The Prospects of Hydrogen in a Clean Energy System

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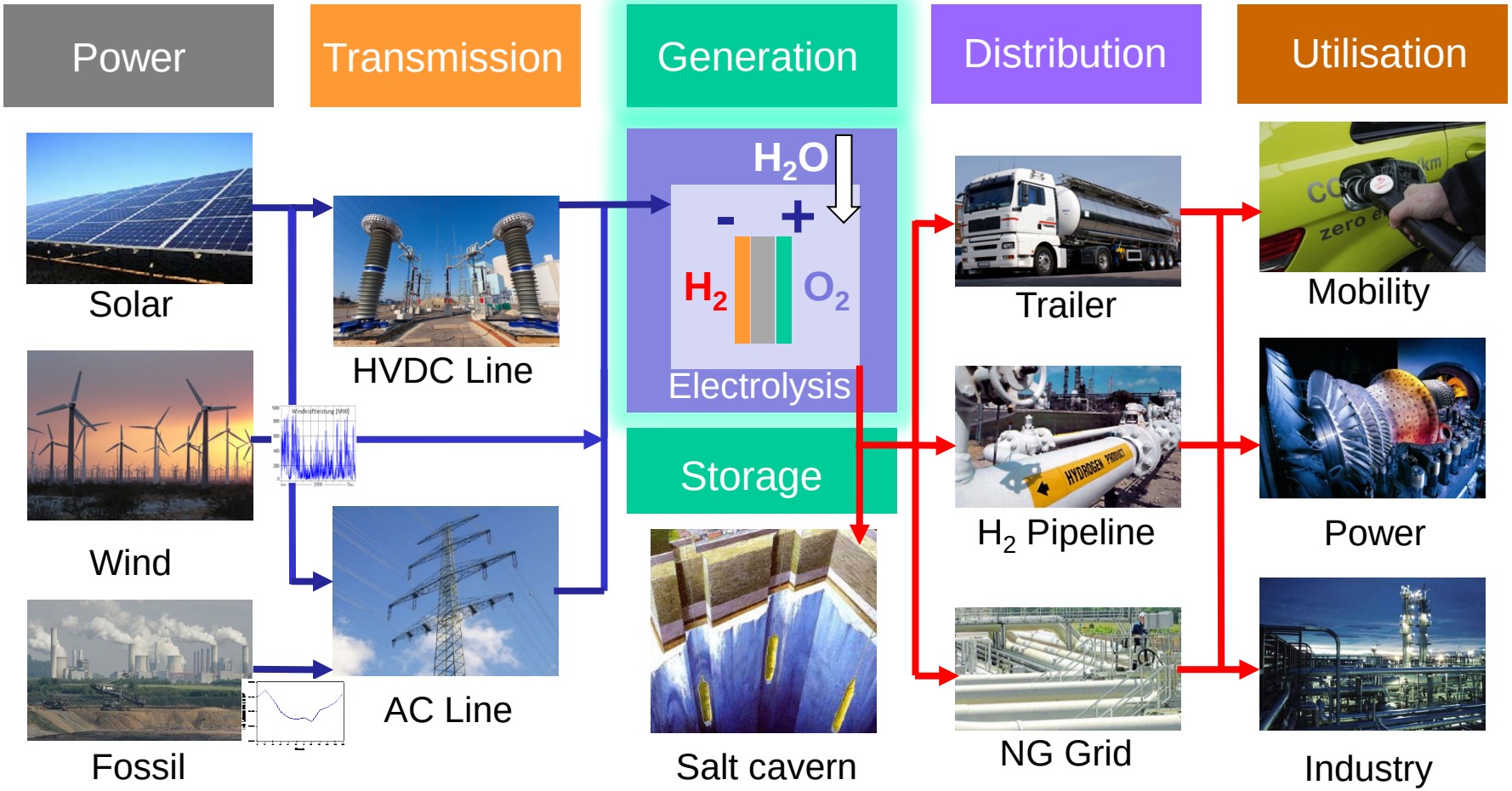
DLR

Hydrogen Paths from Power Generation to Utilization



Different scenarios are possible and analized

- **“hydrogen economy“**
  - hydrogen as a promising energy carrier for many fields of application

- **hydrogen as “additional renewable fuel”**
  - high renewable shares („for the last 20%“)
  - complementary to strong direct use of renewable power
  - limited role and low infrastructural needs

- **hydrogen stays „energy carrier of the future“**
  - disadvantages prevent wider use of hydrogen in the energy system

Role of hydrogen use in the future energy system

"Most promising" future fields of application

Hydrogen as third renewable energy carrier in the transport sector

Premises: introduction of hydrogen required as **biofuel use is limited** and **battery electric vehicles can cover only partly the traffic performance**.

Required: Improvement of durability, costs and market success of fuel cell vehicles.

Infrastructures: Filling stations with on-site electrolyser + H_2 storage. Central backup can deliver hydrogen by trucks during on-peak times.

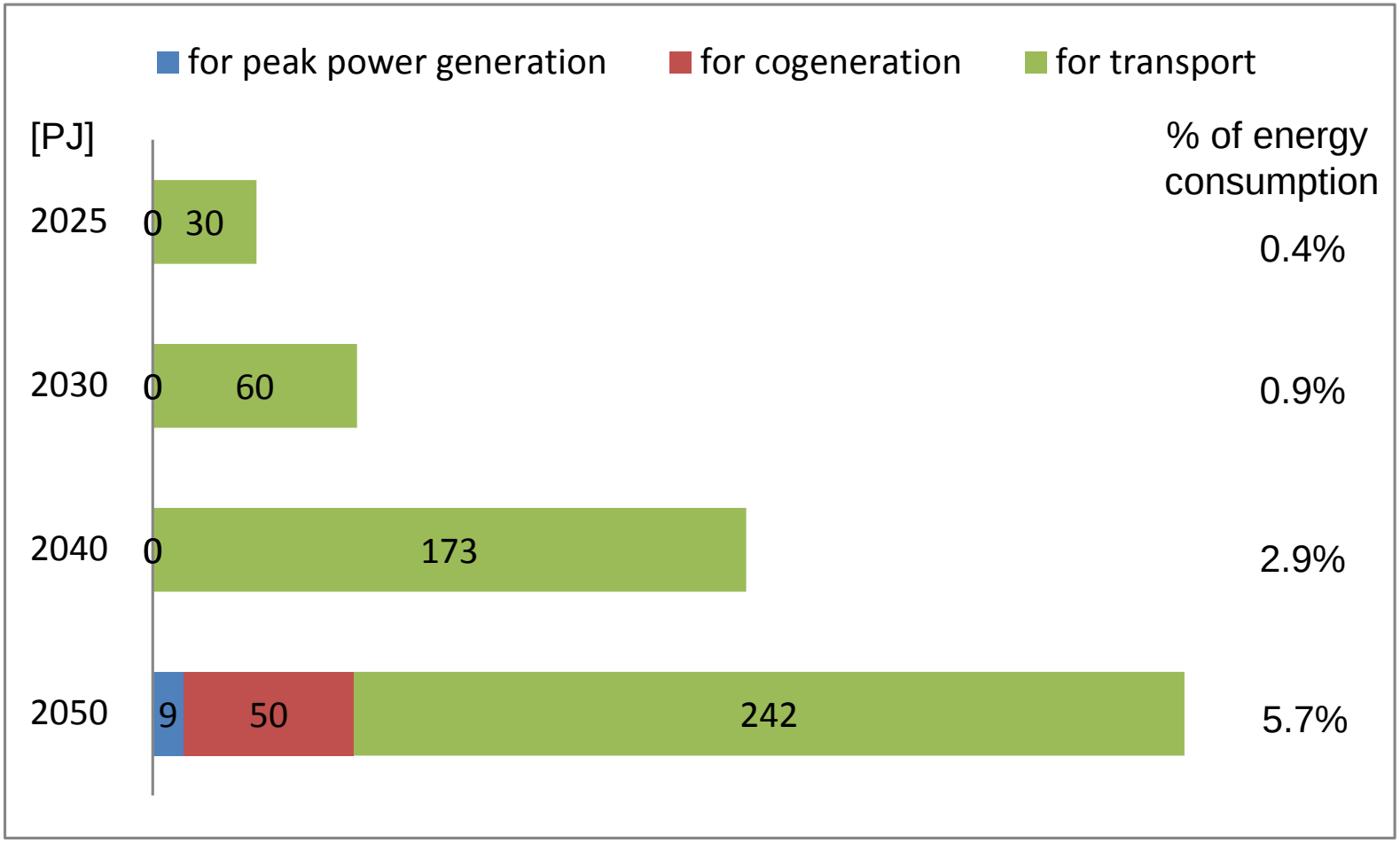
Hydrogen as substitute for natural gas in power plants and for industrial process heat generation

Premises: Hydrogen applied **as a chemical storage medium** for electricity from renewables and used in cogeneration for provision of heat and electricity - and reconversion into electricity in gas turbines (for high RE shares also for process heat). Hydrogen reduces CO_2 emissions by **substituting gas**.

Infrastructures: central electrolyser + H_2 storages close to utilization sites.

GHG reduction in scenario: -80% (2050/1990)

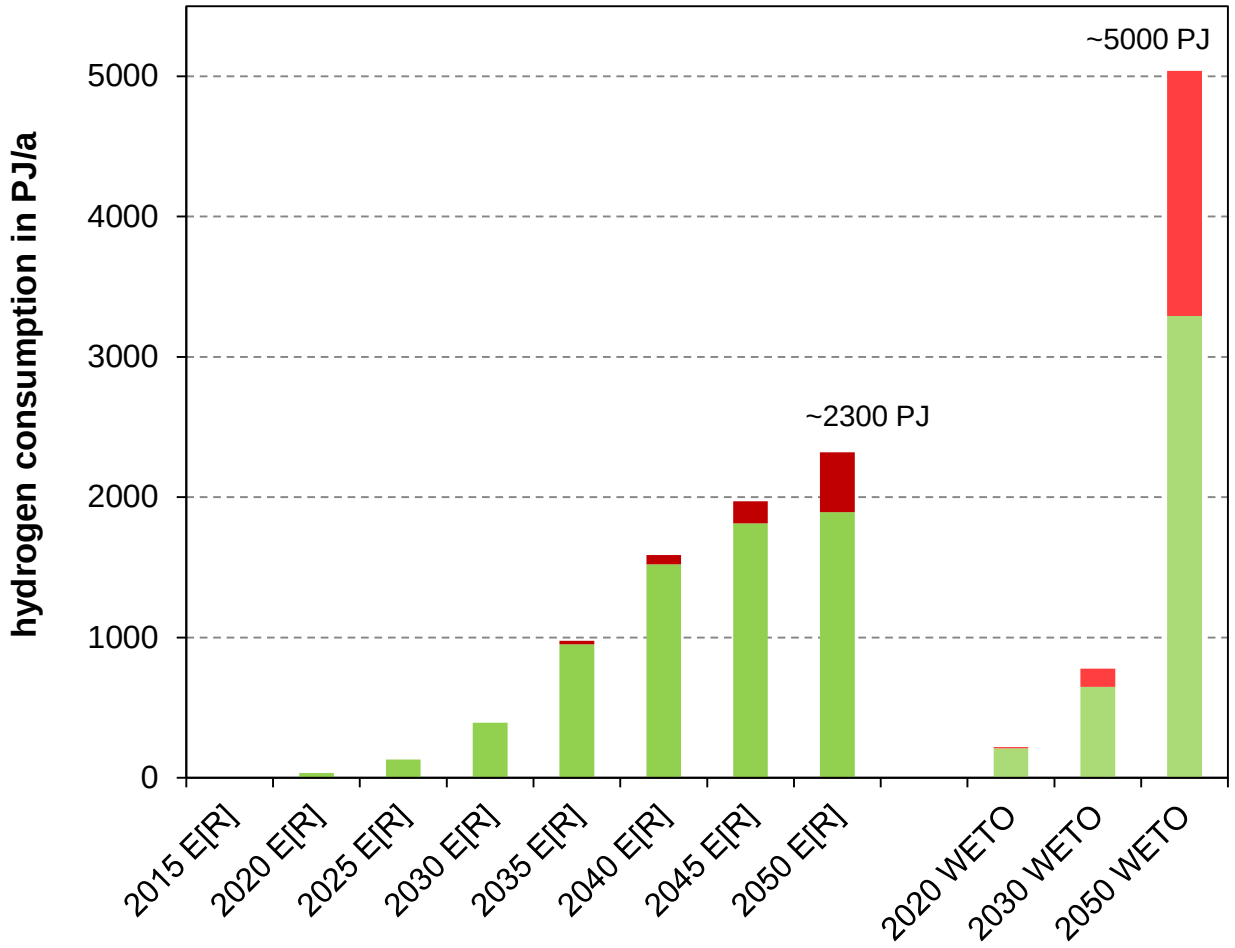
Prospects for hydrogen use in the German energy system



source: DLR scenarios for BMU, March 2012

Scenarios for hydrogen use in Europe

E[R] scenario reaches 85% RE (PE) up to 2050, phase-out of nuclear power generation limited biomass (6 EJ), oil and gas (each 3 EJ) consumption; ~3000 TWh electricity for transport



sources:
WETO 2006: World Energy Technology Outlook 2050
European Commission, scenario H2 case, 11/2006
E[R] 2012: Energy [R]evolution scenario, DLR for
Greenpeace Int., EREC, 10/2012

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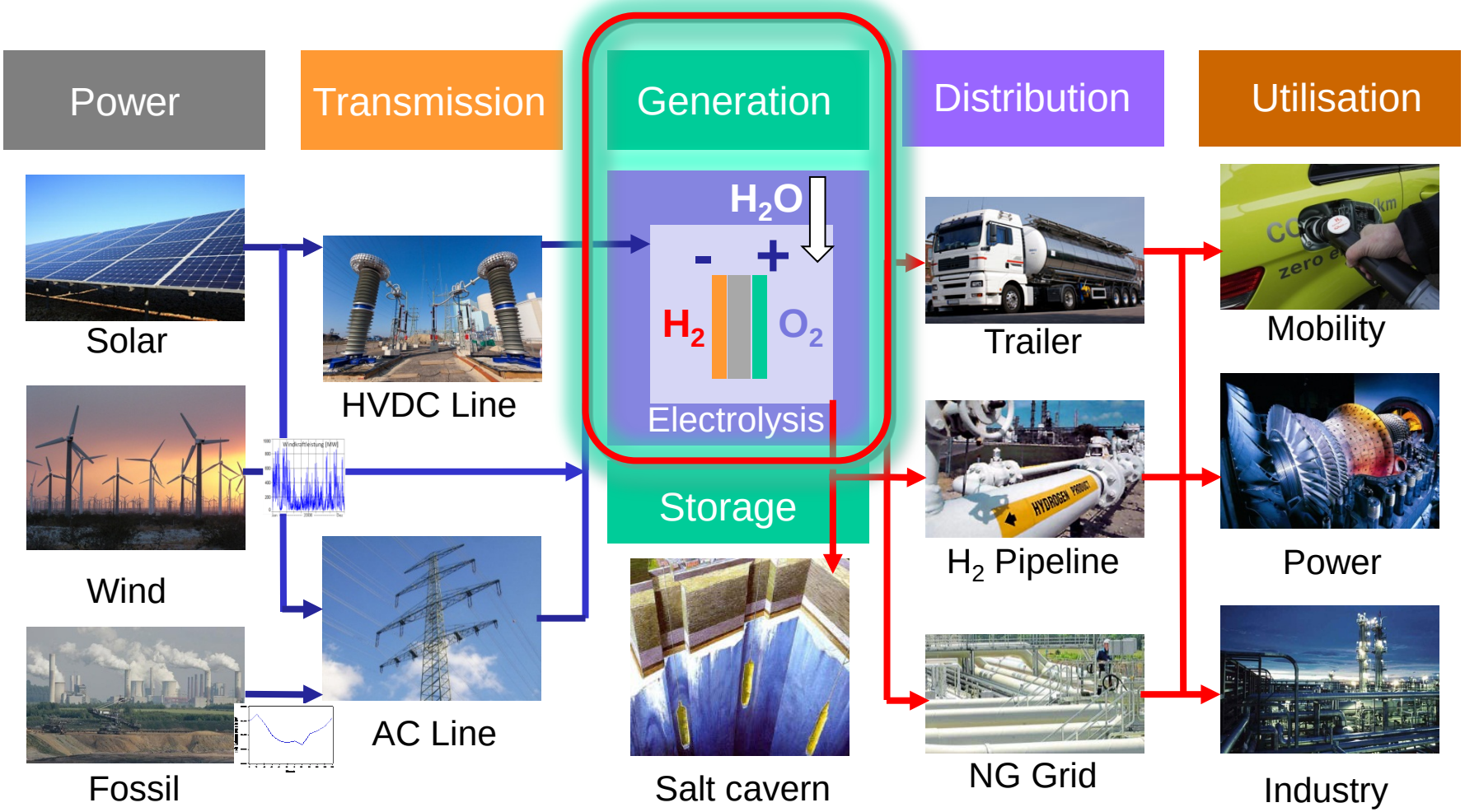
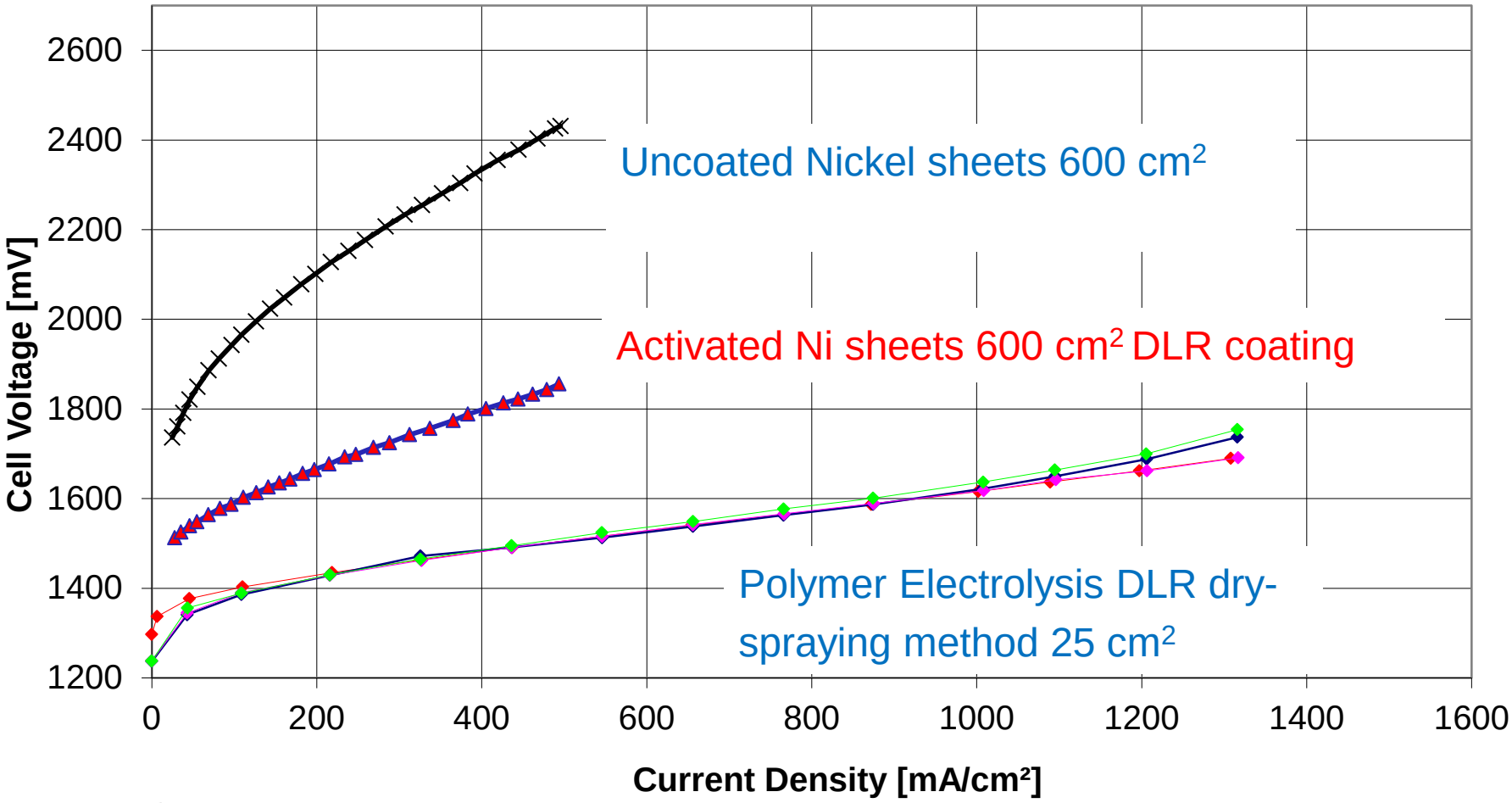


Comparison of Alkaline and Polymer Electrolysis



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Thank you for your attention!

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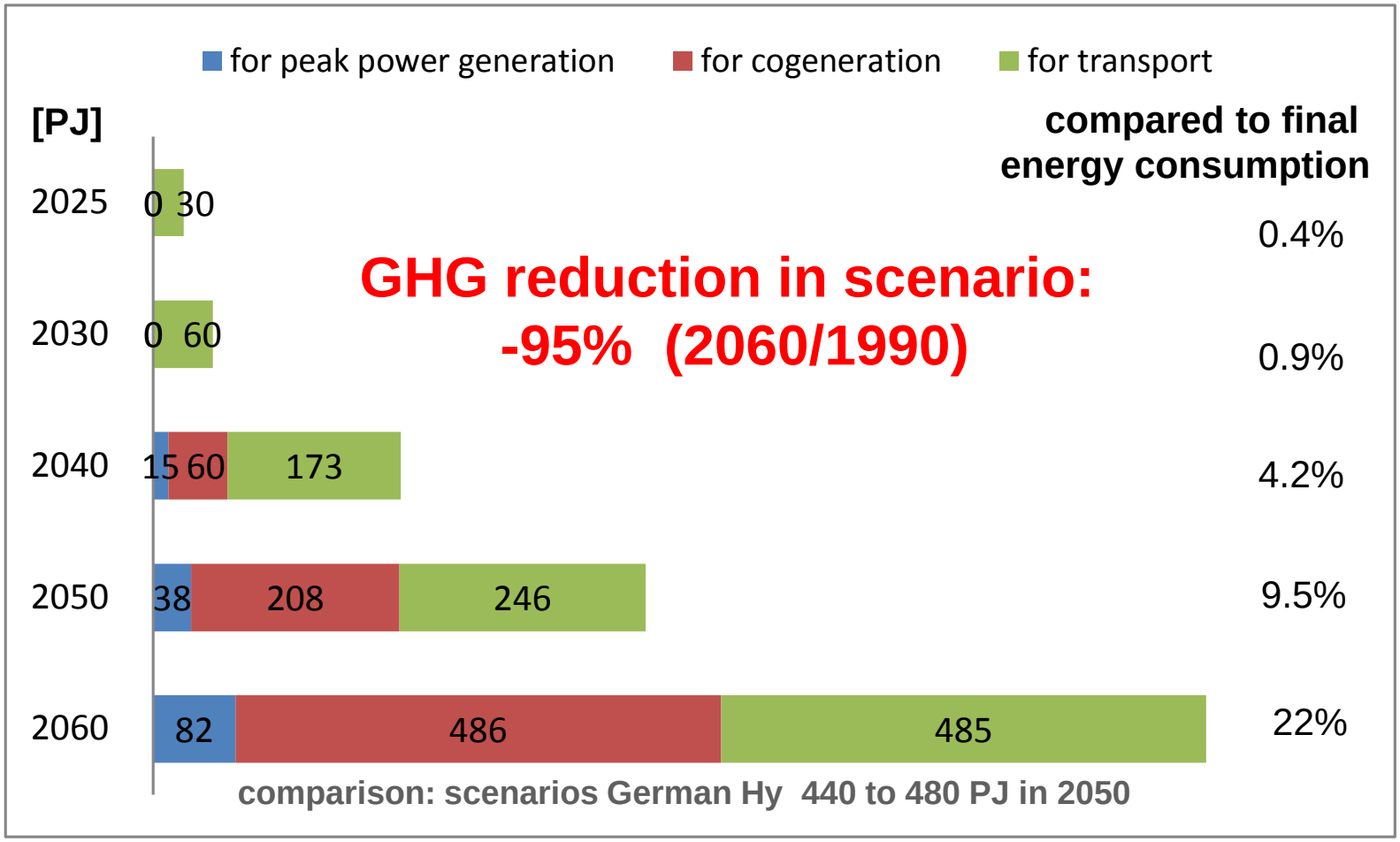
Prospects for hydrogen use in the German energy system

total scenario reaches 100% RE up to 2060



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