

---

Recommendations for the financing of

# DANISH HYDROGEN INFRA- STRUCTURE

---

Developed by :

Danish Industry, STRING Megaregion, Danish Chamber of Commerce, Green Power Denmark, Hydrogen Denmark, Copenhagen Infrastructure Partners, Ørsted, Crossbridge Energy, Everfuel, Eurowind, GreenGo Energy, GreenLab Skive, H2 Energy, Hydrogen Valley, Norwegian Hydrogen, Plug Power, RWE, Skovgaard Energy, Total Energies, and Vattenfall.

# Recommendations for the financing of Danish hydrogen infrastructure

*This memorandum outlines Danish hydrogen actor' recommendations in connection with the upcoming negotiations on financing of the start-up of a Danish hydrogen infrastructure. The memorandum focuses primarily on the conditions that Danish politicians should ensure apply to owners and users of transmission infrastructure, so that the hydrogen network in Denmark and the connection to Germany can be successful.*

## TABLE OF CONTENTS

Introduction .....	4
Recommendations .....	6
Recommendation I: State guarantee .....	6
Recommendation II: Flexible framework.....	6
Recommendation III: DK-DE agreement.....	6
Recommendation IV: Future-proofing .....	7
Recommendation IV: State aid .....	7
Documentation .....	8

# RECOMMENDATIONS

## STATE GUARANTEE OF A STRATEGIC AND MARKET-DRIVEN INVESTMENT DECISION

In connection with upcoming political negotiations on financing, a political agreement should be reached on a state guarantee that will enable the infrastructure owners to make a final investment decision (FID) on a "Jutland backbone" in Q2 2024, or no later than 1 month before the upcoming state North Sea offshore wind tender bidding deadline. Only this way can the objective of Danish hydrogen infrastructure connected to Germany in 2028 and 4-6 GW electrolysis capacity in 2030 be realised. The state guarantee will enable favourable loan terms for the infrastructure owners, and guarantee that any deficit is covered should long-term utilisation of the infrastructure be below expectations.

## FLEXIBLE FINANCIAL FRAMEWORK CONDITIONS FOR INFRASTRUCTURE OWNERS

The upcoming agreement on the financing of a Danish hydrogen infrastructure should also include flexible financial framework conditions for the infrastructure owners in connection with the start-up phase of the hydrogen infrastructure. This is crucial to the infrastructure owners being able to defer payment and ensure a competitive start-up tariff. The infrastructure owners' revenue framework regulation must be made more flexible, to allow them to postpone the depreciation of the infrastructure, and thus a license to operate with a minimum coverage of 10 years for a start - a postponement that will catch up once the quantities of hydrogen increase. The flexibility will allow the infrastructure owners to create a tariff ceiling or fixed tariff for a minimum of 10 years for hydrogen transport in relation to the start-up of the

Jutland backbone, and will thus lower the risk for early stage hydrogen producers and consumers.

## STRENGTHENED DANISH-GERMAN AGREEMENT ON CROSS-BORDER HYDROGEN INFRASTRUCTURE

A political follow-up on the Memorandum of Understanding on hydrogen infrastructure from March 2023 between Denmark and Germany is necessary to ensure sufficient political support of a realisation of integrated German-Danish hydrogen infrastructure in 2028. Such a follow-up will have greater impact on the Danish side if a national agreement on FID in Q2 2024 for Danish hydrogen infrastructure has been decided beforehand.

## FUTURE-PROOF HYDROGEN INFRASTRUCTURE

The Jutland backbone transmission pipeline should be dimensioned to a minimum of 36" in order to future-proof the infrastructure, corresponding to up to 10 GW of hydrogen capacity. The state guarantee will enable such over-dimensioning, whereby reducing the risk of a future need for double lines and any costs that may entail.

## COMPETITIVE HYDROGEN TRANSPORT IN DENMARK VIA POSSIBLE STATE AID

It is recommended that direct CAPEX support is explored as a means to increase Danish use of the hydrogen infrastructure and competitiveness in the hydrogen market, while the European hydrogen market is being established. Possible means of financing include the Green Fund.

# INTRODUCTION

A Danish hydrogen infrastructure with the completion of a Jutland cross-border transmission pipe as early as **2028** can catalyze Denmark's great RE potential and contribute to achieving national climate targets and the ambition of **4-6 GW** electrolysis in **2030**.

Hydrogen infrastructure is a natural monopoly. With the agreement on the possibility of establishing a hydrogen infrastructure of May **2023**, it was decided that the Danish hydrogen infrastructure must fundamentally be market-driven, publicly regulated, and managed by the publicly owned companies Evida and Energinet (hereafter the infrastructure owners). This, while recognising the strategic value of a hydrogen infrastructure.

Evida and Energinet expect investments of **8** and **16** billion DKK respectively for a national hydrogen infrastructure with associated positive socio-economic gains towards **2060** of approx. **60** billion DKK, . An investment of **24** billion DKK in hydrogen infrastructure represents only **7%** of the future RE investments until **2030**, which is expected to amount to approx. **340** billion DKK in electricity infrastructure, PV's, onshore and offshore wind turbines and electrolysis plants. Investments in renewable energy production are commercial activities exposed to competition, and the associated risk is already and best handled by the market.

The utilisation of the North Sea's energy potential, and associated expansion of the offshore wind capacity, depends on the development of Danish hydrogen production and infrastructure. If Denmark can combine climate, energy and industrial policy, as highlighted in the European Green Deal , we will face a new green industry adventure. The total Danish hydrogen export potential (incl. offshore hydrogen pipelines) in **2050** is estimated at almost **200 TWh** (approx. **57 GW** electrolysis capacity). This corresponds to a value of approx. **100** billion DKK annually, taking the energy consumption needed for direct electrification of Denmark into account. Already in **2030**, the export potential for Germany alone is expected to reach **16 TWh** (appx. **4.5 GW** electrolysis capacity) corresponding to an annual DKK **8** billion.

## CLIMATE AND BUSINESS OPPORTUNITIES OF A JUTLAND HYDROGEN BACKBONE BY 2028

The benefits of a strategic and market-driven investment decision in Q2 2024:

- Denmark holds **a unique position to supply EU-certified green hydrogen from 2027**. Very few other countries have this option, as their national electricity supplies are "contaminated" by electricity produced from fossil sources. This position of strength will gradually diminish as more countries transition to a higher level of RE. The agreement with Germany on a pipeline connection in 2028 can secure the export of EU-certified green hydrogen, which is expected to be of great benefit to German consumers.
- Exploiting the RE potential and establishing national hydrogen production will strengthen Denmark's - and Northern Europe's - **security of supply and price stability on the electricity market**⁹.
- Early establishment of Danish infrastructure sends **a strong investment signal** to Danish and international investors in e.g. renewable energy and Power-to-X in Denmark. Market studies on hydrogen infrastructure indicate that uncertainty about the expansion of the hydrogen infrastructure constitutes one of the biggest barriers for Danish PtX projects. In the upcoming offshore bid wind in the North Sea a.o. in 2024/25, clarity on the expansion of the hydrogen infrastructure will be of great importance to the possibility of 'overplanting' offshore wind.
- Denmark is well equipped to help **lift the European and global green objectives** that we have committed to . Denmark should be an active player contributing to: 1) the EU's target of 10 million tonnes of green hydrogen production in 2030, corresponding to approx. 95 GW electrolysis, 2) export to Germany, where a just-updated German hydrogen strategy outlines an up-adjusted import need for hydrogen of up to 90 TWh in 2030 , as well as a goal to be ready with 1,800 km of converted and new German hydrogen infrastructure as early as 2028, including to Denmark.

- A Danish hydrogen industry will **create green jobs outside the big cities in Denmark**, and thus contribute to a balanced Denmark.
- **Market synergy for Danish consumers:** A Danish hydrogen infrastructure with cross-border connections will also enable Danish consumption, which does not exist today. By enabling large-scale hydrogen production, the hydrogen infrastructure will **allow Danish producers and consumers to connect to an activated and connected market**, resulting in **risk reduction and better prices** - and thus increased interest. The hydrogen infrastructure will thereby directly contribute to the green transition of heavy Danish industry, the development of new energy markets, and energy exports.

If Denmark can be ready with a transmission pipe, a "Jutland backbone", which meets the German pipeline in 2028, Denmark has the opportunity to become a decisive exporter of green hydrogen to north Germany's heavy industry. Denmark's internal hydrogen market, and the utilisation of the wind energy potential, will thereby be kickstarted immediately to the benefit of Danish hydrogen consumers, the hydrogen industry's technology and consultancy suppliers, as well as to the green transition of Danish industrial companies that today depend on coal or gas.

## **STRATEGISK FINANCING OF A FUTURE-PROOF DANISH HYDROGEN INFRASTRUCTURE**

The hydrogen infrastructure is a long-term investment with long payback periods. In the first years, the pipe's capacity will not be fully utilised, increasing to a high level of utilisation within 8-10 years as the political RE ambitions are realised. At a competitive hydrogen transport tariff, only limited revenues will be available to cover the start-up costs.

Still, the infrastructure must be dimensioned to future needs from the start. This will future-proof the infrastructure to handle the expected large quantities of hydrogen resulting from expansion of wind parks and hydrogen production in Denmark, as well as the increasing demand from the home market and abroad. The state-owned infrastructure owners have both the financial and technical skills to handle these conditions, and can solve the "chicken-and-egg" situation between hydrogen suppliers and hydrogen consumers, currently each waiting for action from their counter-party, and ensure that the transmission and distribution infrastructure is sufficiently developed in a timely manner.

However, this requires that the infrastructure owners' financial framework conditions are adjusted. An active role from the state is therefore necessary to realise both the Danish wind energy potential and to kick-start the Danish hydrogen industry in 2028.

# FIVE RECOMMENDATIONS FOR A STRATEGIC AND MARKET DRIVEN INVESTMENT IN HYDROGEN INFRASTRUCTURE

The European market for green hydrogen remains sporadic and immature with a lack of pricing, infrastructure, production, demand, and regulation. This is expected to change radically towards 2030. But without a well-functioning, developed market, traditional models for infrastructure development (e.g. Open Season) cannot be used to fulfil the 2028 objective. Uncertainties on prices, regulatory matters, market conditions, and market development mean that buyers and producers cannot enter long-term contracts within a short time frame of 1-2 years. Agreements that will be necessary if a classic Open Season is to be launched from 2028, but only in effect once a live hydrogen market is established.

There are several existing analysis assumptions, market projections, and market signals that demonstrate the need for investment in Danish and European hydrogen infrastructure now. Several of these are shown in Table 1. In Germany, Belgium and the Netherlands, the state has taken a proactive role implementing subsidies and/or state guarantees that mitigate risks for both infrastructure owners and users. As such, a coherent transmission hydrogen network can be built between the countries over the next 5-10 years, based on a stable framework for both transmission owners and users of the infrastructure.

This emphasises the need for a strategic market-driven investment in a future-proof Danish hydrogen infrastructure. Therefore, Danish hydrogen actors have collaboratively developed the following five recommendations of measures to enable the development and financing of a Danish hydrogen infrastructure.

## RECOMMENDATIONS:

### I. STATE GUARANTEE OF A STRATEGIC AND MARKET-DRIVEN INVESTMENT DECISION

In connection with upcoming political negotiations on financing, a political agreement should be reached on a state guarantee that will enable the infrastructure owners to make a final investment decision (FID) on a "Jutland backbone" in Q2 2024, or no later than 1 month before the upcoming state North Sea offshore wind tender bidding deadline. Only this way can the objective of Danish hydrogen infrastructure connected to Germany in 2028 and 4-6 GW electrolysis capacity in 2030 be realised. The state guarantee will enable favourable loan terms for the infrastructure owners, and guarantee that any deficit is covered should long-term utilisation of the infrastructure be below expectations.

### II. FLEXIBLE FINANCIAL FRAMEWORK CONDITIONS FOR INFRASTRUCTURE OWNERS

The upcoming agreement on the financing of a Danish hydrogen infrastructure should also include flexible financial framework conditions for the infrastructure owners in connection with the start-up phase of the hydrogen infrastructure. This is crucial to the infrastructure owners being able to defer payment and ensure a competitive start-up tariff. The infrastructure owners' revenue framework regulation must be made more flexible, to allow them to postpone the depreciation of the infrastructure, and thus a license to operate with a minimum coverage of 10 years for a start - a postponement that will catch up once the quantities of hydrogen increase. The flexibility will allow the infrastructure owners to create a tariff ceiling or fixed tariff for a minimum of 10 years for hydrogen transport in relation to the start-up of the Jutland backbone, and will thus lower the risk for early stage hydrogen producers and consumers.

### III. STRENGTHENED DANISH-GERMAN AGREEMENT ON CROSS-BORDER HYDROGEN INFRASTRUCTURE

A political follow-up on the Memorandum of Understanding on hydrogen infrastructure from March 2023 between Denmark and Germany is necessary to ensure sufficient political support of a realisation of integrated German-Danish hydrogen infrastructure in 2028.

Such a follow-up will have greater impact on the Danish side if a national agreement on FID in Q2 2024 for Danish hydrogen infrastructure has been decided beforehand.

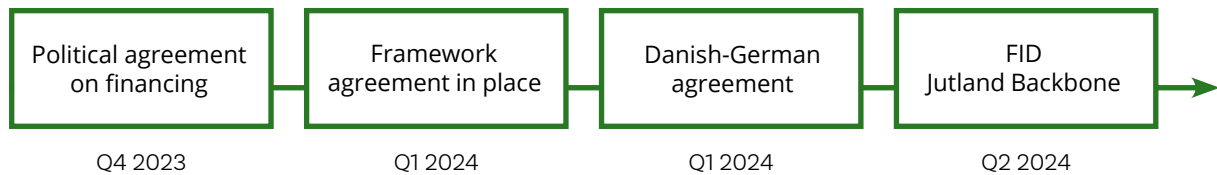
**IV. FUTURE-PROOF HYDROGEN INFRASTRUCTURE**

The Jutland backbone transmission pipeline should be dimensioned to a minimum of 36" in order to future-proof the infrastructure, corresponding to up to 10 GW of hydrogen capacity. The state guarantee will enable such over-dimensioning, whereby reducing the risk of a future need for double lines and any costs that may entail.

**V. COMPETITIVE HYDROGEN TRANSPORT IN DENMARK VIA POSSIBLE STATE AID**

Following the decision on state guarantees and flexible financial regulation, it is recommended that direct CAPEX support is explored as a means to increase Danish use of the hydrogen infrastructure and competitiveness in the hydrogen market, while the European hydrogen market is being established. This particularly seen in the light of CAPEX support schemes adopted in the Netherlands and Belgium, and supporting models that are currently being investigated in Germany. Possible means of financing include the Green Fund.

**TIMELINE, PROVIDED THE RECOMMENDATIONS ARE FOLLOWED:**



# DOCUMENTATION

- 1) Aftale om udvikling og fremme af brint og grønne brændstoffer af 15. marts 2022
- 2) Energinet feasibility studie, 2023 (midterværdi for investering, 16 mia. DKK, og samfundsøkonomisk gevinst, 52. mia. DKK)
- 3) Evida, Cost-benefit analyse af en dansk brintinfrastruktur, 2022
- 4) [https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal\\_da](https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_da)
- 5) CIP Fonden, 2023, "Markedsvurdering"
- 6) CIP Fonden, 2023, "Markedsvurdering"
- 7) Ved alle omregninger af brint er følgende antagelser anvendt: 5000 fuldlasttimer og 70 pct. effektivitet for elektrolyseanlæg og brints nedre brændværdi på 0,033MWh/kg. Alle GW kapaciteter for elektrolyseanlæg er el-kapaciteter
- 8) Forudsat, at biobaseret elproduktion kan anvendes til RFNBO-godkendte brændsler
- 9) Hans Henrik Lindboe, EA Energianalyse, 2021: <https://greenpowerdenmark.dk/nyheder/power-to-x-er-fjerde-paradigme-danske-vindmoelleeventyr>
- 10) Evida, Energinet, 2022, <https://evida.dk/media/4a0pt5sg/markedsdialog-om-brintinfrastruktur.pdf>
- 11) Klimalov, 2019, Afsnit IV
- 12) Regeringens strategi for global klimainsats, 2020
- 13) BMWK, Fortschreibung der Nationalen Wasserstoffstrategie, Juli 2023, s. 6 (95 - 130 TWh i 2030) samt s. 9. (50 - 70 pct. importeret)
- 14) Belgien og Nederlandene støtter investeringen i infrastrukturen og Tyskland forventes at afhjælpe infrastrukturejeres risici samt støtte aktørernes brug af infrastrukturen. Detaljer fremgår i 'Baggrund for anbefaling IV'.
- 15) Det indebærer, at markedsaktørernes behov skal drive udviklingen af infrastrukturen samtidig med, at infrastrukturejerne skal have en risikoafdækning, så de kan få godkendt en investeringsbeslutning efter §4 baseret på markeds-signaler og analyser.
- 16) H2 Energy har bl.a. investeret 200 mio. DKK i udvikling af brintanlægget i Esbjerg
- 17) CIP har investeret 150 mio. DKK i udvikling af HØST
- 18) Baseret på 15,6 GW kystnær vind, 6,2 GW landvind, 30 GW sol, 41 GW havvind
- 19) Hele lånebeløbet vil ikke belaste finansloven, men derimod kun den tilknyttede risikoprofil
- 20) Analyseforudsætninger 2022 og antaget 5000 fuldlasttimer for elektrolyseanlæg
- 21) Power-to-X Muligheder og erhvervspotentialer, Rambøll, 2021
- 22) Feasibility Studie, 2023: <https://energinet.dk/media/xgqdx30e/resultater-fra-feasibility-studiet.pdf>
- 23) Evida, 2022: <https://evida.dk/media/adjgkjrj/deloitte-hydrogen-cba-report-dk-v6b.pdf>
- 24) Energinet, Feasibility studie, 2023. <https://energinet.dk/media/3g2htdyf/energinet-feasibility-rapport-2023.pdf>
- 25) Gennemføres udmeldte havudbud indenfor tidsrammen forventes ca. 12 GW i 2030
- 26) Esbjerg Declaration, 2022
- 27) Energinet og Gasunie, 2023: <https://en.energinet.dk/media/pjqnaedq/energinet-gasunie-rapport-2023.pdf>
- 28) <https://www.dw.com/en/germany-to-join-mediterranean-hydrogen-pipeline-project/a-64483071>
- 29) <https://www.cleanenergywire.org/news/germany-and-netherlands-aim-connect-hydrogen-grids>
- 30) <https://www.euractiv.com/section/energy/news/germany-norway-want-to-tie-the-knot-with-new-hydrogen-pipeline/>
- 31) Produktionserhverv omfatter landbrug, skovbrug og gartneri, fiskeri, fremstillingsvirksomhed (ekskl. raffinaderier) samt bygge- og anlægsvirksomhed - Energistatistik 2021, s. 28: <https://ens.dk/sites/ens.dk/files/Statistik/energistatistik2021.pdf>
- 32) Se Figur 6. [feasibility-studie-for-jysk-brint-transmissionsnet-forudstninger-og-forelbige-analyser.pdf](#) (energinet.dk)
- 33) <https://www.reuters.com/markets/europe/dutch-government-invest-750-mln-euros-develop-hydrogen-network-2022-06-29/>
- 34) <https://www.hydrogeninsight.com/policy/belgium-approves-250m-of-public-funding-for-hydrogen-pipelines-through-country-and-into-germany/2-1-1487495>
- 35) <https://dserver.bundestag.de/btd/20/079/2007915.pdf>



# RECOMMENDED BY:

Brintbranchen

