


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

7th Stakeholder Forum of the European Partnership for Fuel Cells and Hydrogen
"Delivering Hydrogen and Fuel Cells ambitions in Horizon 2020"
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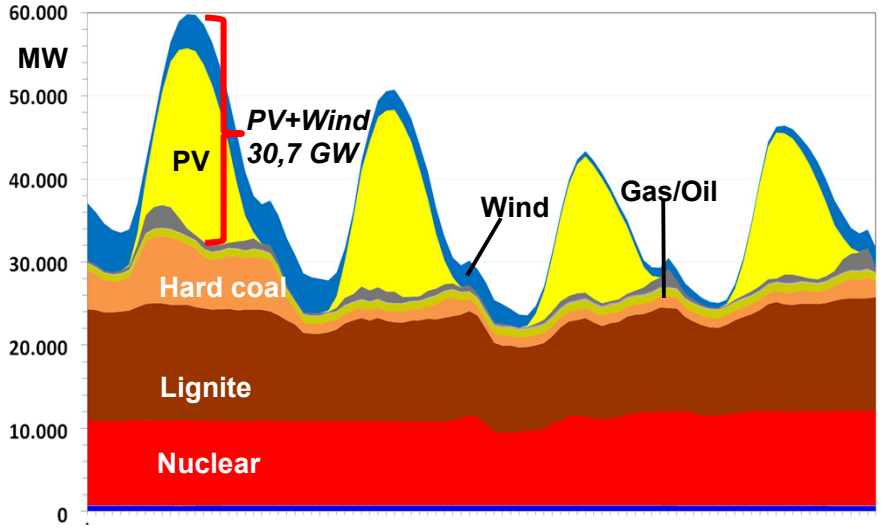
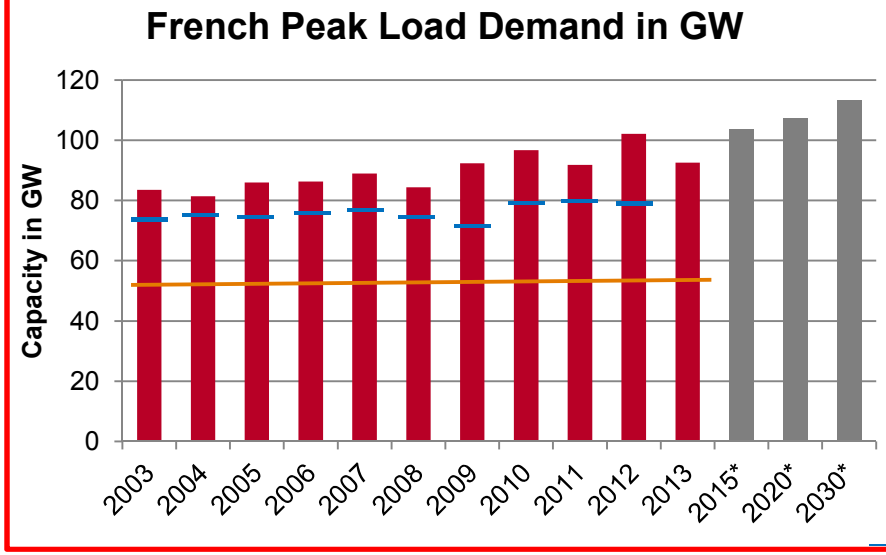
Challenges in the German and the French power systems

Germany: Intermittency of renewables capacities (national + local)



Source: EEX, Frauenhofer, Mars 2013

France: Increasing peak load demand



Source: RTE, BDEW — Annual average consumption — German peak demand

In both power systems significant and growing need for flexibility

Flexibility from …

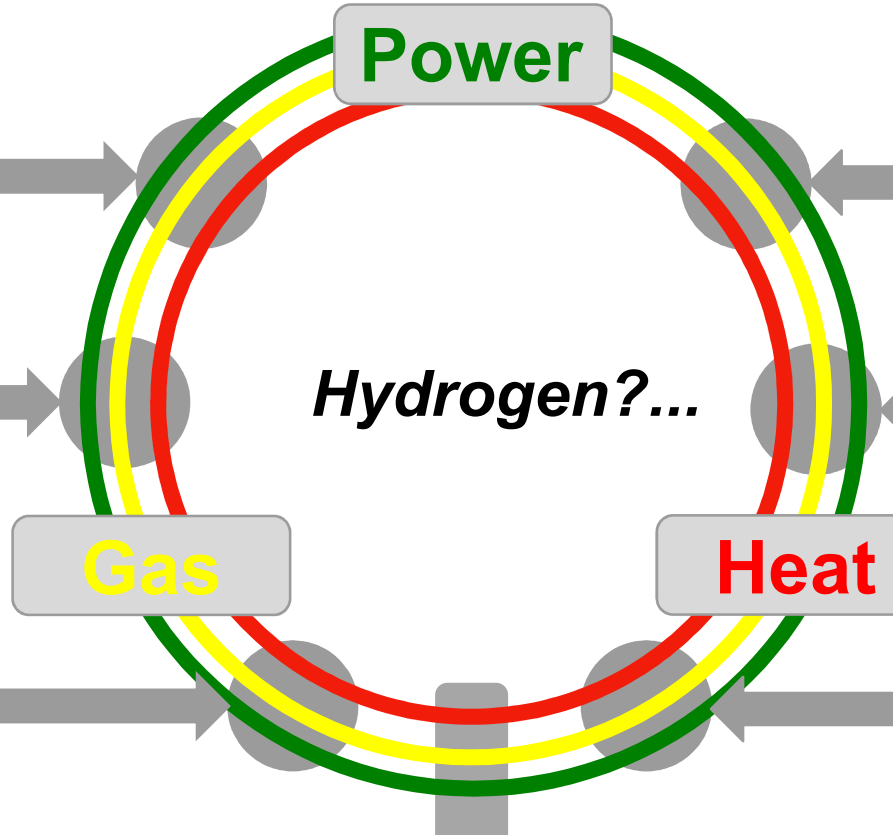
…Generation

Hydro-to-Power

Gas-to-Power/Heat

Coal-to-Power/Heat

…Grids



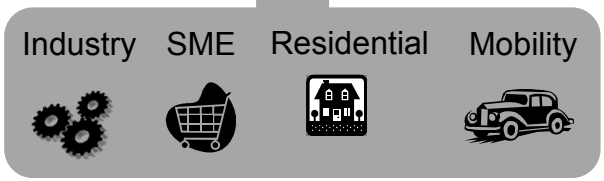
…Storage

Power-to-Power

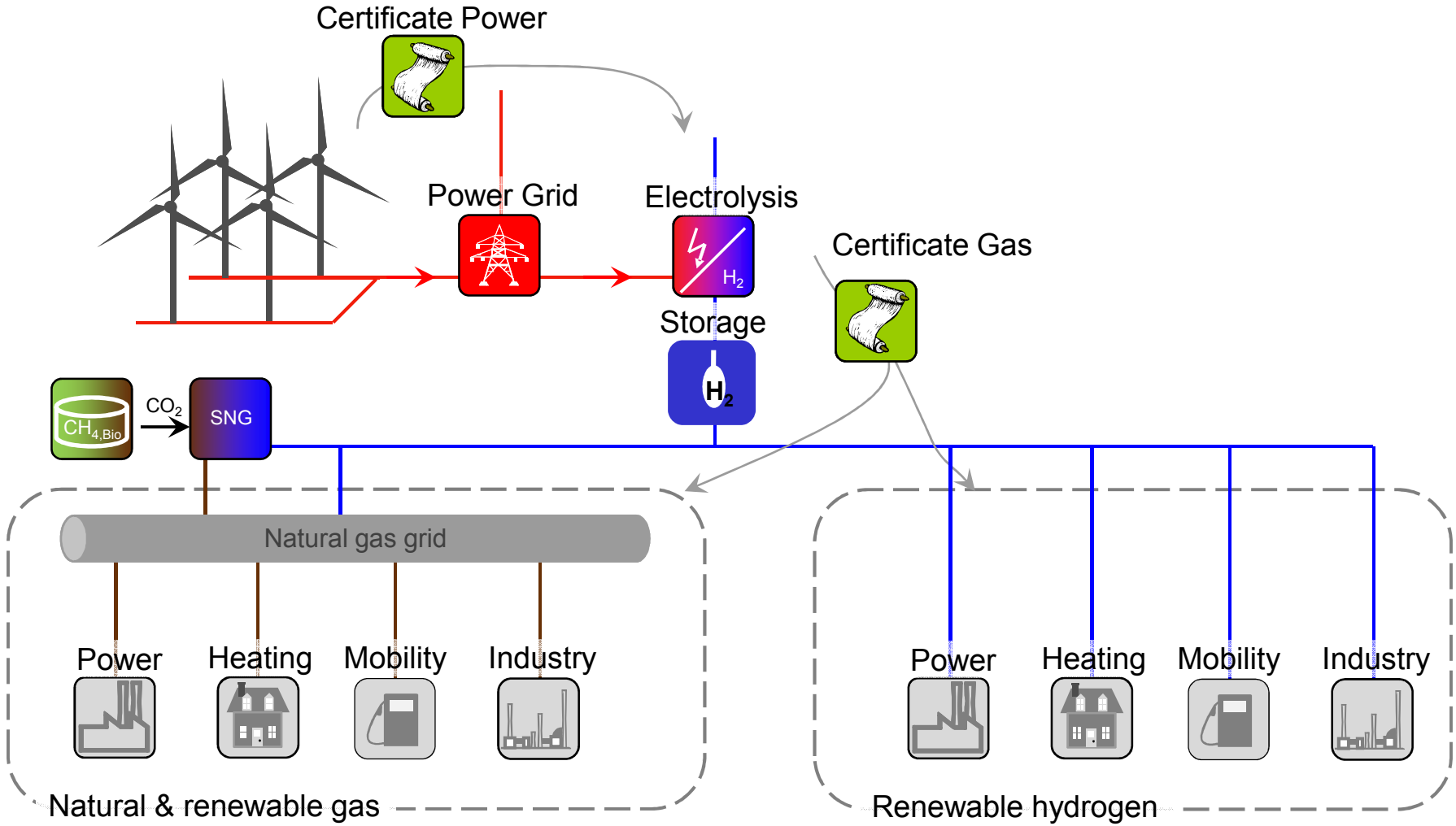
Power-to-Gas

Power-to-Heat

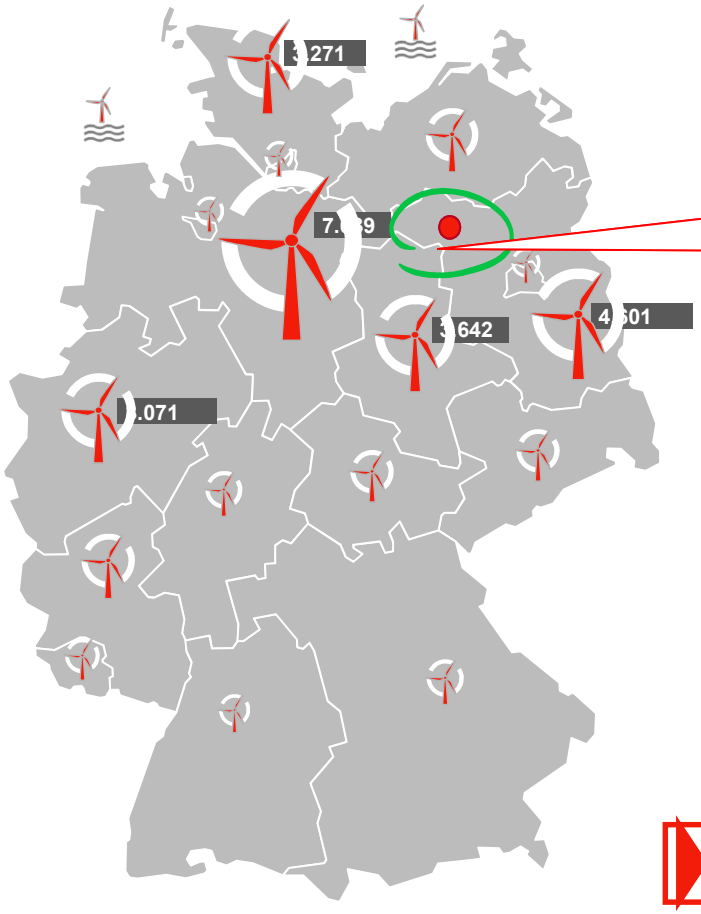
…Demand



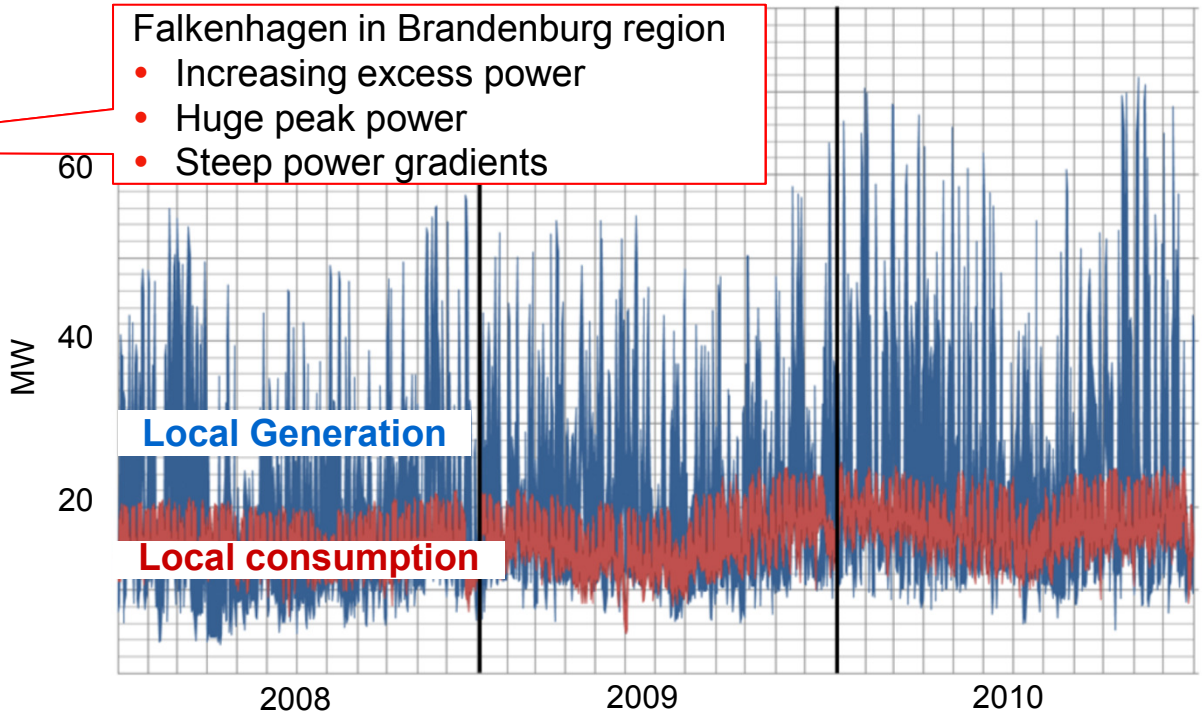
Why Power-to-Gas? Connecting markets



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

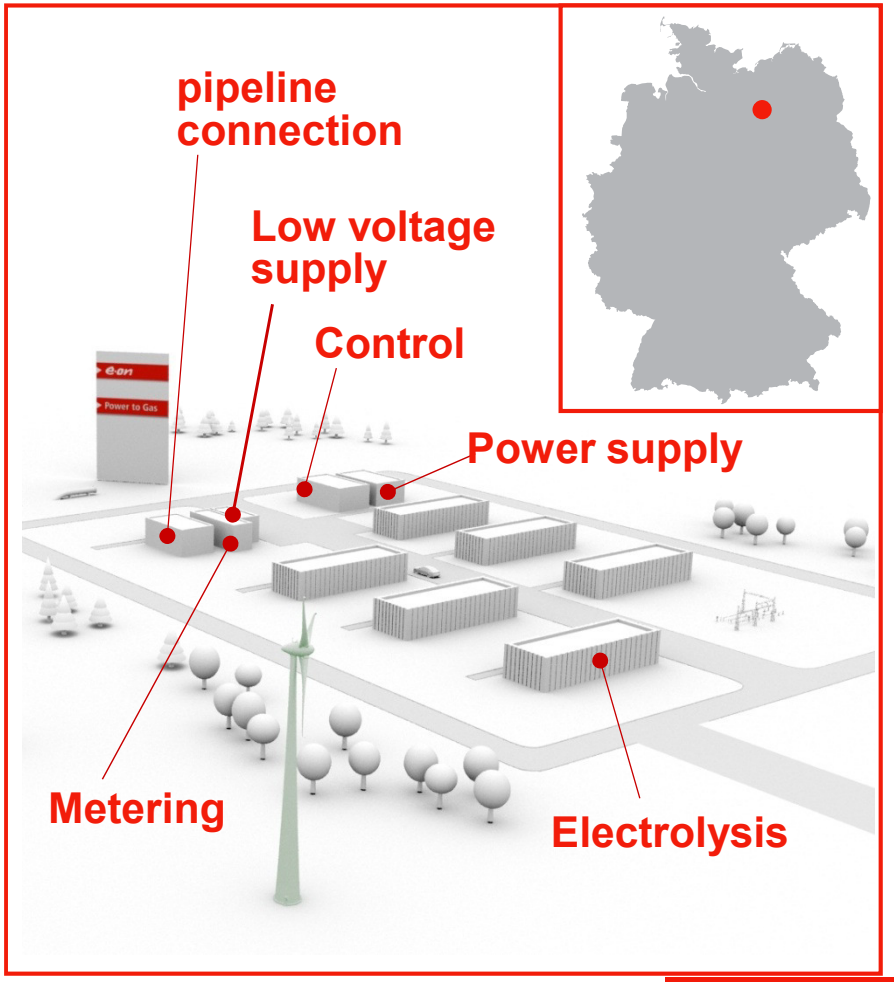
in cooperation with Swissgas

Key Parameters

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

Goals

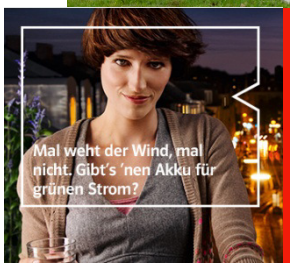
- Demonstration of the process chain
- Optimize operational concept (fluctuating power from wind vs. changing gas feed)
- Gain experience in technology, costs, consenting
- Establish a new WindGas product



Falkenhagen: In operation since 28th of Aug. 2013

What we will learn is about

- availability
- efficiency
- dynamics
- acceptance
- market for H_2
- potential for improvement



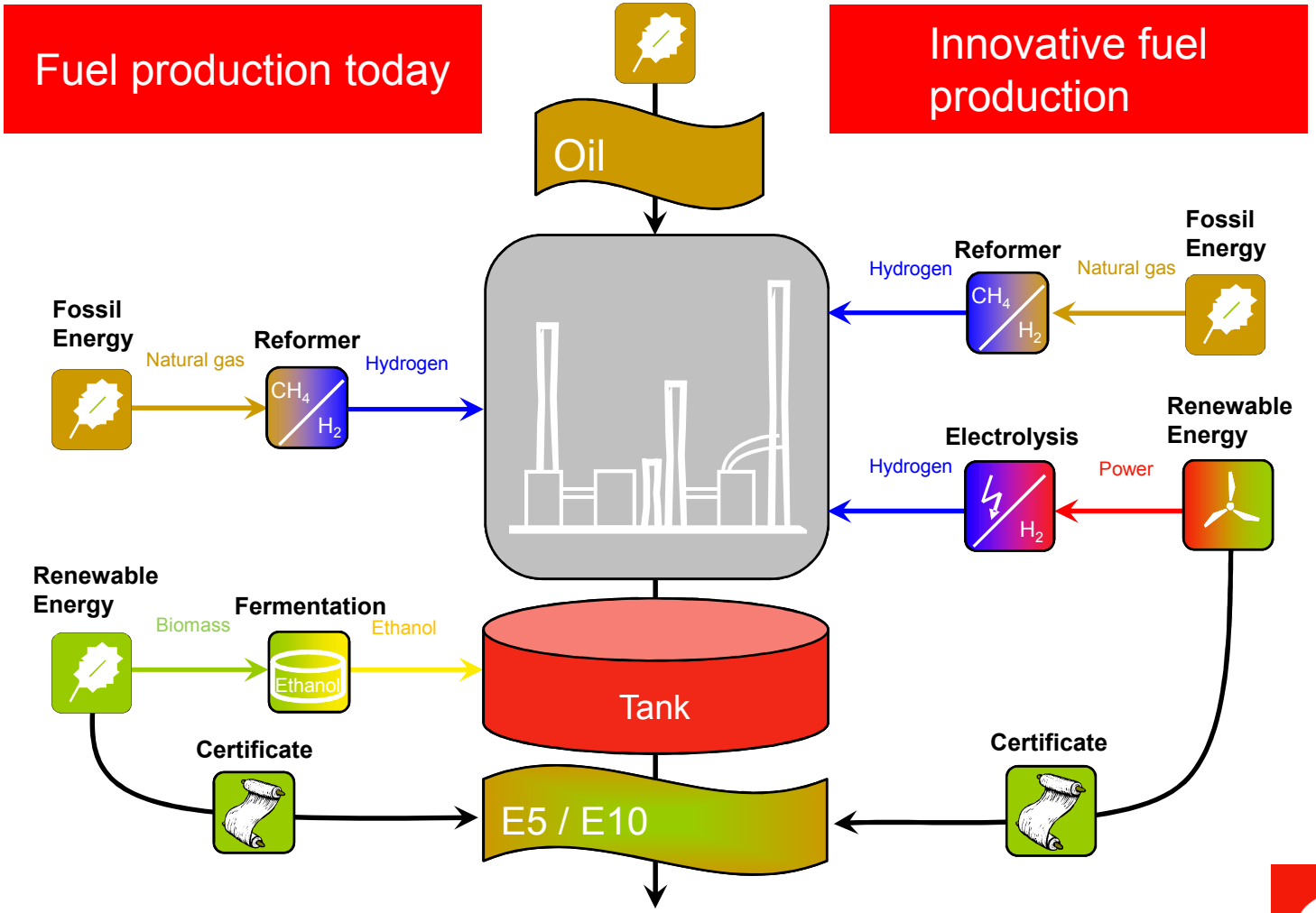
E.ON WindGas

Innovatives Gas aus Windenergie

SWISSGAS

e·on

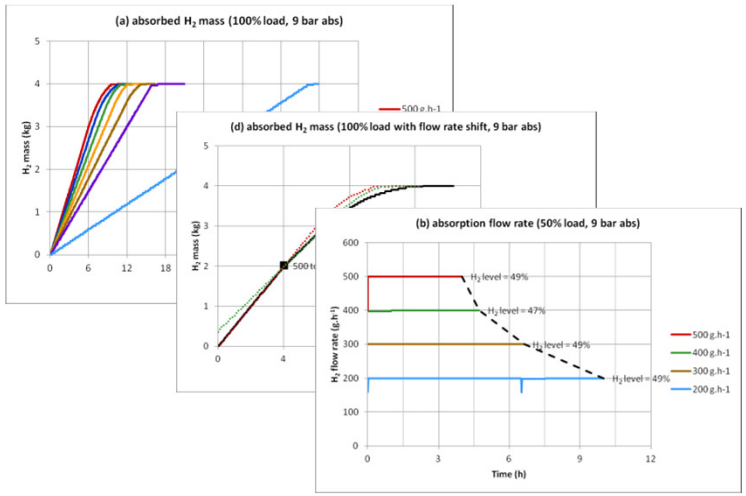
Example: Power to Gas for Refineries



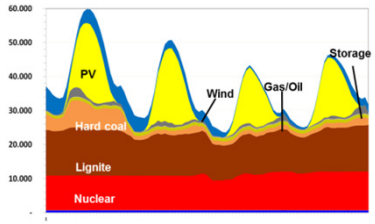
Example Project Hydor: Demonstrator for solid storage of hydrogen in France

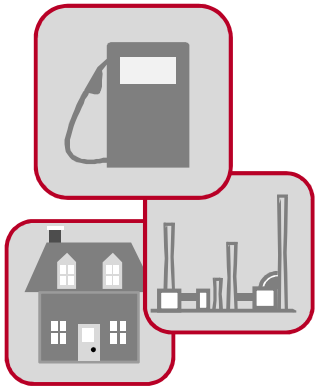
The project

- 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

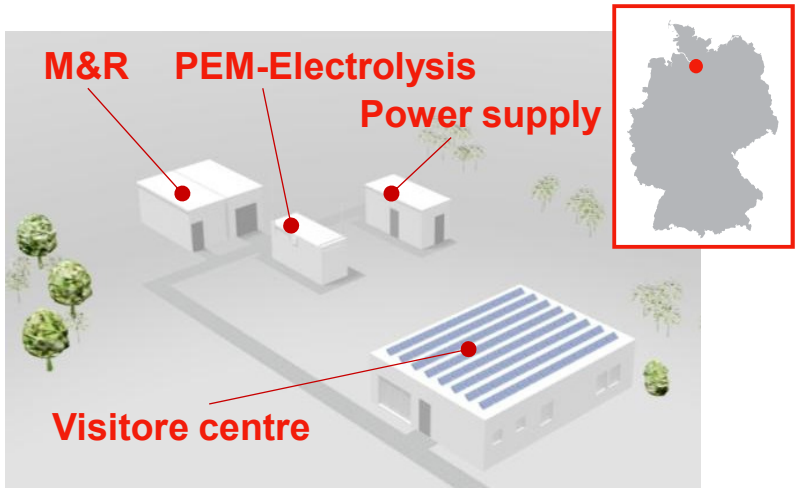
Backup

Example: „WindGas Hamburg“

Demonstration of advanced power to gas technology

Key Parameters

- Power: 1 MW_{el}, 265 m^3/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