Green Fuels for Denmark

A view on practical development experiences

17 June 2022

Michael Nylykke – Ørsted P2X

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Our P2X ambition | Our aspiration for 2030 is to become the world's leading green energy major

One of the world's largest **green electricity producers**

Global no. 1 in offshore

Global top 10 in onshore

A global leader in renewable H_2 & green fuels

One of the world's largest and most value creating **deployers of capital** into the green transformation

The world's **leading talent platform** in renewable energy

A **globally recognised sustainability leader**

A core contributor and **catalyst for change** towards a world running entirely on green energy

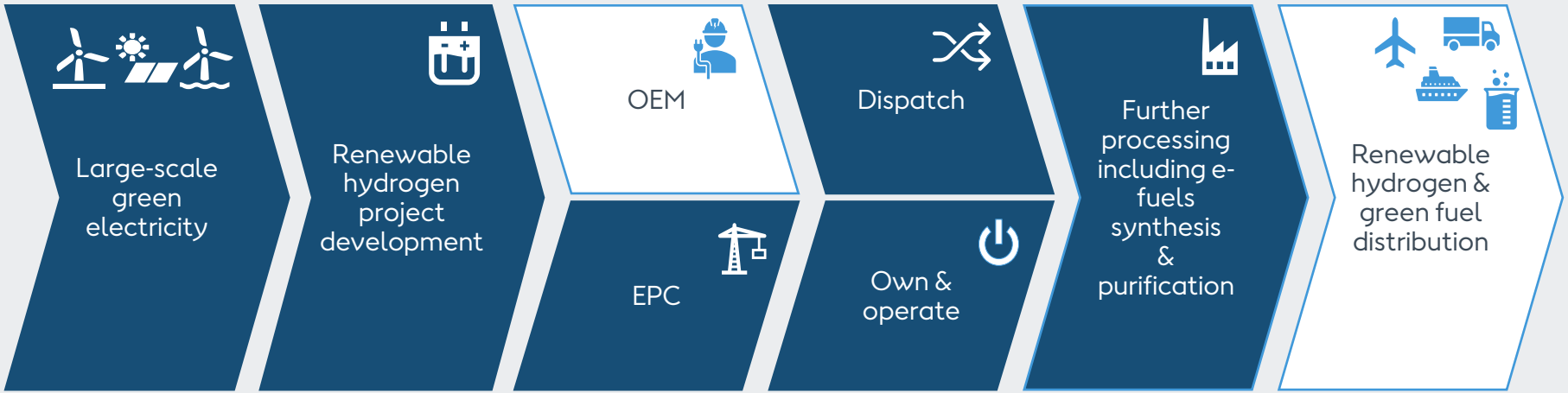
Execute and expand **current pipeline of +3 GW** in close collaboration with key offtake partners

Pursue global opportunities across our growth platform in EU, UK, US and APAC

Lean forward into selected value chains to drive deep decarbonization together with key offtake partners

Our P2X ambition | We are leaning forwards into selected value chains to drive deep decarbonisation

Ørsted value chain focus for renewable hydrogen and green fuels



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We are working to mature a PtX project pipeline of >3GW

Heavy transport · Refineries · Chemicals & fertilizers · Steel · Green Hydrogen · eMethanol · eKerosene

	Project	Maximum potential (MW)	Country	Application	Product(s)	Partners
1	H2RES	2			H_2	Everfuel, DSV, GHS, +more
2	Green Fuels for Denmark	1,300			H_2 MeOH	Maersk, SAS, CPH Airport, DFDS, DSV, +more
3	FlagshipONE	70			MeOH	Liquid Wind
4	Project Star	675			MeOH	Maersk
5	Sluiskil	100			H_2	Yara
6	SeaH2Land	1,000			H_2	North Sea Port and a range of regional offtakers
7	Westküste 100 / HySCALE100	700-2,100			H_2 MeOH	Raffinerie Heide, Hynamics, Holcim, +more
8	Lingen Green Hydrogen	600			H_2	bp
9	Gigastack	100			H_2	Philips 66, ITM Power, +more
10	Oyster	1		*R&D project for Offshore H_2*	H_2	ITM Power, Siemens Gamesa, Element Energy

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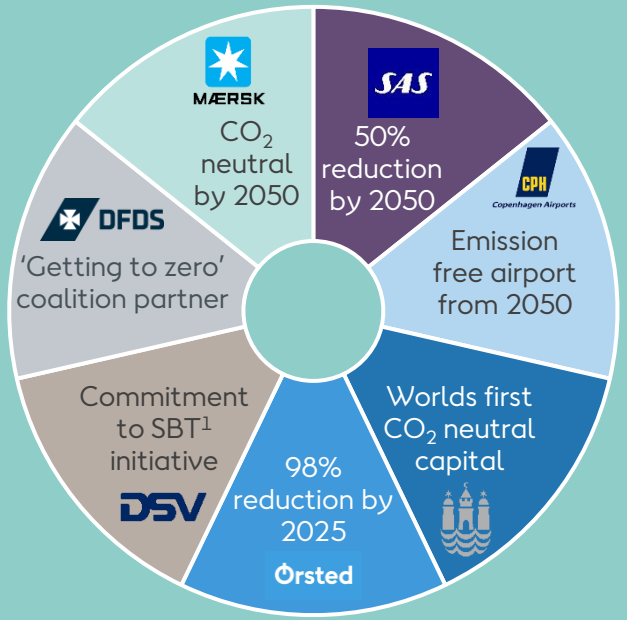
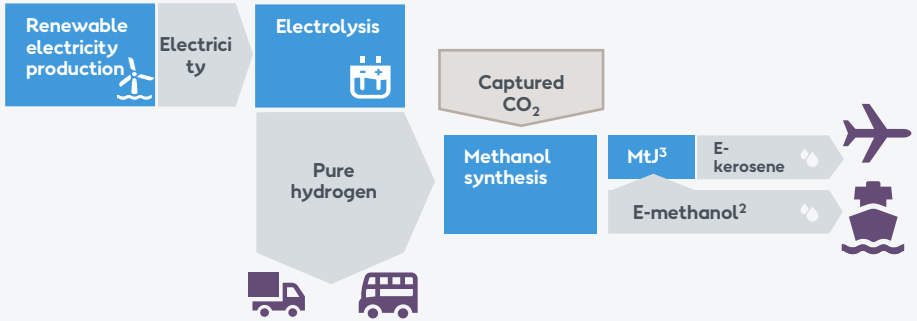
The Green Fuels for Denmark project vision was born out of the Climate Partnerships launched by the Danish Government

The project took the climate commitments of offtake partners as point of departure[2]



.. and concluded synergies could be reaped by addressing multiple offtakes simultaneously



1 Science Based Targets 2. Situation as of end 2019 3. Methanol-to-Jet

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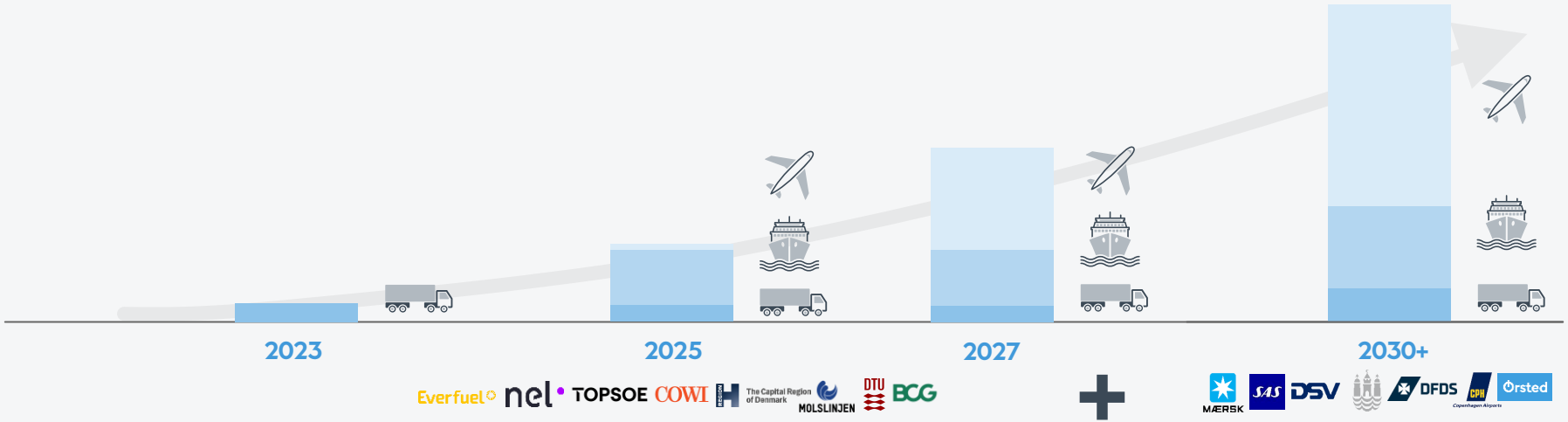
Successfully realizing the objective of the Green Fuels for Denmark project requires active involvement to ensure the relevant technologies and offtake is in place when needed

	Phase 1: Develop hydrogen	Phase 2a: Insert carbon	Phase 2b: Further scale-up	Phase 3: Scale through aviation
	Build H2 production capabilities, start with trucks and buses. Pilot MeOH-to-jet synthesis	*Build carbon capture and e-MeOH synthesis capacities. Demonstrate MeOH-to-jet[1]*	*Scale-up e-fuel MeOH capacity, scale-up MeOH-to-jet output*	*Scale and drive cost parity by meeting large potential demand in aviation. Use side products in maritime*
Cum. fossil fuel replaced (Cum. electrolyzer size)	**~3 kt/year fuel (~10 MW)**	**~ 20 kt/year fuel (~100 MW)**	**~60 kt/year fuel (~250 MW)**	**~270 kt/year fuel (~1.3 GW)**



Source: Ørsted analysis 1. Methanol-to-Jet. Intention to complete ASTM certification.

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Regulatory certainty and efficient permitting procedures are needed for hydrogen and green fuels market ramp-up

Key challenges for the PtX production ramp-up

- **Financial support is necessary to lift PtX from pilot to scale** so that cost-reductions and innovation can be realized
- **Massive RES build-out is a pre-requisite and must be accelerated**
- **Permitting processes** is oftentimes the factor setting the pace and timeline of project realisation
- **Offtaker's willingness-to-pay** should be enhanced by ambitious targets and incentives – with flexibility for smart implementation
- **Access to sustainable CO2 from point-sources** is important for cost-efficient eMethanol production
- **PtX product definitions and standards** are needed soon

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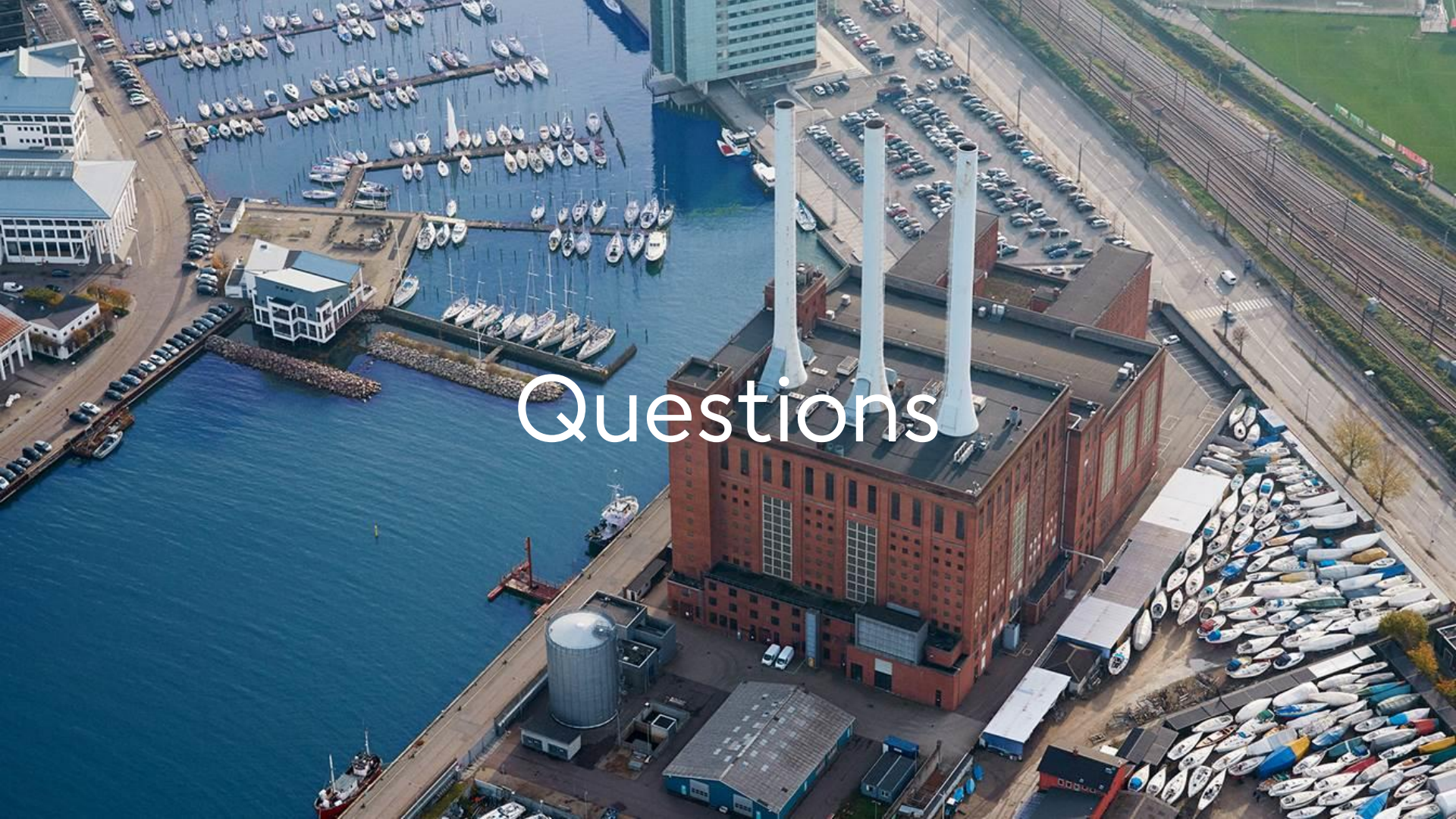
Questions