Hydrogen and sectoral integration

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The European context

- The energy sector represents >2/3 of GHG emissions → need to tackle these emissions (EU commitment to the Paris Agreement)

- Growing shares of variable renewable energy in the electricity grid → threaten the stability of the grid

- Air pollution → responsible for 467,000 premature deaths according to the EEA

Need for a transformation of our energy system

Hydrogen is one of the potential key contributors to this transformation
2030 framework for climate and energy policies

Targets agreed by the EP and the Council:

- 32% Renewable Energy (binding)
- 32.5% Energy Efficiency
Renewables in the EU – progress per sector towards 2020

**Share of final energy (2016, rounded figures)**

- **46% of final energy**
- **c. 21%** (indicative)
- **33% of final energy**
- **21% of final energy**

**RES target 2020**

- **19.1%** (Heating and cooling)
- **7.1%** (Transport)
- **29.6%** (Electricity)

**RES in 2016 = 17%**
Integrating various economic sectors

Source: Fuel Cells and Hydrogen Joint Undertaking
RED revision

32 % EU binding target for 2030
Empower consumers, including energy communities, and self-consumption
- Right to self-consume and store energy
- Non-discriminatory grid fees and charges

More targeted non-distortive market support
- Coherence in support schemes across EU

Revised renewable targets in transport
- Focus on advanced biofuels & fuels from non-biological origin

Thermal storage: DSO's and DH operators to assess annually the potential of thermal storage (district heating/cooling)
- To assess if more resource- and cost-efficient than alternative solutions
# A flexible and adaptive energy system

## Smart Energy System

- Generation
- Demand
- Electricity, gas and heat networks
- Storage

## Flexibility

- Power generation
- Grid
- Storage

## ICT

- Demand management
- Transport; BEV, etc.
- Prosumers
- Markets

## Adaptability

- Fuel switching
- Avoid lock-in
- Adaptation of the gas grid
The Hydrogen Initiative

- Launched by the Austrian Presidency
- Signed by 26 MS + CH, IS and the EC
- Signed by 100 private stakeholders
- Puts emphasis on:
  - the usage of hydrogen for seasonal storage of electricity
  - the potential of renewable hydrogen for climate transition
  - the versatile use of hydrogen (decarbonisation of industry and greening the gas network)
First study on Sectoral Integration at EU level – ASSET - preliminary evaluations (1) -

Hydrogen roadmap to 2050: Technological and market developments

• Linking the power and mobility sector & Usage of H2 in transportation
• Linking the power sector and H2-demanding industry
• Linking the power sector with transport and heating sectors
• Energy storage, integration of RES and sectorial integration
• Analysis by country

Modelling the impact of sectoral integration

• We analyse the following three scenarios:
  • H2 as a carrier
  • H2 as feedstock
  • H2 for power storage
  • and a
  • Balanced realistic scenario
  • The new assumptions add to a basic decarbonisation scenario (EUCO)

PRIMES modeling

• Full projections for each EU MS up to 2050
• Impacts on the EU energy system including costs and infrastructure investment
• Modeling market equilibrium with complete integration of demand and supply
• Explicit policy and technological drivers
A combined – realistic scenario achieving zero emissions

**Hydrogen uses**

- Mix up to 15% in gas distribution
- Use fuel cells using H2 in vehicles that cannot run in batteries, such as trucks, buses, taxis, duty vehicles. Combine with large-scale H2 refueling stations, which may include electrolysis and H2 storage
- Use H2 directly in high temperature furnaces in industry combined with local electrolysis and storage
- Produce clean methane in methanation plants using CO2 captured from air, integrated in power utility facilities well interconnected. H2 produced in these locations also serve electricity storage
- ¾ of total directly used in final consumption and ¼ of total as a feedstock to produce clean methane (CH4)

**Rest of Options**

- Fully decarbonize power generation using maximum contribution by RES, dispersed and centralized, complemented by nuclear and CCS where possible. Direct storage and chemical storage, as well as interconnections, succeed to balance the RES.
- Develop advanced sustainable biomass feedstock to produce fungible jet fuels and ship fuel, as well as bio-methane mixed in the gas grid
- Exploit to maximum possible potential energy efficiency in buildings and industry
- Electrify car mobility and heating
First study on Sectoral Integration at EU level – ASSET - preliminary evaluations (2) -

Emissions and costs in the Balanced Scenario

PRIMES projections

- 96% CO2 emissions reduction in 2050 (relative to 1990)
  » 12 percentage points more than in the basic decarbonisation scenario (~84% CO2 in 2050)

- The balanced scenario abates CO2 at an average cost of €88/t CO2 (cumulatively in the period 2030-2050)
  » Which is less than half of the cost in the basic decarbonisation scenario (€182/tCO2 abated)

- The performance owes to the multiple roles of hydrogen in sectoral integration, and its particular role in the transport sector
Research and Innovation

**Fuel Cells and Hydrogen Joint Undertaking:**

- Finances R&D on FC and hydrogen with an EU financial contribution of EUR 646 million from Horizon 2020 for 2014-2020
- 227 projects (FP7 & H2020), for a total FCH JU contribution of EUR 843 million
Studies by the EC

1. Study on the role of trans-European gas infrastructure 2050

**Objective:** assess the role of TEN-E gas infrastructure in the light of the EU’s long-term decarbonisation commitments, based on three storylines:

- strong **electrification**
- a coordinated role of the gas and electricity infrastructures with a focus on **carbon-neutral methane**
- a coordinated role of the gas and electricity infrastructures with a focus on **hydrogen**

2. Study on sector coupling

**Objective:** identify barriers which might limit the potential for sector coupling to contribute to cost-effective decarbonisation in the EU

- discuss the possible **role of gas** to contribute to decarbonisation (system flexibility, seasonal storage, cost-efficient transportation of energy, etc.).
- help policy makers establish a suitable **regulatory framework**
Hydrogen in the energy market
Regulatory and policy topics - electricity and gas

• Key role for **innovation**: H2020, FCH JU, Informatics and data exchange
• Reinforce the **policy framework**, (Clean Energy package - incl. RES, distributed generation (RE), storage, smart technologies, capacity markets etc.)
• Important role for **balancing and** for **demand side flexibility**.
• Energy prices and network **tariff structures** which could integrate the increasing variability of power generation and secure investments.
• **Certification** (=market) for low-carbon gas (P2G), linking to the electricity market.
• Mechanisms for **linking energy storage to other economic sectors** (transport, industry).
• **Standardisation** - infrastructure, equipment and gas quality (incl. Hydrogen and bio-methane)
Thank You for Your Attention!

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http://ec.europa.eu/energy/index_en.htm