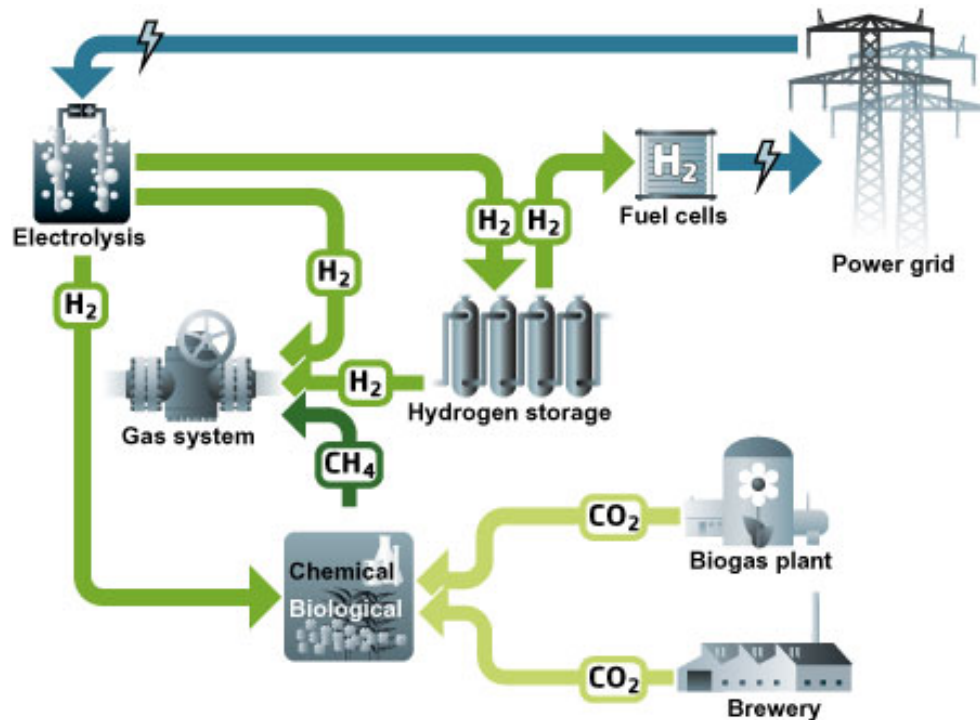


Energy Storage – Hydrogen injected into the Gas Grid via electrolysis field test

HIPS Meeting
The 26th of June 2014



Hydrogen a part of integrating energy systems



- Hydrogen will be used in several different applications
- Important for the infrastructure owners to know the limits
- This knowledge is crucial whether the hydrogen is methanized or not

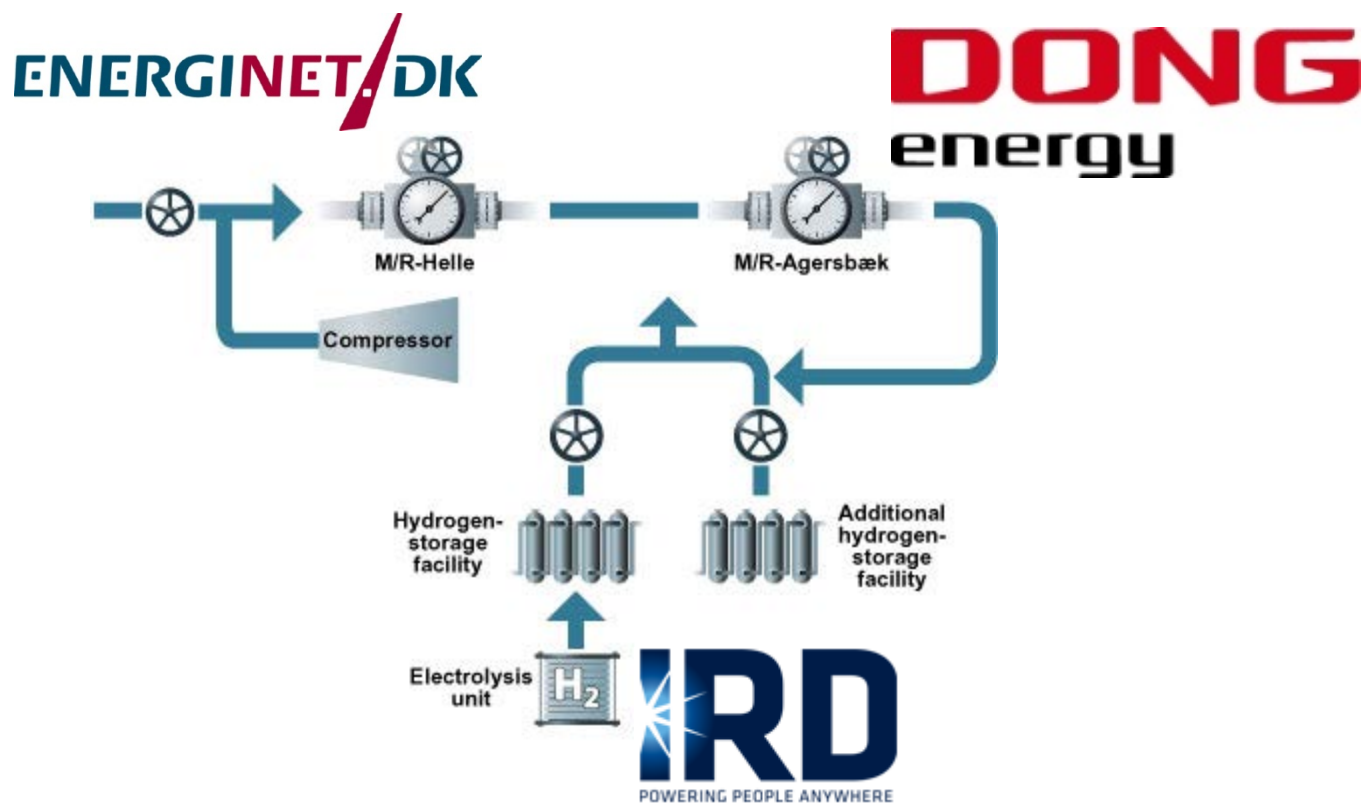


Scope of the project

- To acquire knowledge of the solutions and costs of upgrading the gas grid to handle hydrogen admixed in the natural gas
- Important to build up competences in the participating companies
- Test period: 2 years
- Up to 15 % hydrogen
- Hydrogen content will be varied during the test
- Total costs around 1 mill. €
- Funded partly by EUDP: Energy Technology Development and Demonstration Programme



The test loop



Consultant:

DGC

Dansk Gasteknisk Center a/s
- rådgivning, udvikling og måling inden for energi og miljø



Summary

- Project started January 2014
- The 2 year test phase starts March 2015
- A lot of experience will be gained during the building of the test loop
- The project results will be:
- A practical, public guideline that describes
 - how the M/R stations and gas grid must be adapted to handle the injection of hydrogen in the natural gas grid
 - including consequences for regulatory approvals and operation & maintenance.



Hydrogen in cavern storage

- Storing 100% hydrogen
- Elements under investigation for embrittlement, tightness and corrosion: all parts of the surface process installation, as well as the cavern and well
 - Pipes at cavern pressure and transmission system pressure
 - Both sales spec and untreated (moist), and both high and low temperatures
 - Seals and different kinds of valves including check valves, for large pressure and temperature ranges, treated and untreated gas
 - Metering; flow, pressure, temperature
 - Compressor units, cooling and heating
 - Treatment facilities (dehydration, particle filters etc.)
 - Pressure reduction valves (possibly with pre-cooling)



Hydrogen in cavern storage

- Regarding detection and general safety
 - Detection of leaks
 - Venting
 - Flaring (low/high LEL/UEL)
 - Failure rates for installations
- Regarding the cavern itself
 - Consequences of possible high frequency operation
 - Biology in the cavern
 - Tightness and corrosion of the cemented casings
- Goal of study is to determine, if it is possible to store pure hydrogen in the existing salt caverns, and what changes to the installation are needed in order to do so in a safe and reliable manner.

