"Power to Gas" – Potential of hydrogen from a utility perspective

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“Delivering Hydrogen and Fuel Cells ambitions in Horizon 2020”
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Challenges in the German and the French power systems

Germany: Intermittency of renewables capacities (national + local)

France: Increasing peak load demand

In both power systems significant and growing need for flexibility
Flexibility from ...

...Generation
- Hydro-to-Power
- Gas-to-Power/Heat
- Coal-to-Power/Heat

...Grids
- Power-to-Gas
- Power-to-Heat
- Power-to-Power

...Storage
- Power-to-Power
- Power-to-Gas
- Power-to-Heat

Hydrogen?...

...Demand
- Industry
- SME
- Residential
- Mobility
Why Power-to-Gas? Connecting markets

Certificate Power

Power Grid

Electrolysis

Storage

Certificate Gas

Natural gas grid

Power

Heating

Mobility

Industry

Natural & renewable gas

Renewable hydrogen

Power

Heating

Mobility

Industry
Example Falkenhagen: Power-to-Gas pilot project
Regional oversupply by onshore wind capacities

Falkenhagen in Brandenburg region
- Increasing excess power
- Huge peak power
- Steep power gradients

Solution: Storage of excess wind power instead of curtailment
Falkenhagen: From planning to operations in 12 months in cooperation with Swissgas

Key Parameters

- Power: $2 \text{ MW}_{\text{el}}$
- Hydrogen production: $360 \text{ m}^3/\text{h}$
- Feed into the local gas grid (ONTRAS)
- Start of operation 28 Aug. 2013
- Concentration H2 : max 2%
- In partnership with Swissgas AG

Goals

- Demonstration of the process chain
- Optimize operational concept (fluctuating power from wind vs. changing gas feed)
- Gain experience in technology, costs, consenting
- Establish a new WindGas product
Falkenhagen: In operation since 28th of Aug. 2013

What we will learn is about:
- availability
- efficiency
- dynamics
- acceptance
- market for H₂
- potential for improvement

E.ON WindGas
Innovatives Gas aus Windenergie
Example: Power to Gas for Refineries

Fuel production today

- Fossil Energy
  - Natural gas
  - Reformer (CH₄ → H₂)

- Renewable Energy
  - Biomass
  - Fermentation (Ethanol)

- Certificate

Innovative fuel production

- Fossil Energy
  - Reformer (H₂)

- Electrolysis (H₂)

- Power

- Certificate

E5 / E10
Example Project Hydor: Demonstrator for solid storage of hydrogen in France

The project

• Location: E.ON France thermal power plant site Emile Huchet in Lorraine region

• Demonstration: Evaluation of performance and flexibility for solid storage of hydrogen (McPhy) in an industrial environment

• Storage capacity 5kg H2

• Project duration: 6 months
Summary

- Increasing need to integrate renewable energy leads to the interconnection between power, gas and heat system.

- Power to Gas can provide both, storage services for the power market and the integration of renewable power into mobility, industry and heating.

- Today, the major levers to push the development are
  - Reduction of technology costs
  - Exemption from end consumer fees
  - Favorable regulation for green hydrogen
Backup
Example: „WindGas Hamburg“

Demonstration of advanced power to gas technology

Key Parameters

- Power: 1 MW_{el}, 265 m³/h hydrogen
- Public funding from BMVI
- Partners: Hydrogenics, SolviCore, DLR, Fraunhofer ISE
- Fed into the local gas grid of Hamburg
- Planned start of operation Q4/2014

Idea

- Development of high efficient Proton exchange membrane electrolysis (PEM with 80% eff.)
- Demonstration within E.ON infrastructure
- Business development