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GREEN H₂ AS AN ENABLER FOR A +100% RES SYSTEM

Flexible consumption is key with varRES

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WE ARE WORKING FOR THE DANES

Energinet is responsible for the supply of gas and electricity in Denmark.

We safeguard society's interests as we move to a 100% green energy system.

We are a regulated TSO owned by the Danish Ministry of Climate, Energy and Utilities.



HOW TO BALANCE

We work hard to make the green transition socioeconomic optimal while ensuring security of supply





GOVERNMENT GOAL: 70% reduction in CO2-emissions by 2030 (1990 ref)

DANISH GREEN TRANSITION

TODAY (2020): 68% green electricity 41% green energy 21% green gasses 2030: 100% green electricity 55% green energy 2040: 100% green gasses 2050: 100% green energy



HOW TO REDUCE EMISSIONS MOST EFFICIENT?



RE FUELS WITHOUT SLOWING THE TRANSISTION?

If there's a wish for maximal CO2-reduction when producing H2/PtX the production must take place using system integration



Also looks expensive compared to hotspots

System integration



Hydrogen infrastructure can be important support that electrolysers indeed "play together! With the green transition in the power grid

WIND CURTAILMENT



WIND & ELECTROLYSIS



A ONE WAY STREET

SYNERGY & BUILDOUT

PTX IN EUROPE AND DENMARK

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LARGE SCALE OFFSHORE WIND

The Danish offshore potential exceeds the Danish direct demand... by far

LARGE SCALE SOLAR

Solar and wind are best friends. It is likely that large scale solar will closely follow large scale wind







WIND & ELECTROLYSIS WIND CURTAILMENT **STOP** A NEED FOR REAL FLEXIBILITY IN THE TRANSITION

A ONE WAY STREET

SYNERGY & BUILDOUT



DANISH ENERGY ISLANDS

North Sea: capacity of 3 GW wind in 2030 rising to 10GW in 2030ies

Baltic Sea: capacity of 2 GW in 2030

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NORTH SEA WIND POWER HUB - NSWPH

International massive build-out of North Sea wind (180GW)

Essential to meet European contribution to Paris agreement

Combined wind landing and ICs (hub & spoke concept)

Effective integration in Europe





http://northseawindpowerhub.eu



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http://en.energinet.dk/Green-Transition/Energy-Islands

FROM A FOSSIL BACKBONE TO A RES-E BACKBONE



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FROM A FOSSIL BACKBONE TO A RES-E BACKBONE



✓ No CO2 emissions

Artists impression (n=not exact scale)

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ONE SYSTEM OF SYSTEMS CENTERED ON THE POWER GRID (and a digital infrastructure)







Artists impression (n=not exact scale)

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RECIPE FOR A RENEWABLE EUROPE









INDIRECT ELECTRIFICATION

(system integrated)



KEY MESSAGES Hydrogen & PtX in Denmark and Europe

> Electrolysis is a tool for increased direct electrification

- System integration for competitive hydrogen
- Flexible power consumption in co-placement zones: Use it "locally" or loose it!
- Optimizing infrastructure utilization factors
- Hydrogen infrastructure can be the incitement to secure flexible power consumption

> We can decarbonize 100% using PtX

- Euroelectric: up to 60-65% can be directly electrified
- Carbon, carbon, and carbon before DAC arrives, DK stronghold on biogas

PtX in Denmark

- Almost zero hydrogen consumption
- Infrastructure enable H2 export to Europe
- PtX in clusters have EU competitive edge, but globally?

PtX in Europe

- Differing country roles (green, blue, importers, exporters)
- High ambitions, and strategies for coordinated roll-out

> H2 infrastructure is one piece in value-ecosystem optimization

- Enables acceleration of RES integration while maximizing value
- Cross carrier optimization of e-H2 infrastructure
- District heating networks for excess heat from electrolysis (and DAC)
- Clusters for symbiosis networks



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