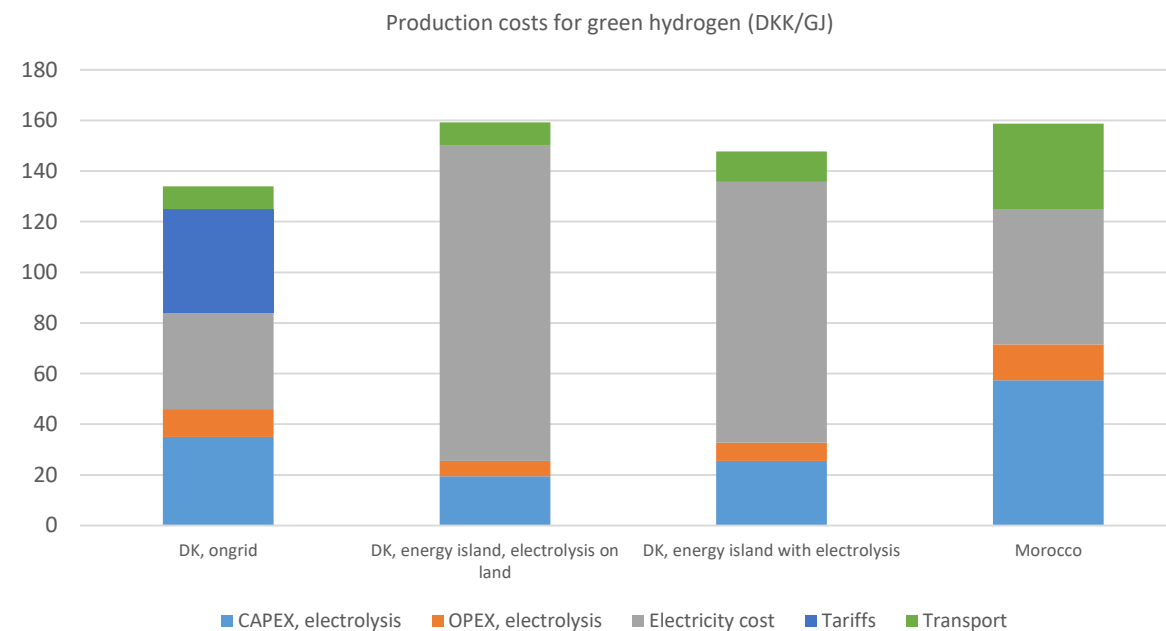
Production cost for green hydrogen

- Significant potentials for reducing production cost of green hydrogen through industrialization and adjustment of the regulatory framework.
- *Direct links, geographically differentiated consumption tariffs, local collective tariff*



Production cost for green hydrogen (and ammonia) in Denmark and Morocco

- Marginal higher production costs in Denmark without transport
- Probably competitive when including transport (to Rotterdam)
- Electricity and tariffs constitute the majority of the costs

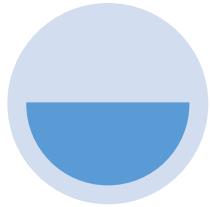


Specific initiatives in the Government's strategy for PtX

A hydrogen grid can support use of hydrogen and be used as storage.

- Pipeline transport of hydrogen
 - Enables separating production and use of hydrogen
 - More flexible location in regard to the collective electricity grid
 - Enables export
- Hydrogen storage
 - Works as energy storage
 - Supports flexibility of electrolysis with a steady consumption
- Gradual expansion possible
 - Existing natural gas pipeline in Southern Jutland (Egtved – Ellund) can be converted for hydrogen export in 2025
 - The remaining natural gas grid has long term bindings - preventing conversion to hydrogen (in appx. 15 years)

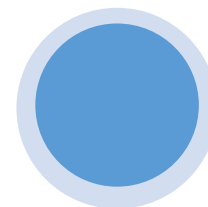




Q1 2022

PtX negotiations:

- Political negotiations about the strategy for PtX



Q2-Q4 2022

The Government presents:

- An energy and utilities proposal
- A proposal for the green transition of air traffic
- A strategy for rolling out propellant infrastructure for heavy road transport



Questions?

DAC-plant - ORCA in Iceland, source: Climeworks