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Potential and Challenges of PEM Electrolysers

Kick-off meeting for the IEA Technology Roadmap on Hydrogen, Paris, July 09/10, 2013

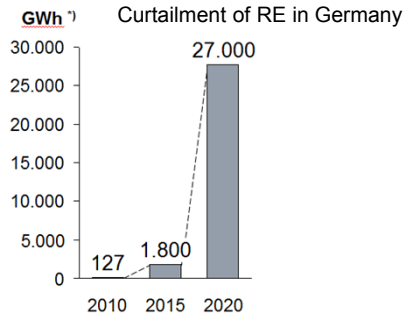
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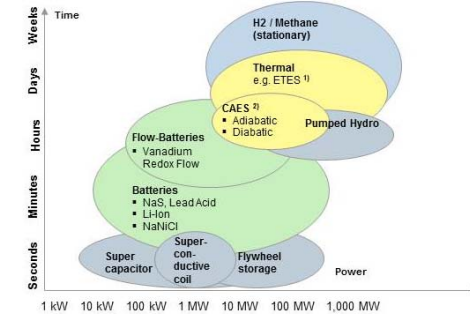
Hydrogen is the enabler for the integration of renewables

1) Motivation



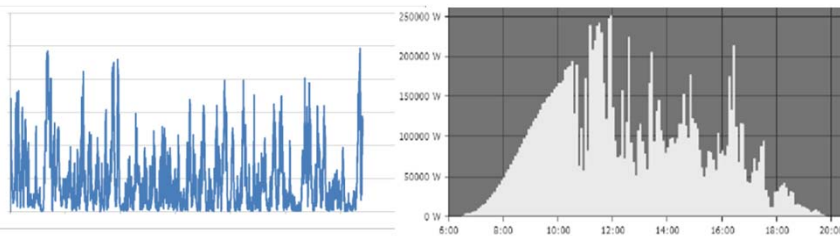
- The EU-targets for CO₂-Reduction can only be realized with further extension of renewables (RE)
- In order to prevent increasing RE-curtailment energy storage in the TWh-range will be essential

2) Energy Storage



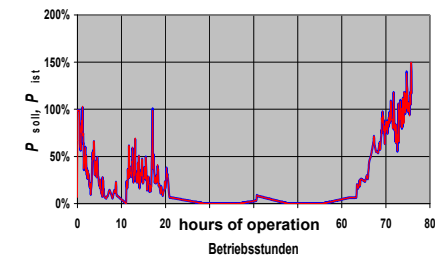
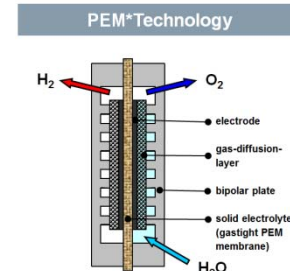
- There is no energy storage technology fitting to all applications
- Hydrogen is the only energy storage concept to address energy storage in range > 100 GWh

3) Requirements



- Grid frequency has to be kept constant at any time. Generation has to follow demand
- Electrolyzers as a concept for grid stabilization must be very dynamic and durable under changing load conditions

4) Solution



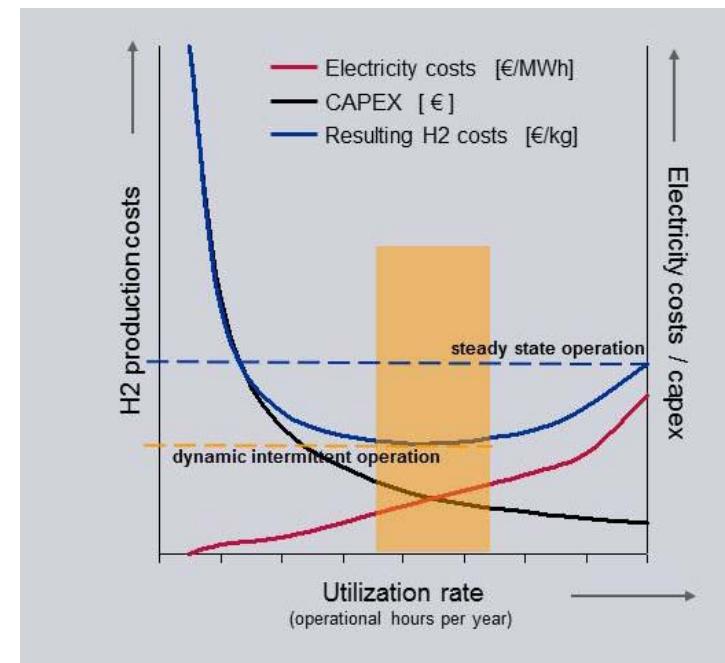
- The emerging PEM-technology provides the requested technical properties.

The dynamic behaviour of PEM Electrolyzers opens new business opportunities

PEM specific properties

- fast ramp-up (from cold stand-by to full power in less than 10 s)
- high dynamic range (down to 0 %)
- easy start/stop procedures
 - no inert gas purging
 - no preheating (--> low power consumption at idle status)
- fast load cycles without related degradation
 - even at high pressure up to 100 bar
- compact footprint due to high current density
- pure water as electrolyte (--> low corrosion; no environmental burden)

Advantage of dynamic operation



High dynamic operations enables access to grid services and related cheap electricity

PEM Electrolyzers: Status and Challenges

Status

- emerging technology, available in the 100 kW-range



300 kW-PEM Electrolyzer (Siemens) at RWE site Niederaußem

- announcements for MW-systems, eg.:
 - Reitbrook, E.on (Ger) 1 MW Hydrogenics
 - Mainz/Hechtsheim (Ger) 6 MW Siemens
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Challenges

technology:

- scale-up of cells, stacks and systems into the 100-MW-range
- grid integration (into mid-voltage and high-voltage grids)

government:

- hydrogen must be supported as a storage issue to enable an economic renewable extension

public community:

- acceptance of H2 as a safe technology for storage of renewable energy
- sustainable market development (hype without substance will lead to disappointment)