Production of hydrogen from wind: challenges in Denmark

Søren Bjerregaard Pedersen, CEO, Hydrogen Valley

HyBalance workshop 08.10.2019

The HyBalance project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking under grant agreement No 671384. The Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation program. www.fch.europa.eu. The HyBalance project has furthermore received funding from the Danish EUDP program, which is administered by the EUDP Board.

HyBalance

Who is Hydrogen Valley?

- Business fund working with hydrogen, biogas and methanol
- We take *active* part in the green transition of the Danish energy system – turning visions into actions: projects and jobs
- We collaborate with private companies, public authorities and research institutes
- Non-profit organization – financed by the municipality of Mariagerfjord, the region in northern Jutland and project aids
- 30 m. € from funds invested in project and activities within the FCH-sector

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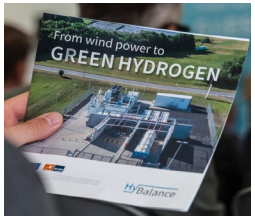
Hydrogen Valley's role in the HyBalance project

- Responsible for the dissemination and communication of the project
- Make the north Denmark region attractive for new energy industry stakeholders
- Creating a local demand for the usage of hydrogen
- Coordinate activities and stakeholders to build up a demand for hydrogen for mobility and for industrial purposes



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Why has Denmark been chosen for the project?

- Denmark is one of the countries in the EU with the most ambitious energy policy
- Denmark has a lot of wind energy
- Denmark has know-how within FCH technologies
- Denmark is the first and only country in the world to have a national network of hydrogen refueling stations
- Hydrogen cars are exempt from taxes until 2019

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The need to balance the grid

- Wind energy fluctuates – the grid requires stability.
- During some periods we produce more electricity from wind turbines than we are able to use.
- The excess electricity production can be exported or the wind turbines can be stopped.
- Or the excess wind power can be stored by converting it into hydrogen.
- HyBalance will develop business models to determine when it will pay to convert the wind power into hydrogen.

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The HyBalance process

GRID BALANCE

WATER ELECTROLYSIS

STORAGE

CLEAN MOBILITY, LOGISTICS AND INDUSTRY

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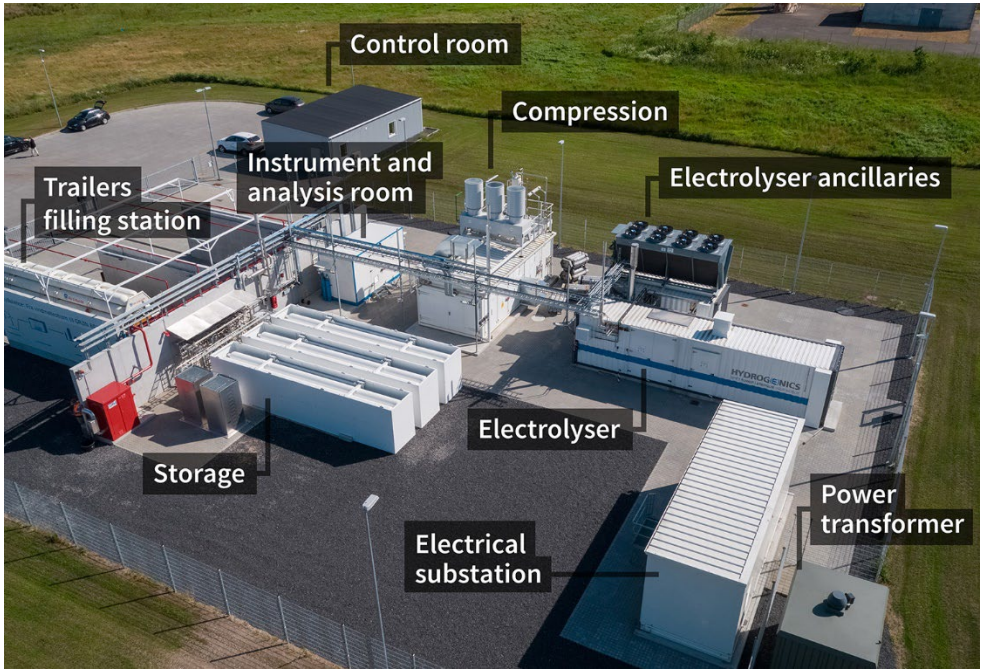
HyBalance overview



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Project achievements so far

- Three hydrogen busses are on their way to Aalborg
- HyBalance nominated for the EUSEW Award 2019
- Hydrogen Valley has together with a local school in Mariagerfjord developed a teaching material which focuses on HyBalance and the role of hydrogen in the future energy system
- Much attention and media publicity have been created around the project

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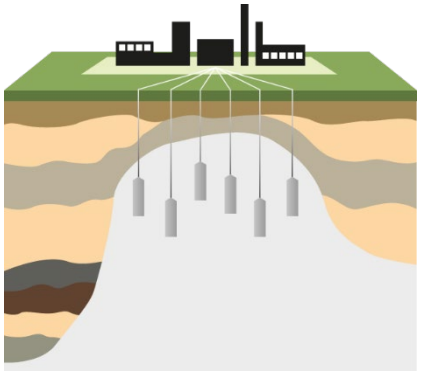
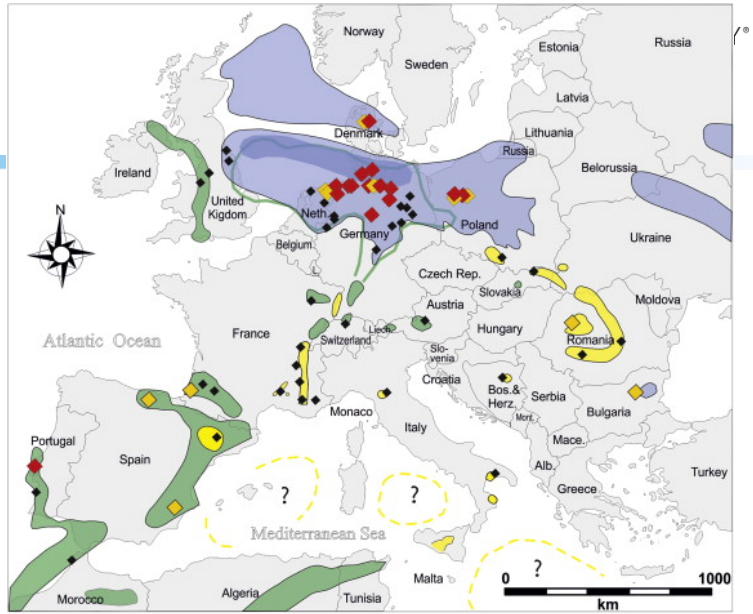
The potential

- The underground of the Northern part of Denmark holds unique opportunities for the storage of hydrogen in large scale, in the form of salt caverns





(from Gillhaus & Horvath 2008)

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Hydrogen- implementing phases

- Hydrogen being launched in larger scale across Europe
  - Primarily in cities
- Next step is large scale electrolysis and demonstration (+100 units)
- → price reduction of Hydrogen with a factor 3 before 2030

Denmark receives EU funding for 200 new hydrogen buses

02 OCTOBER 2018 - CLEANTECH

Due to Denmark's strong position in the field of green energy and hydrogen technology, Denmark has been selected by the EU to receive EUR 40 million. The funding is expected to bring 200 hydrogen buses to Denmark.

Hype to roll out fleet of 600 hydrogen taxis in Paris

Alstom presents hydrogen train in six federal states in Germany

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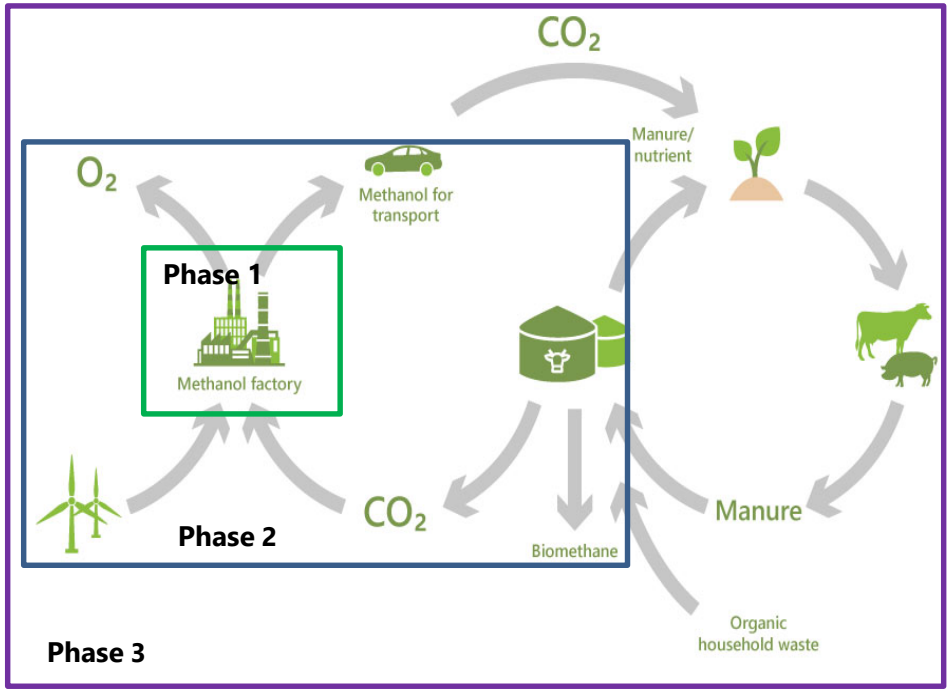
Methanol - implementing phases

Methanol Synthesis combines CO_2 from biogas with green hydrogen. This is a key enabler for the multi-output

Partners are biogas plant owners, industry and gas companies.

- Phase 1 – Pilot-demo at Aalborg University (Started: March 1st 2019)
- Phase 2 – Full-scale test of local biogas plant in Hydrogen Valley Hobro
- Phase 3 – Circular system involving all value streams



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Amonia – implementing phases

- Ammonia can be (and already is) produced in large scale.
- A Danish consortium plans to bring a large-scale green ammonia plant to market.
- This project meets future demand of CO2 neutral bunker fuels.

MAN Energy Solution in World Trade

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Conclusions

Hydrogen is the key enabler:

1. Hydrogen with zero-emission profile
2. Methanol with low-emission profile, and possibility to blend in with existing fuels
3. Ammonia as an alternative to bunker fuel

HyBalance is the stepping stone for this enabler to happen

Scania-chefens hån mot Tesla: Duger till att transportera chips

TRANSPORT 07 dec 2017, kl 16:20

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Thank you for your attention

hybalance.eu

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