

Ørsted

P2X: building a new industry

Swedish hydrogen conference
5 December 2023



Lars Hansen, Head of Business Development P2X Nordic



Agenda

01 Who we are

02 P2X fundamentals

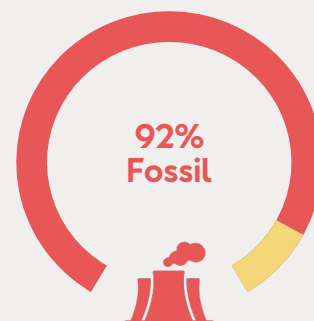
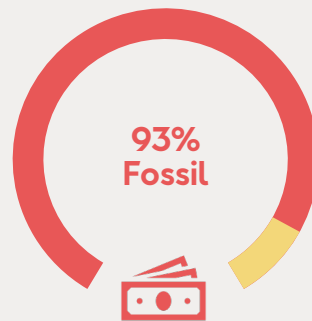
03 Ørsted's P2X projects

04 Focus on Sweden



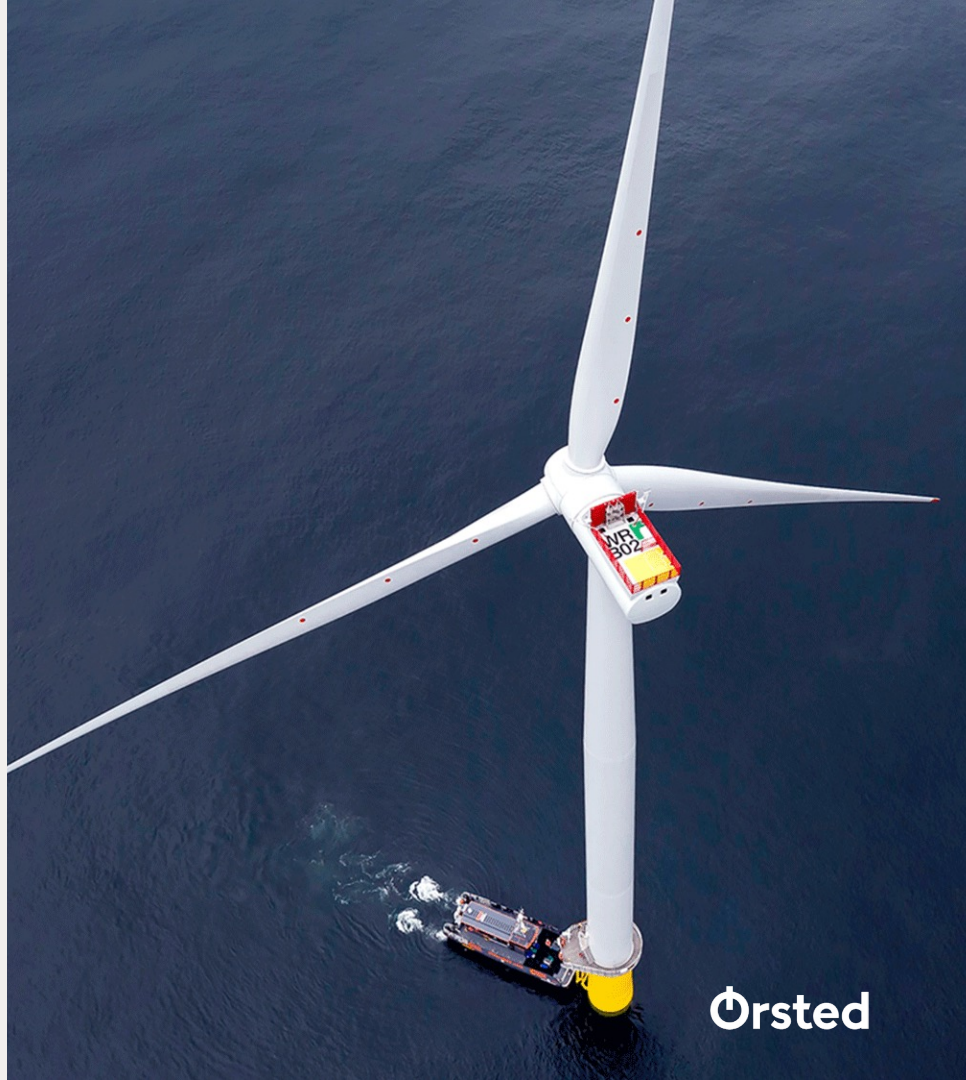
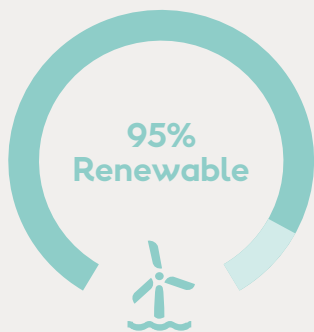
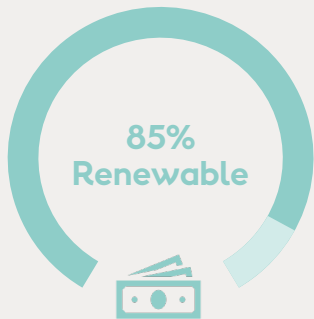
We were

DONG
energy



Today we are

Ørsted



Ørsted develops energy systems that are green, independent and economically viable

■ Installed ■ Under construction



Offshore wind



- Global leader in offshore wind
- Ambition to reach ~30 GW installed capacity by 2030



Onshore renewables



- Strong presence in the United States and Europe
- Ambition to reach ~17.5 GW installed capacity by 2030



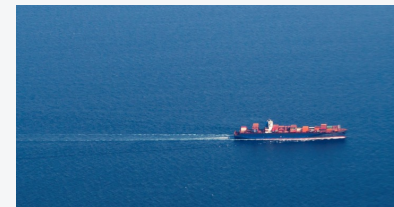
Bioenergy & other



- Presence in Europe, including bioenergy plants, legacy gas activities and patented waste-to-energy technology
- Own and operate bioenergy and waste-to-energy plants, and optimise gas portfolio

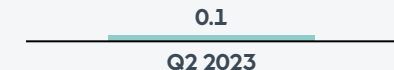
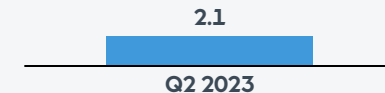
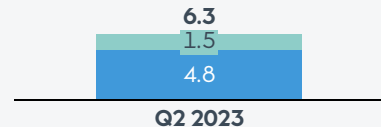
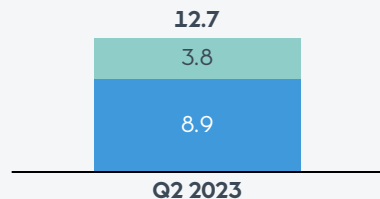


Renewable hydrogen and green fuels



- Emerging platform with 10 pipeline projects (+2 GW) mainly in Europe
- Ambition to become a leader in renewable hydrogen and green fuels by 2030

Capacity, GW





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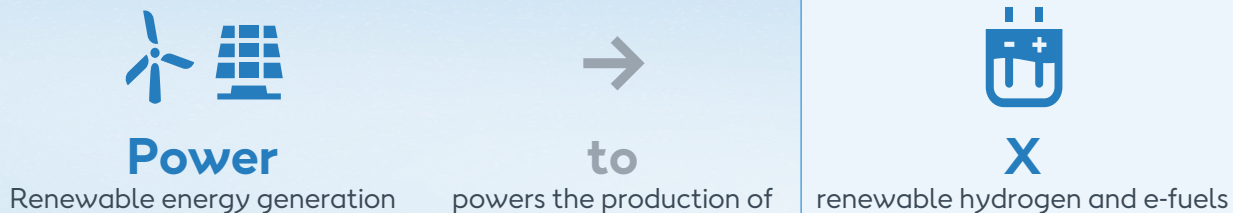
04 Focus on Sweden

To reach net-zero, the world requires Power-to-X solutions

Many sectors can be decarbonised with green electricity, but

~30 %

of global emissions come from **hard-to-electrify** sectors, which need different solutions



Direct hydrogen	E-fuels		
	E-methanol	E-ammonia	E-kerosene
Steel	Chemicals	Chemicals	Aviation
Refining	Maritime	Maritime	
Transport	Input to jet fuel	Fertilisers	

Roughly 800 P2X projects have been announced globally – majority in EU

~800 announced projects

With the US H₂ PTC passed, the US is unlikely to import any H₂ because domestic production will be significantly cheaper. Centred around domestic use and export to Europe.

Canada will most likely produce for domestic use and export eA/eM to Europe

Major import hub

Asia will mostly import due to high LCoH¹

Major import hub

Africa will export to Europe, but strong competition from Australia and Chile

Middle East will export mostly to Asia, in lesser extend to EU

Rest of South America will supply Europe

Chile will export mostly to Europe and Asia

Australia will export mostly to Asia, in lesser extend to Europe

- ➔ Export route of H₂ products
- Major demand hub

Announced projects size

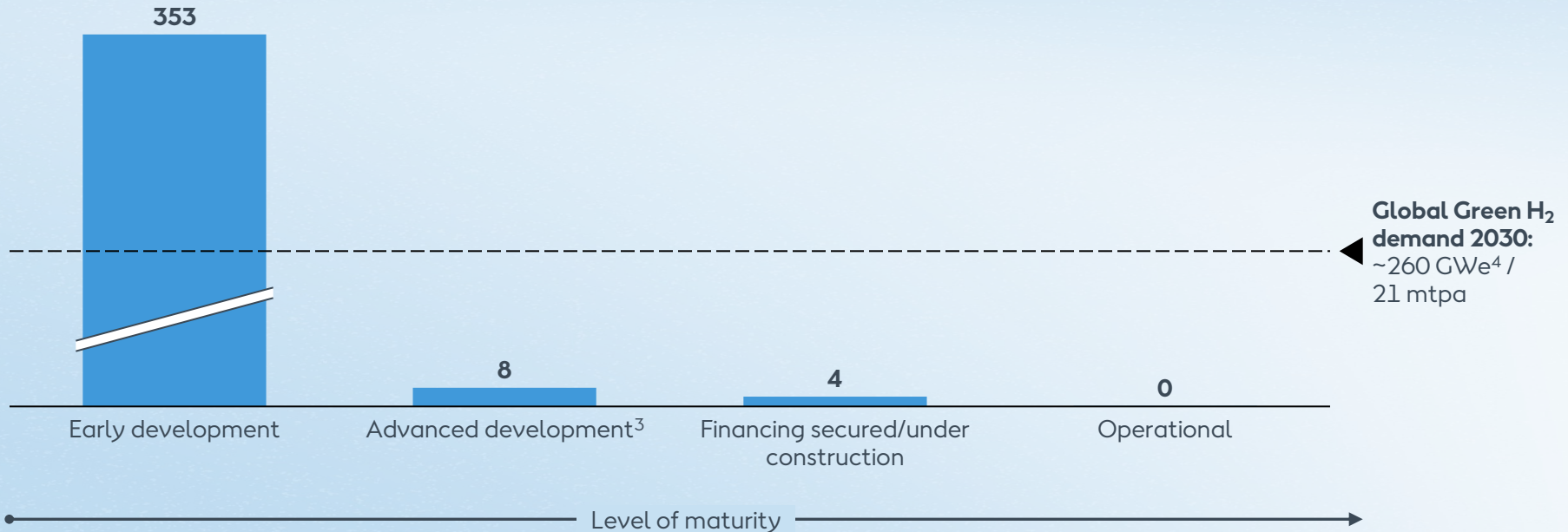
- >20 GW
- 10 GW – 20 GW
- 1 GW – 10 GW
- 100 MW – 1 GW
- 10 MW – 100 MW
- <10 MW

Notes: 1. Levelized cost of hydrogen.

Source: IHS Markit, IRENA

But many P2X assets struggle to reach maturity

Total global green H₂ announced pipeline by status¹ (excluding China²)
GWe



Notes: 1. Estimates based on publicly available information. 2. Announced project pipeline in China amounts to 45 GWe, with 2 GWe operational. 3. Advanced planning consists of projects with "Permits obtained" according to BNEF categorization. 4. Estimated electrolyser capacity required to meet forecasted renewable H₂ demand of 21 mtpa, based on IEA's Announced Pledges Scenario (APS) H₂ balance. Demand includes China.

Sources: BNEF (2023), IEA (2022), Ørsted analysis.



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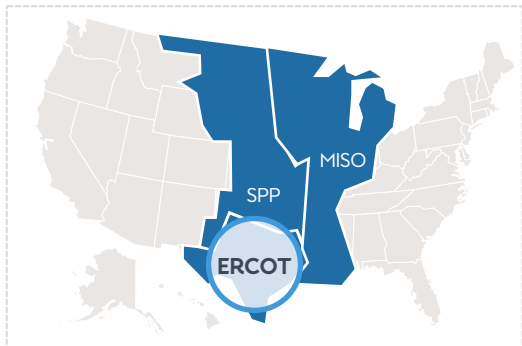
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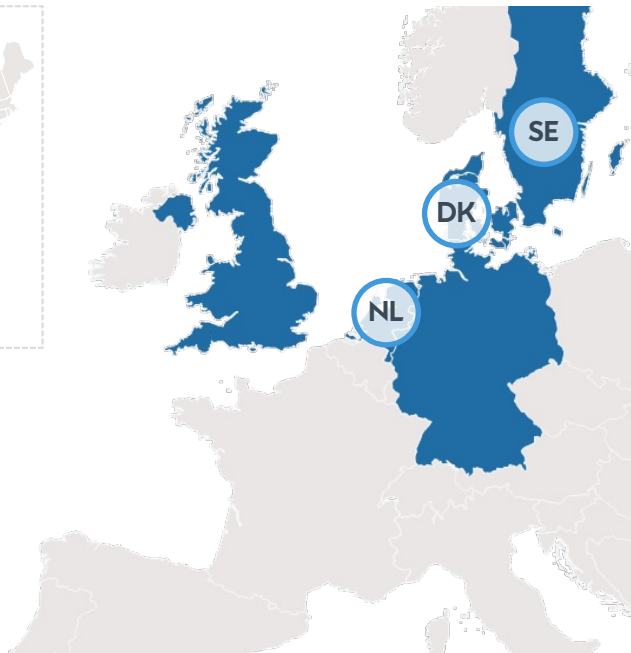
04 Focus on Sweden

Ørsted targeting development of production hubs in key markets

P2X production hub development in Europe and North America



- Priority markets
- Production hubs pre-2030



Our prioritisation

Targeting four key production hubs across selected markets



Products

Hydrogen and e-methanol

Offtake sectors

Maritime, steel, and chemicals



Products

E-methanol and late-decade e-ammonia

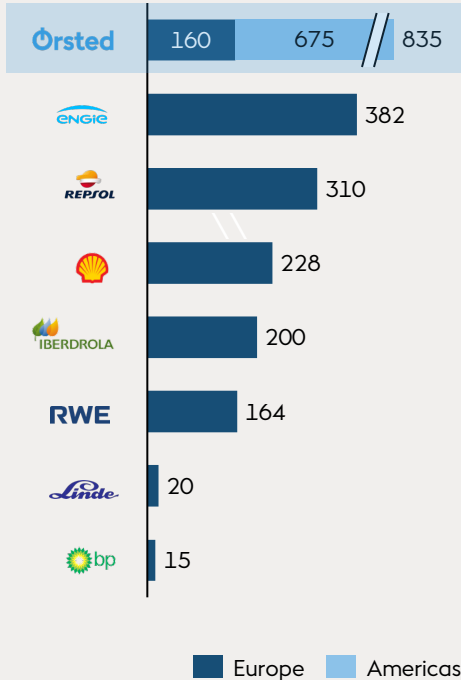
Offtake sectors

Maritime and chemicals





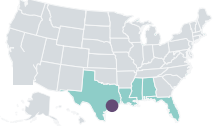







With an eMethanol pipeline of ~1 GW of electrolyser capacity by 2030, Ørsted is positioned as the market leader for eMethanol projects worldwide

Market leader for eMethanol production

Announced electrolyser capacity (MW)



Ørsted eMethanol announced pipeline

	FlagshipONE 	Project Star 	Green Fuels for Denmark 
Project location	 FID TAKEN IN 2022		
Electro. Size (MW)	70	675	1,000 <i>Increasing size until post 2030</i>
eM cap. (kt/y)	50	300	50
Bio CO2 source	CHP plant	Pulp & Paper	CHP plant
Planned CoD	2025	2025	2025 to Post 2030
Offtakers	 		  



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FLAGSHIPONE – Europe's biggest eMethanol plant



eMethanol

- FlagshipONE will produce 50.000 t eMethanol per year.
- Electrolysers of 70 MW.



Location

- Location in SE2 power grid, which is over 90% renewable.



Partners

- Facility is 'hosted' by local municipality-owned Övik Energi who will supply biogenic CO2 and other products.
- Siemens Energy, Topsoe och Carbon Clean are main technology suppliers.



Timing

- Build commenced during summer.
- Expected COD in 2025.

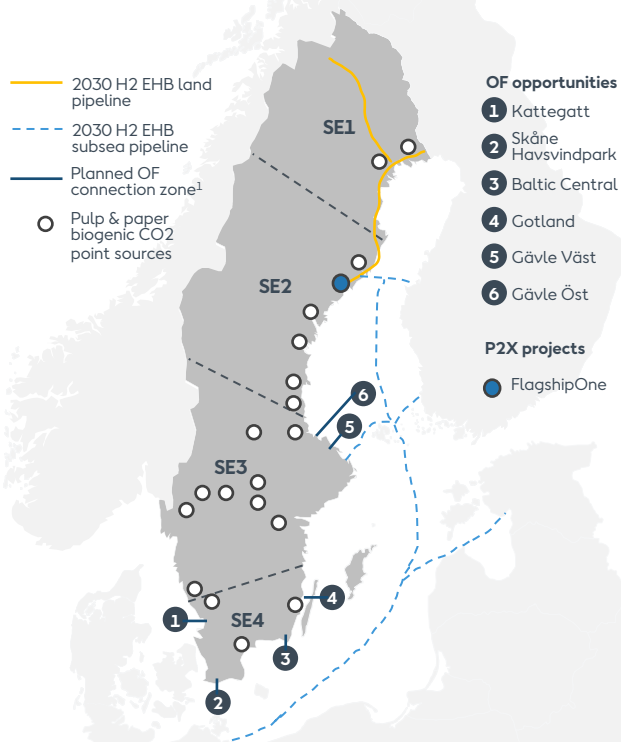


Funding

- Funded by Klimatklivet.

Swedish fundamentals | eMeOH opportunities in SE1 and SE2 due to access to biogenic CO2 and green power

Ørsted activities Sweden



	① SE1	② SE2	③ SE3	④ SE4
>90% renew. grid	Yes	Yes	No	No
Biogenic CO2 avail.	Pulp & paper	Pulp & paper	Pulp & paper	Pulp & paper
Excess Renewables	High	High	Low	Low

In sum, Sweden has the opportunity to be a hub for e-fuels production

- High level of biogenic carbon resources
- High level of renewable electricity
- Opportunities for renewables build out
- Proximity to maritime transport
- Attractive sites (land and water)
- Technical competences

To secure this the following is needed:

1. Funding schemes to support early development of e-fuels and to make e-fuels cost-competitive.
2. Ambitious targets for the use of hydrogen and e-fuels in industry and transport
3. An energy system development framework which supports new green, hydrogen-based industries

Ørsted

Thank you!

