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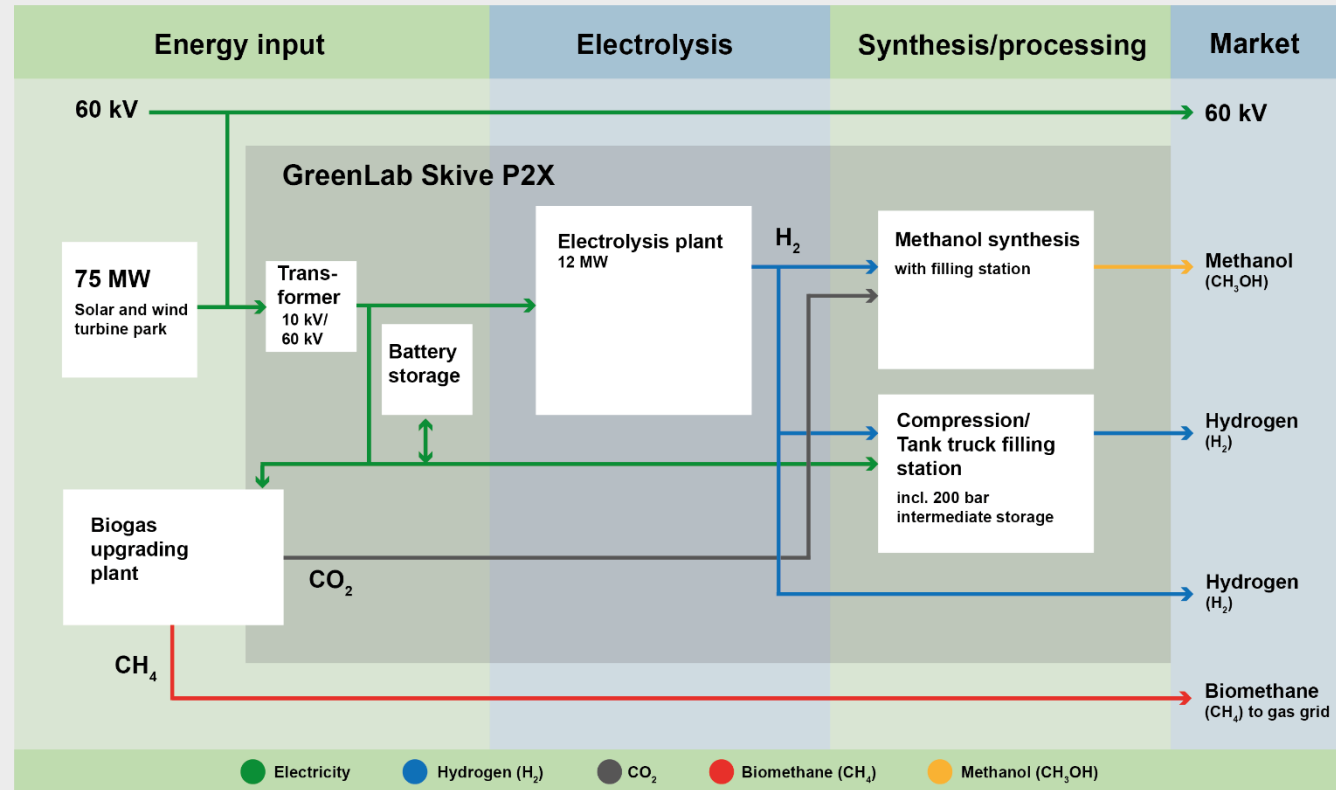
Test Centre for Hydrogen Technology

**GERG 60th Anniversary Conference
Hydrogen
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- 2020-2024
- Demonstration of production of electrofuels etc.
- Establishment of H₂ distribution grid
- DGC's role
 - Safety and authority process related to H₂ infrastructure
 - H₂ metering and analysis
- EUR 10.7m financial support from the Danish Energy Agency



Project participants:

Greenlab A/S, Eurowind Energy, Green Hydrogen Systems, Norlys Holding, RE:Integrate, Energinet, DGC, Everfuel Europe, E.on Danmark, Technical University of Denmark and EA Energianalyse

Test Centre for Hydrogen Technology

- A collaboration between Danish Gas Technology Centre and FORCE Technology
- Supported by EUDP - Green Labs DK
- Main objective:

To develop test facilities and knowledge in order to support and facilitate the development of hydrogen technologies so hydrogen can deliver its full potential in an integrated energy system.



Hydrogen Technology Test Centre services

- Material and component testing
- Hydrogen purity and quality testing
- Measurement of emissions from H₂ consuming equipment and exhaust gases from energy consumption and chemical processes
- Efficiency and safety in energy systems
- Metrological services
- On-site inspection services - onshore and offshore
- Modeling and calculation



Plans for DGC laboratory services for Hydrogen Technology Test Centre

DGC will further develop the provided services for the areas of:

- Hydrogen purity analysis
- Leakage measurement
- Extension of laboratory facilities to further include performance test and development of different hydrogen technologies.

Both stationary and mobile solutions will be considered, and the final solutions and timelines will reflect demands from the industry and the technical development.

Hydrogen purity according to ISO 14687 specifications grade D

– full package primo 2022



ISO 14687 Grade	D PEM, road vehicles	E, Cat. 3 PEM, stationary	B industrial fuel	A combustion
Total non-hydrogen gases	300 ppm	0,1 %	0,1 %	2%
Nitrogen + argon + helium	300 ppm	0,1 %	-	-
Water + oxygen + nitrogen + argon	-	-	-	1,9 %
Methane	100 ppm	100 ppm	-	-
Non-methane hydrocarbons (C1)	2 ppm	2 ppm	non-condensing	100 ppm
Oxygen	5 ppm	50 ppm	100 ppm	-
Water	5 ppm	non-condensing	non-condensing	non-condensing
Carbon dioxide	2 ppm	2 ppm	-	-
Carbon monoxide	0,2 ppm	0,2 ppm	-	1 ppm
Carbon monoxide + formaldehyde + formic acid	0,2 ppm	0,2 ppm	-	-
Ammonia	0,1 ppm	0,1 ppm	-	-
Halogenated compounds	0,05 ppm	0,05 ppm	-	-
Total sulfur compounds (S1)	0,004 ppm	0,004 ppm	10 ppm	2 ppm
Mercury	-	-	0,004 ppm	-
Particles	1 mg/kg	1 mg/kg; < 75 μ m	no damage	no damage

Detection/quantification of leakages – expected in operation during 2022 and 2023

**High Flow Sampler
(for quantification
of single leakages)**

- DGC has different equipment for identification and quantification of methane leakages.
- DGC plans to extend the methods and equipment to include hydrogen leakages due to safety as well as environmental concerns

**Mobile detection of
leakages from
pipelines and
equipment**

- For hydrogen¹, an estimate for global warming potential is found to be in the area of

$$\text{GWP}_{\text{Hydrogen}} = 4-7$$

**Gas test detector
for manual
detection of
leakages**

- In comparison, IPCC estimates a 100-year value for methane² of

$$\text{GWP}_{\text{Methane}} = 28$$

¹ Derwent, R.G. (2018-10-07). "Hydrogen for Heating: Atmospheric Impacts. A literature review

² AR5 Synthesis Report: Climate Change 2014 — IPCC

FORCE Technology will further develop the provided services for test of materials and components

Hydrogen compatibility and sensibility

- Hydrogen in materials as function of different parameters
- Material qualification
- Test of electrodes in representative environments



Specialized autoclave

Hydrogen permeability

- Test of hydrogen diffusion for different materials
- Test of packing and sealing materials
- Test of coatings



Hydrogen diffusion evident in liquid

Fracture mechanical testing

- Static and dynamic tests
- ASME B31.12



Dynamic fracture mechanical test



Static fracture mechanical test

Large-scale component test

Container

- Mobility, flexibility, safety



Thank you for your attention

