



Hydrogen and sectoral integration

Dr Tudor Constantinescu

Principal Adviser , European Commission – DG Energy

**27th meeting of the EU-Russia Gas Advisory Council's
Work stream on internal market issues
*Brussels, 7 December 2018***

The European context

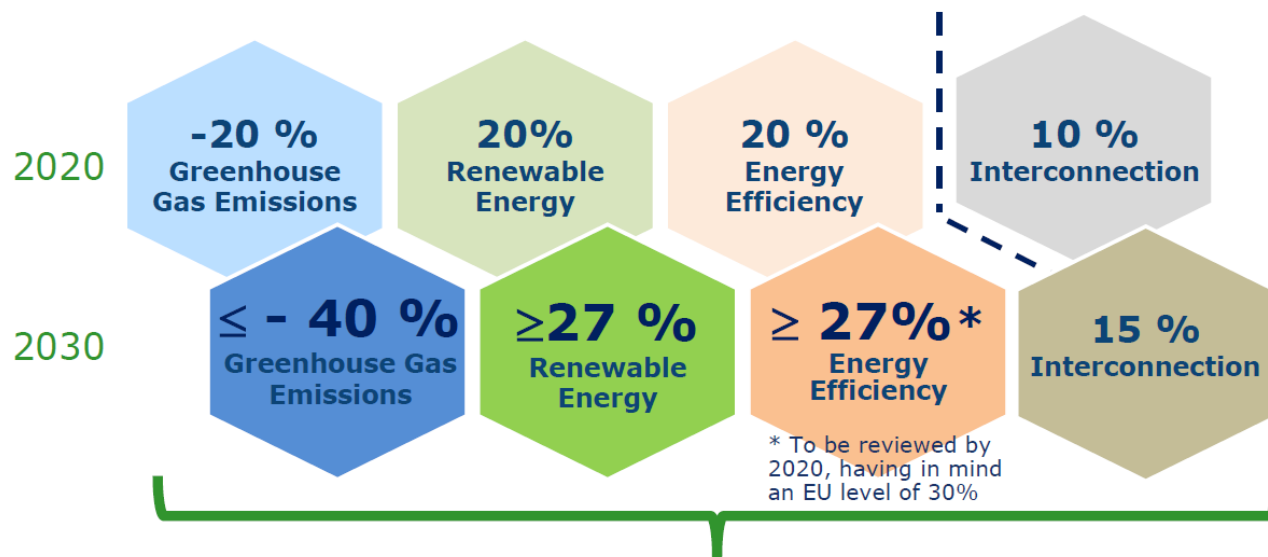
- The energy sector represents $>2/3$ of GHG emissions → need to tackle these emissions (EU commitment to the Paris Agreement)
- Growing shares of variable renewable energy in the electricity grid → threaten the stability of the grid
- Air pollution → responsible for 467.000 premature deaths according 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



New governance system + indicators

Targets agreed by the EP and the Council:

- **32 % Renewable Energy (binding)**
- **32.5 % Energy Efficiency**

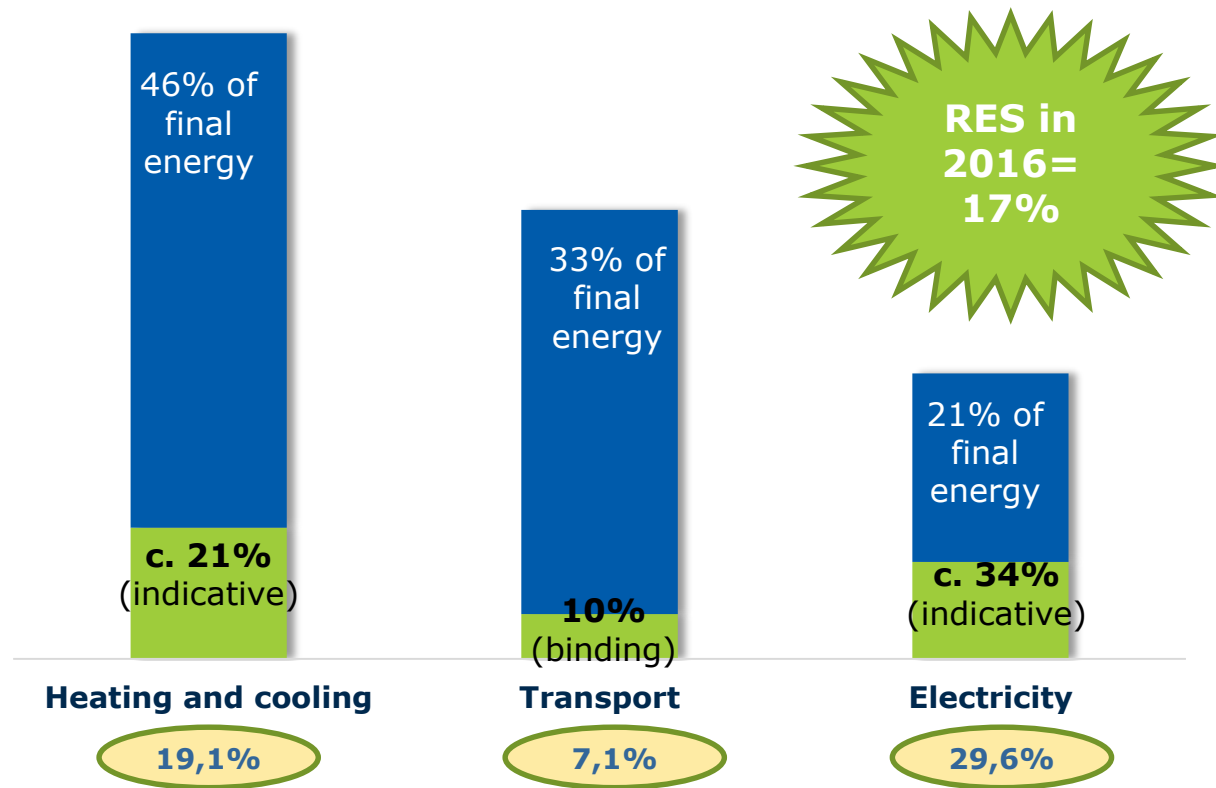
Renewables in the EU – progress per sector towards 2020

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

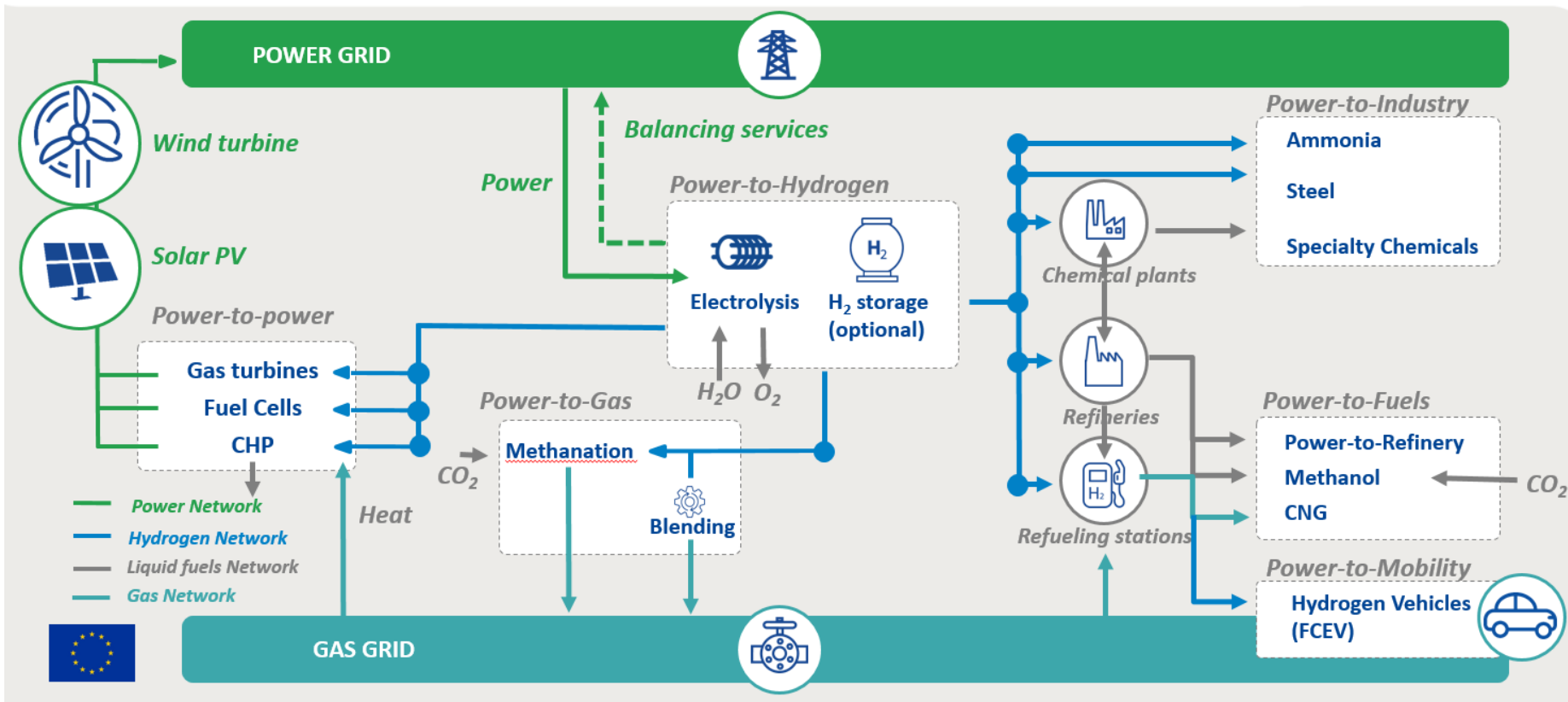
RES target 2020

Energy service

**Share 2016
(Eurostat)**



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**

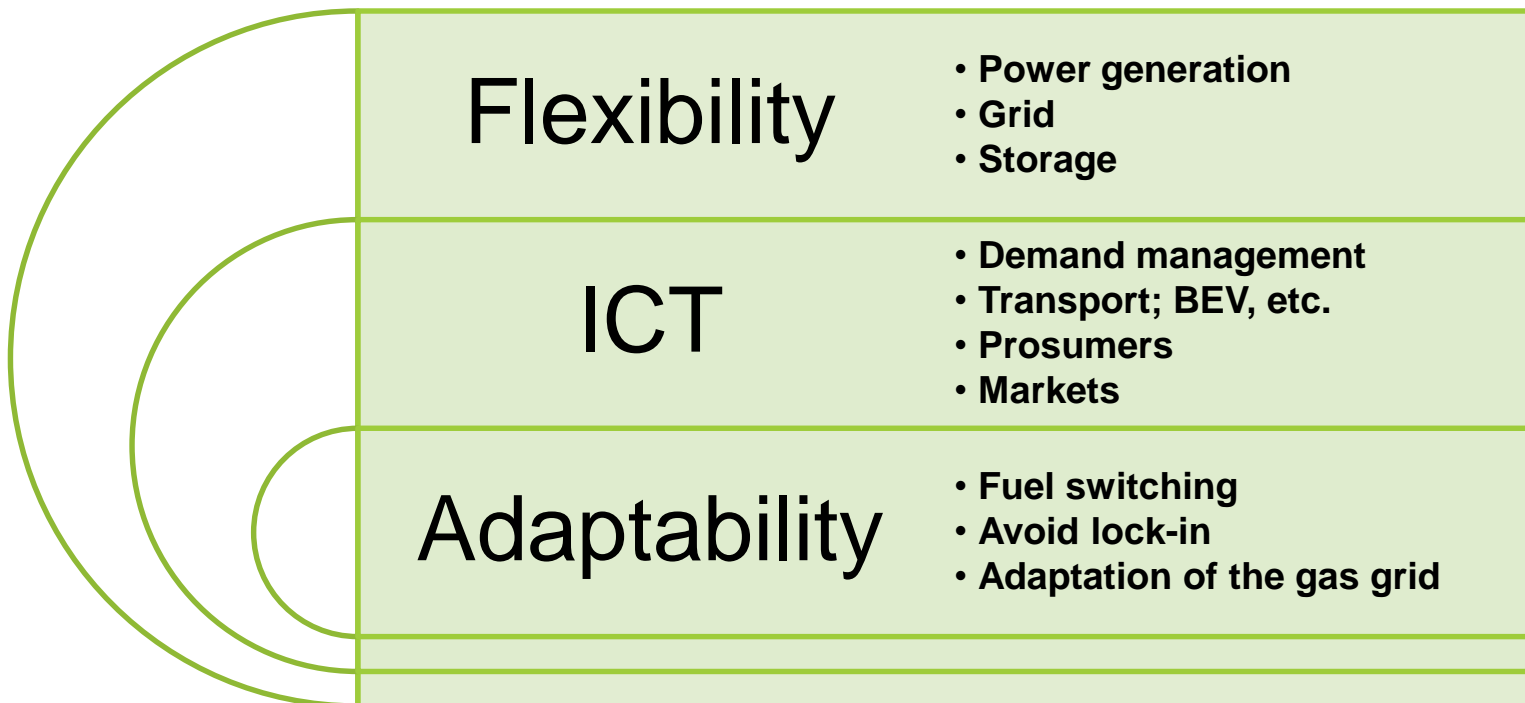
***Thermal storage:** DSO's and DH operators to assess annually the potential of thermal storage (district heating/cooling)*

- **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



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 (EUCCO)

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
- $\frac{3}{4}$ of total directly used in final consumption and $\frac{1}{4}$ of total as a feedstock to produce clean methane (CH₄)

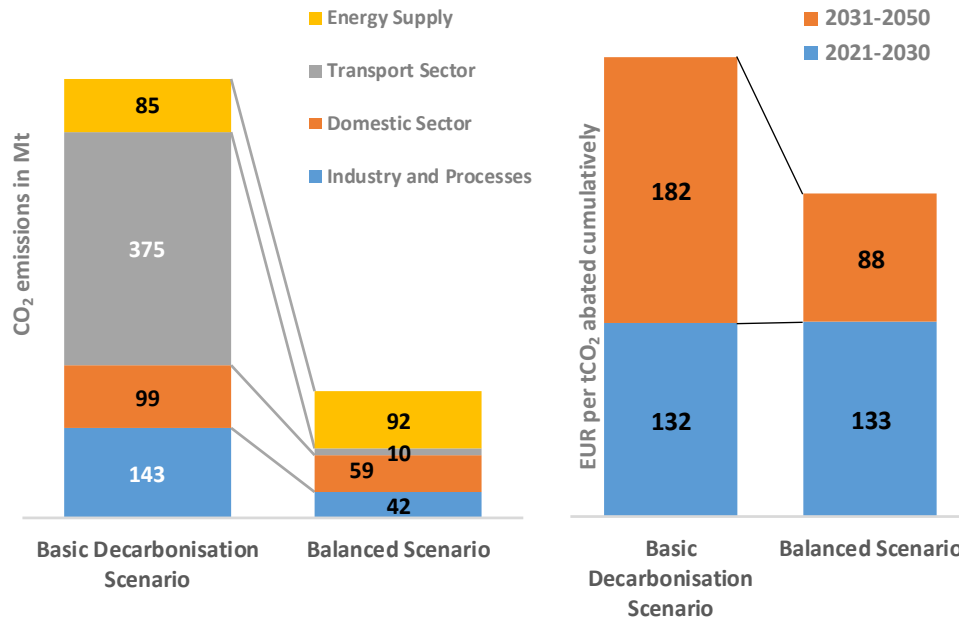
Rest of Options

- 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 ₁₁ sector

Remaining CO₂ Emissions in 2050

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!

tudor.constantinescu@ec.europa.eu

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

