



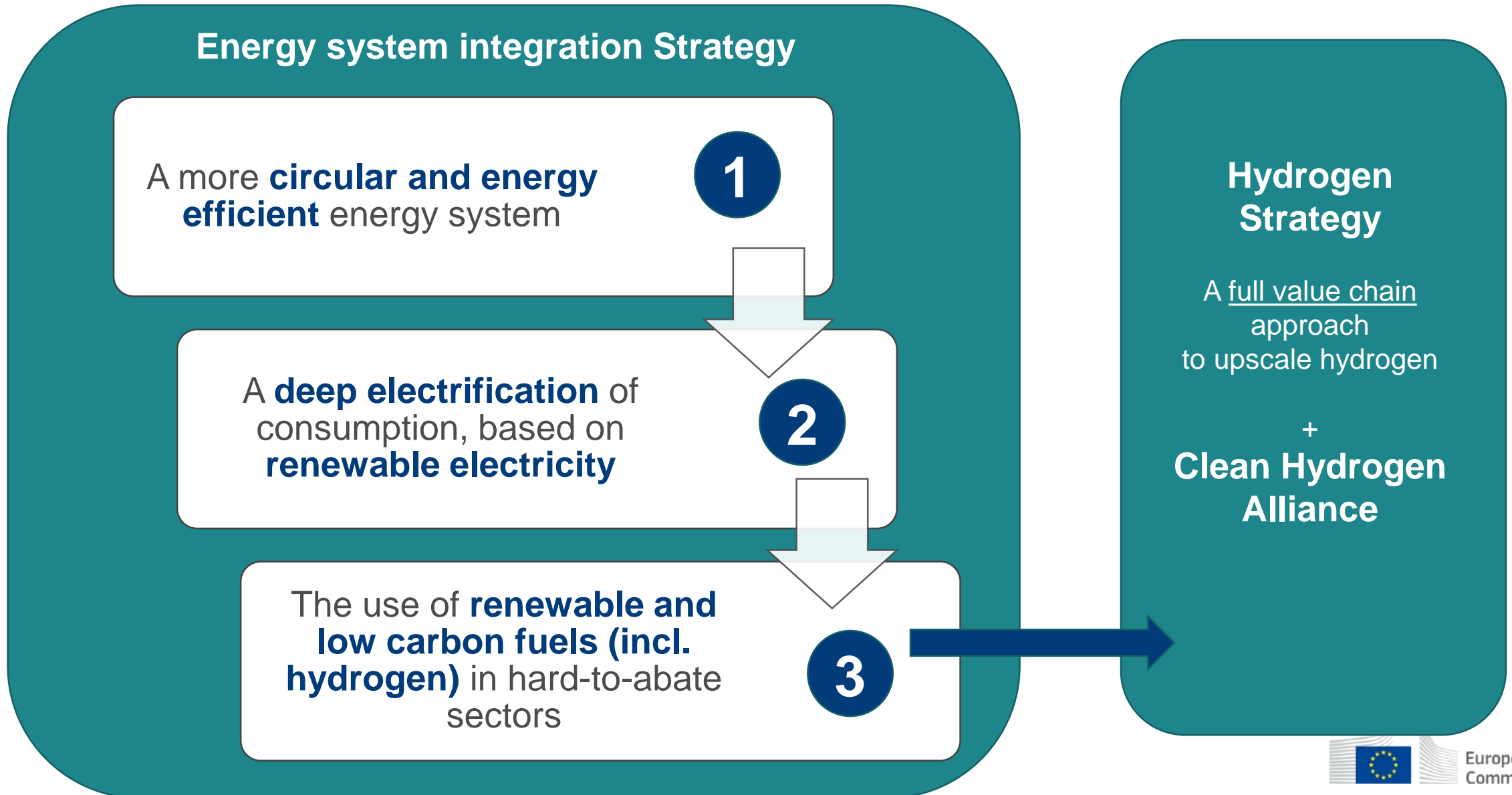
The Energy System Integration and Hydrogen Strategies: Future implementation actions

Fourth inter-service coordination meeting on hydrogen

DG Energy, European Commission

6 November 2020

Laying the foundation for a climate-neutral energy system



The Hydrogen Strategy

**A hydrogen
roadmap**

**Definitions for
hydrogen**

**Three phases:
2020-2024
2024 – 2030
2030 – 2050**

+

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An investment agenda

2

Boosting demand and scaling up

3

Markets and infrastructure

4

Research and Innovation

5

The international dimension

Making it happen – an action plan for the Hydrogen Strategy

Full value chain approach,	Actions oriented towards	Main tools involved (*)
An investment agenda	<ul style="list-style-type: none"> • Create project pipeline • €220-340 bln renewable power, €24-42 bln electrolysers, €65 bln infrastructure 	Clean Hydrogen Alliance, InvestEU, IPCEI, State aid, Cohesion policy
Boosting demand and scale up production	<ul style="list-style-type: none"> • Comprehensive terminology and EU-wide certification of hydrogen • Support schemes and CCfD for renewable and low-carbon hydrogen • Demand-side policies in end-use sectors 	RED, EU ETS, Transport policy, Industrial strategies
Develop hydrogen infrastructure and markets	<ul style="list-style-type: none"> • Planning of hydrogen transport and storage infrastructure • Rules ensuring competitive markets, enabling infrastructure development (incl. repurposing) whilst retaining integrity of internal gas market 	TYNDPs, TEN-E, TEN-T, AFID, CEF, decarbonisation of gas package
Research and Innovation	<ul style="list-style-type: none"> • Scale up electrolysers • Develop hydrogen value chain • Innovative hydrogen technologies 	Clean Hydrogen Partnership, ETS Innovation Fund, Horizon Europe,
The international dimension	<ul style="list-style-type: none"> • International standards, regulation and definitions for hydrogen • Promote cooperation 	IEA, IRENA, CEM, G20, Neighbourhood policy, EU-Africa Green Energy Initiative, bilateral energy dialogues, € benchmark

(*) Non-exhaustive list

Progress so far

Full value chain approach,	Main tools involved (*)	Progress so far
An investment agenda	Clean Hydrogen Alliance, InvestEU, IPCEI, State aid, Cohesion policy	<ul style="list-style-type: none"> - <i>Clean Hydrogen Alliance</i> - <i>State aid reforms and IPCEI</i> - RFF Flagship 'Power UP' - Consultation on revision ETD (closed Oct. 20) - Ongoing EU taxonomy for sustainable finance
Boosting demand and scale up production	RED, EU ETS, Transport policy, Industrial strategies	<ul style="list-style-type: none"> - <i>Smart and sustainable mobility strategy</i> - Hydrogen within raw materials strategy - Launch of offshore energy strategy - Consultation on revision REDII (until Feb. 21) - Consultation on EU ETS – aviation (until Jan. 21)
Develop hydrogen infrastructure and markets	TYNDPs, TEN-E, TEN-T, AFID, CEF, decarbonisation of gas package	<ul style="list-style-type: none"> - Ongoing TEN-E revision - CEF-renewables eligible for RRF - Preparation of decarbonisation of gas package
Research and Innovation	Clean Hydrogen Partnership, ETS Innovation Fund, Horizon Europe,	<ul style="list-style-type: none"> - <i>Clean Hydrogen Partnership</i> - <i>H2020 electrolyser call open (until Jan. 21)</i> - First call ETS Innovation Fund closed
The international dimension	IEA, IRENA, CEM, G20, Neighbourhood policy, EU-Africa Green Energy Initiative, bilateral energy dialogues, € benchmark	<ul style="list-style-type: none"> - Technical meetings with India/US - Engagements with Australia/Chile/Morocco/UAE - EC is chairing green hydrogen platform under IRENA

Back-up

Hydrogen – an investment agenda

Next Generation EU, Invest EU, Cohesion Policy, CEF-E, CEF-T
ETS Innovation Fund, Horizon Europe

Renewable electricity
production

€220-340 BLN

Renewable
hydrogen

€24-43
BLN

Hydrogen
transport,
distribution,
and storage

€65 BLN

Transport
(HDV)
€13 BLN

Steel
€8 BLN

European Clean Hydrogen Alliance

Hydrogen – Research and innovation

Maintain and strengthen EU's global leadership role through support:

- Establish Clean Hydrogen Partnership
- Targeted research and innovation in Horizon Europe
- ETS Innovation Fund
- Interregional Innovation Investment Instrument with pilot action on hydrogen technologies

Scale-up production

- Larger size, more efficient and cost-effective electrolysers
- Mass manufacturing capability and new materials
- Break-through solutions like direct solar hydrogen

Infrastructure

- Distribute, store and dispense hydrogen at large volumes
- Repurposing of existing gas infrastructure
- Adaptation of LNG terminals

End-use applications

- New industrial processes
- Multi MW-fuel cells
- Hydrogen-derived synthetic fuels for the maritime and aviation sector

Cross-cutting areas

- Improved harmonized safety standards
- Reduced environmental impacts and sustainability
- Critical raw materials, re-use and recycling

Hydrogen – the international dimension

Strengthening Europe's global leadership role and putting renewable hydrogen high on its strategic agenda:

Bilateral and regional cooperation

- Clean hydrogen support under Neighbourhood Investment Platform
- Joint hydrogen research and development programmes through Association Agreements
- Hydrogen collaboration under the Africa-Europe Green Initiative

Multilateral fora

- CEM and MI: Exchange of latest technological developments
- IEA and IRENA: Role of hydrogen and hydrogen policies
- Mainstream hydrogen in energy, diplomacy, climate, research, trade and international cooperation

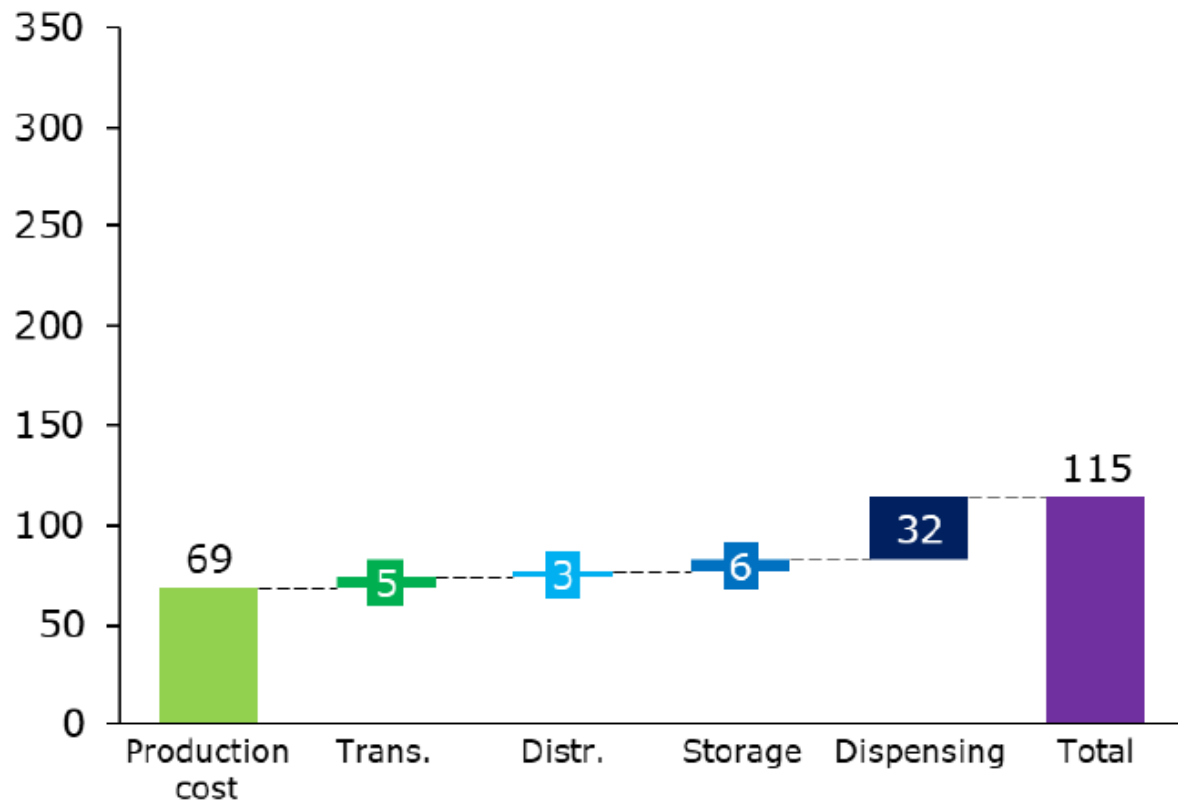
International markets

- Set common GHG emission reduction standards and sustainability criteria
- Benchmark for euro denominated transactions in hydrogen
- Facilitate emergence of rules-based hydrogen market

Importance of hydrogen value chain

Low Cost Example

levelized cost (EUR2019/MWh H₂ LHV)



High Cost Example

levelized cost (EUR2019/MWh H₂ LHV)

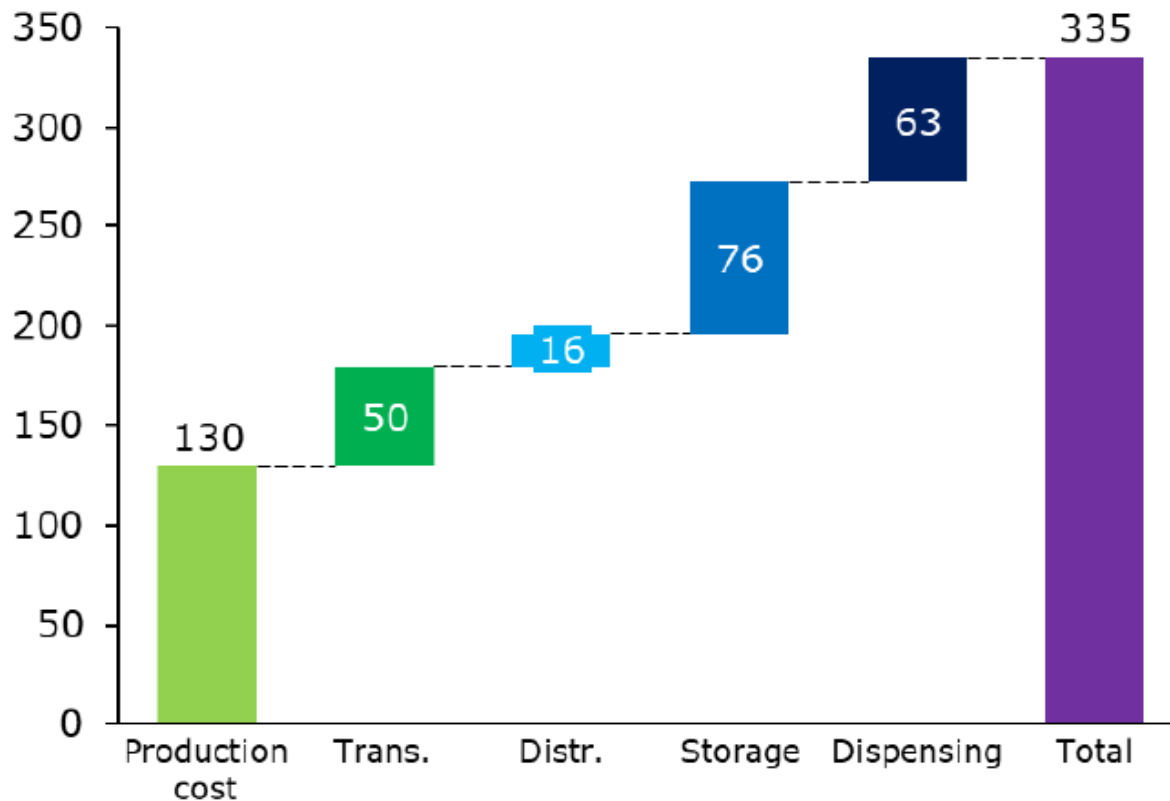
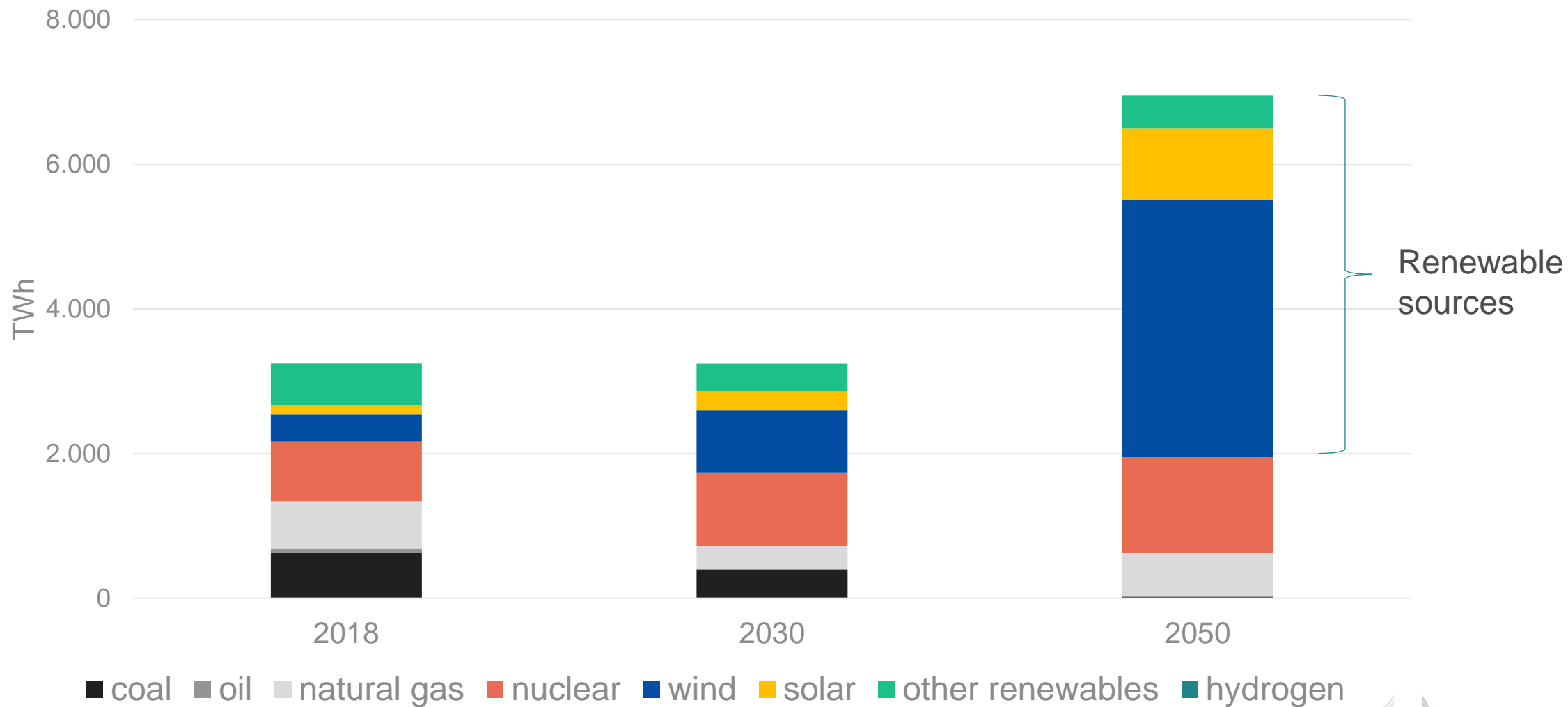


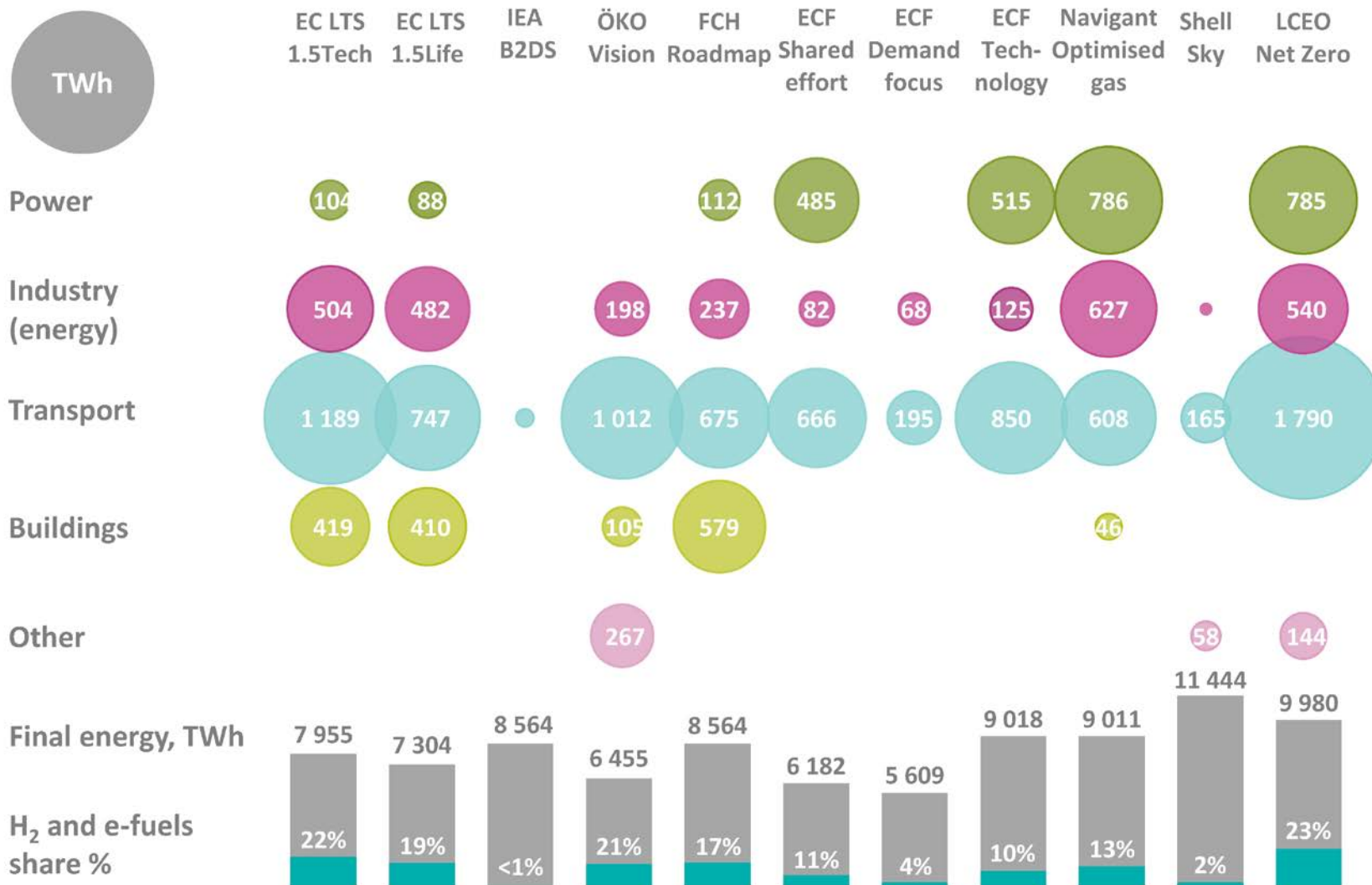
Figure 1-2: Breakdown of costs for delivered hydrogen in 2020 - example cases¹⁰

Power system is most rapid to decarbonise



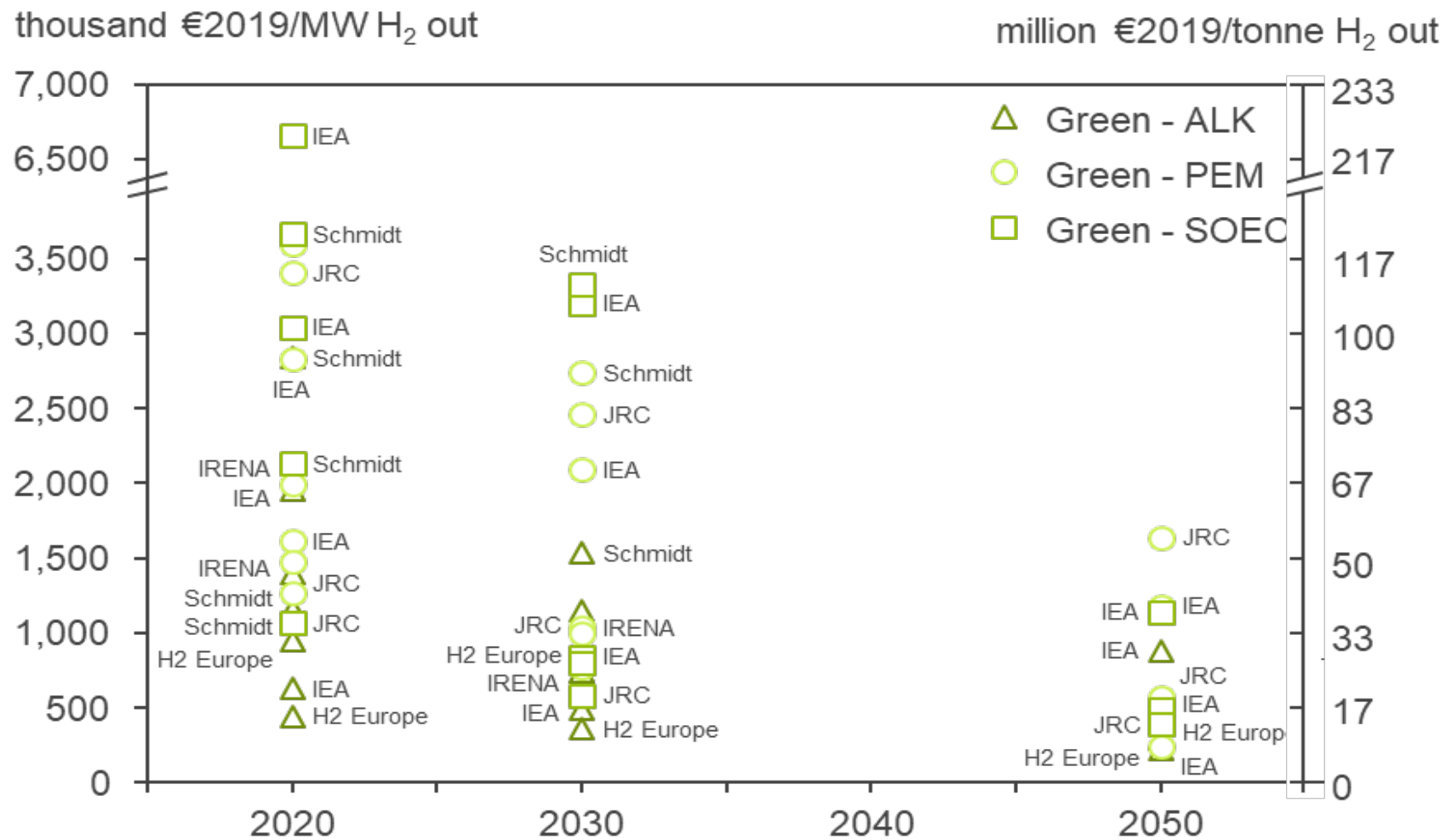
Source: Based on EU28 Eurostat/LTS 1.5LIFE/TECH scenarios

Hydrogen – large range of future scenarios



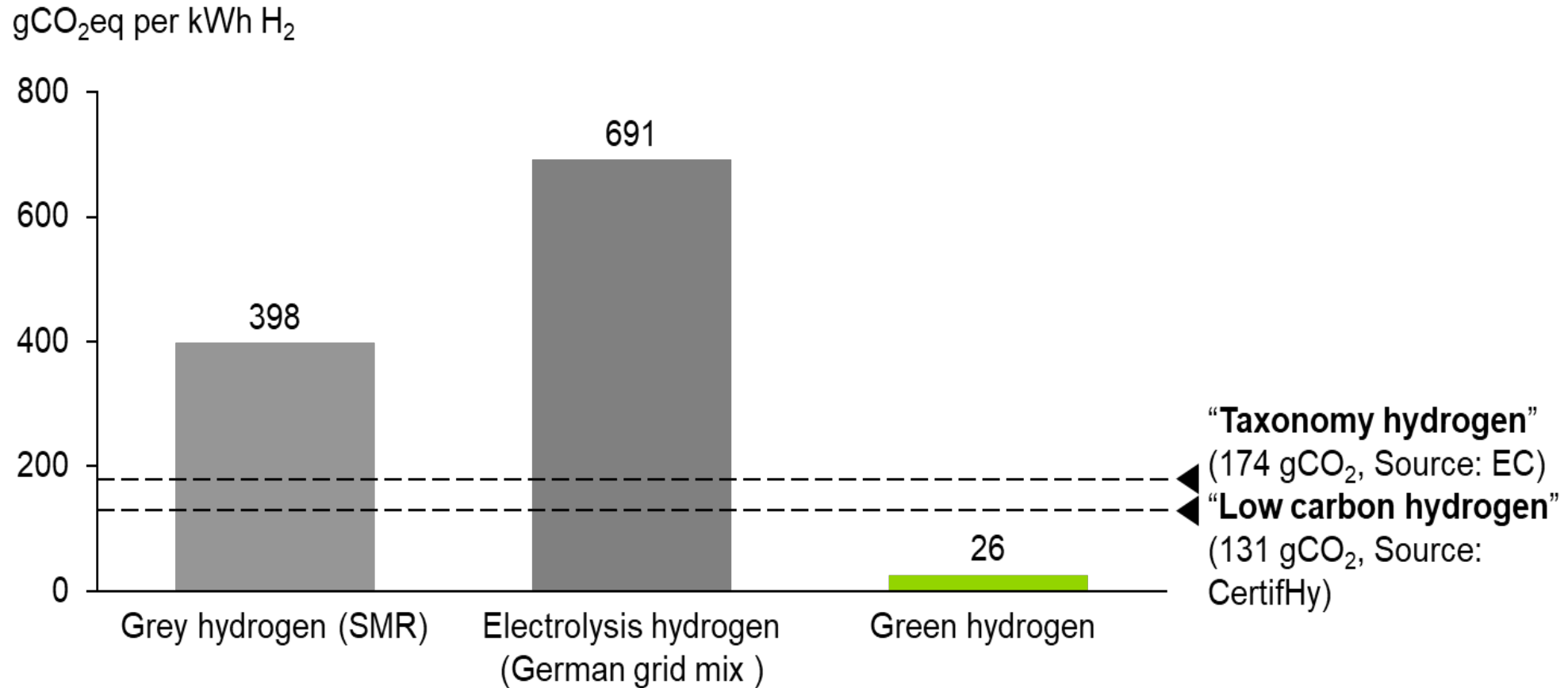
Source: JRC

Hydrogen – cost of electrolysers



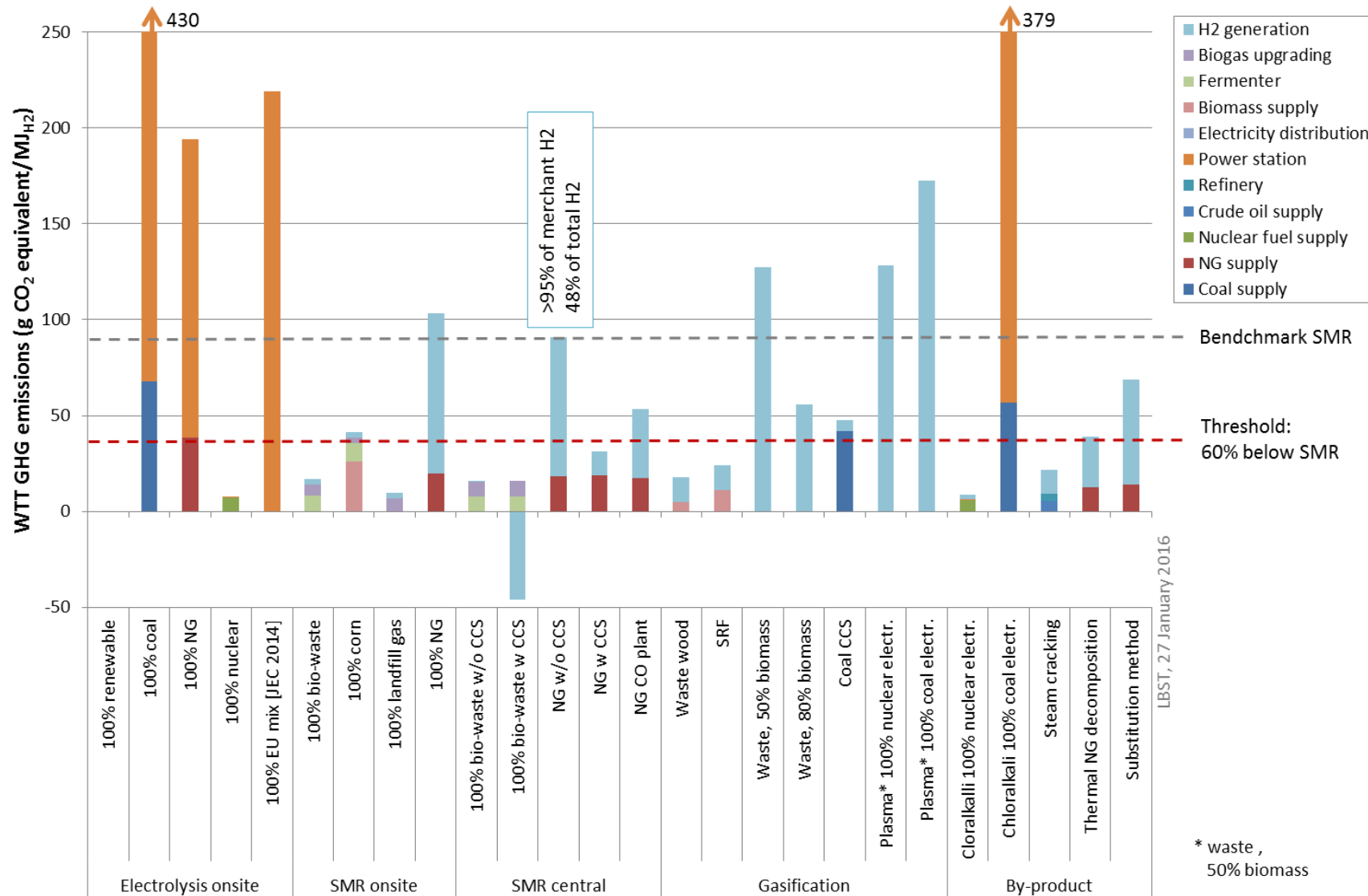
Source: Asset study (2020)

Hydrogen – life cycle emissions



Source: Asset study (2020)

Hydrogen – life cycle emissions of different pathways (well-to-tank)

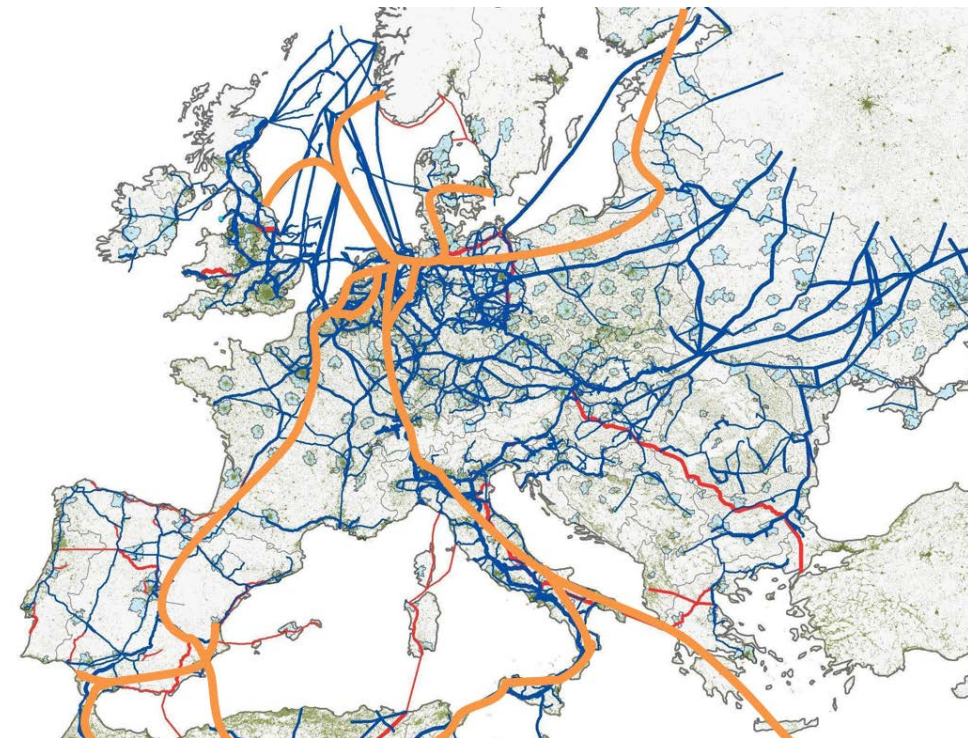


Source: CertifHy (2019)

Hydrogen – infrastructure



Existing hydrogen infrastructure:
Belgium – 613 km
Germany – 376 km
France – 303 km
Netherlands – 237 km



Future hydrogen infrastructure:

Source: Hydrogen Europe, 2x 40 GW initiative