Monitor
Deloitte.

The European hydrogen economy – taking stock and looking ahead

An outlook until 2030

Executive summary

Clean hydrogen investment activity is surging

- Project announcements for clean hydrogen production have ramped up in Europe with planned capacity reaching 54 GW and 5.2 MtH_2/year by 2030

- Electrolyzers will predominate at 85 percent of installed capacity (+4 GW/year), but methane reformers + CCS will produce 25 percent of volumes (1.3 MtH_2) in 2030

- 75 percent of hydrogen supply is centered around the North Sea, with GW-scale "Hydrogen Valleys" creating hydrogen ecosystems that help spawn a multitude of smaller supply and end-use projects

Nevertheless, a supply gap is emerging

- Announced projects are not yet enough to reach all targets; in particular, neither EU production target for 2030 has been met

- However, based on observed trends, we forecast European clean hydrogen supply will reach some 170 GW and 20 MtH_2 by 2030

- This implies a 10 MtH_2* supply gap against potential demand of 30 MtH_2 in 2030, the volume needed to ensure the EU energy sector remains on its path to net zero emissions according to our Hydrogen4EU study. This makes increasing imports from outside Europe and encouraging a faster ramp-up of local production even more vital

- Achieving the forecasted 170 GW and 20 MtH_2 bears its own challenges and opportunities: almost half a trillion euros of investments will be needed to sustain a capital-intensive ramp-up of clean hydrogen production in Europe

- A 10 MtH_2 supply gap could lead to a short-term increase in prices above market-clearing levels, encouraging new entrants or incumbents to increase their supply and thus reducing prices in the long term, provided regulators set the right economic conditions for an acceleration of supply projects.

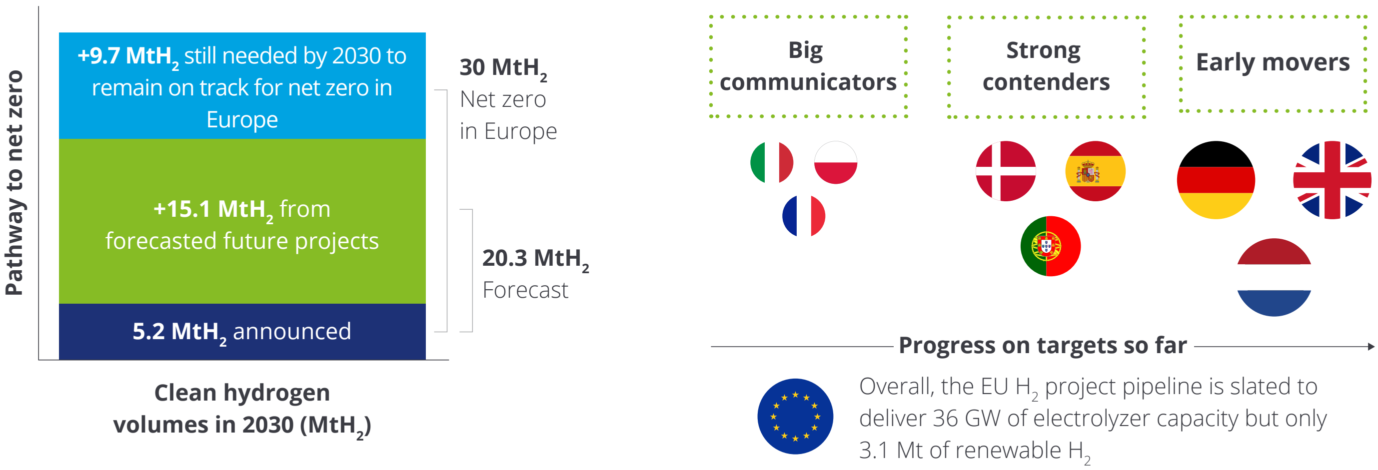
Overall, the EU H_2 project pipeline is slated to deliver 36 GW of electrolyzer capacity but only 3.1 Mt of renewable H_2

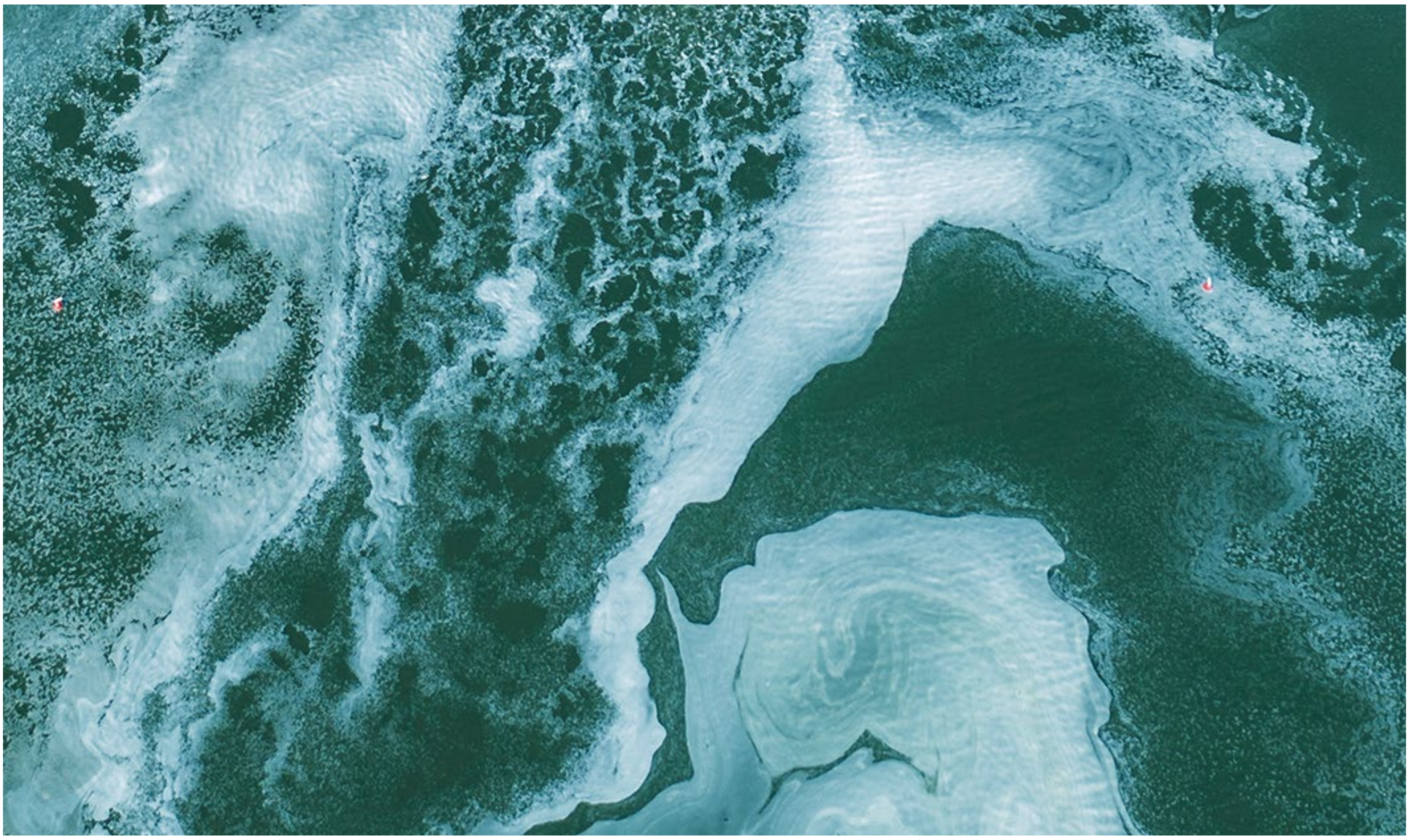
Bridging the supply gap will require reducing costs and establishing a level playing field between technologies

- The production costs of clean hydrogen fall between 3 and 6 €/kgH_2
- Financial support and regulatory action is crucial to provide sufficient hydrogen at an affordable price

* Source: Hydrogen strategy for a climate-neutral Europe, European Commission July 2020, accessed April 29, 2022.

Fig. 1 – Summarized hydrogen volumes for a pathway to net zero





Take-off

Hydrogen has been identified as a key piece in the energy transition puzzle

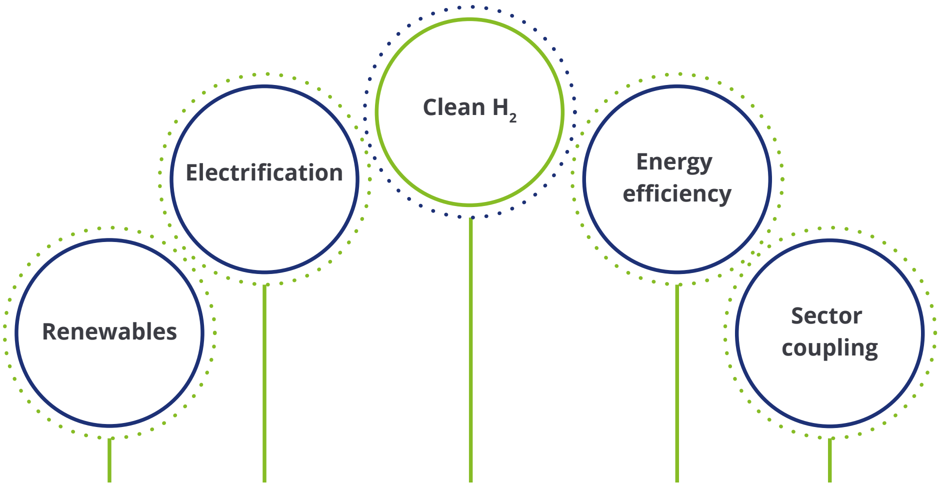
Energy transition in the EU

- The European Green Deal, announced in December 2019 by the European Commission, sets ambitious objectives for the decarbonization of the EU, with a target of net zero emissions by 2050 and an intermediary 55 percent reduction of emissions by 2030, compared to 1990

Decarbonization approaches

- Decarbonization efforts so far have focused on renewables, electrification and energy efficiency measures. But the faltering expansion of renewables, technical and economic constraints on electrification and the sluggish expansion of power grids mean that we are currently not on track for net zero

Fig. 2 – H_2 is a key component of the energy transition



H_2 is a key component of the energy transition

- It is becoming increasingly clear that the European energy sector will have to rely on decarbonized gases as an additional energy source in the future. The focus is primarily on clean hydrogen, produced by means of electrolysis using renewable energy or by combining methane reforming technologies with carbon capture and storage

H_2 targets for the EU and Deloitte's perspective

- The EU and other national strategies have set major targets for hydrogen, including at least 10 MtH_2* of renewable hydrogen production and 40 GW of installed electrolyzer capacity by 2030

- Deloitte's tailor-made hydrogen dashboard visualizes the announced and projected supply and demand of hydrogen in Europe and breaks it down by technology, end-use sector, geography, and energy source

- In this report, we describe the major implications this will have on investors and stakeholders in the whole energy system

Hydrogen definitions

Renewable hydrogen
made using renewable energy
Low-carbon hydrogen
made from low-carbon grid electricity or methane reforming processes equipped with CCS
Clean hydrogen
either low-carbon or renewable hydrogen

*Source: Hydrogen strategy for a climate-neutral Europe, European Commission July 2020, accessed April 29, 2022.


OGEN
RGY

Strategic policy objectives for clean hydrogen in Europe

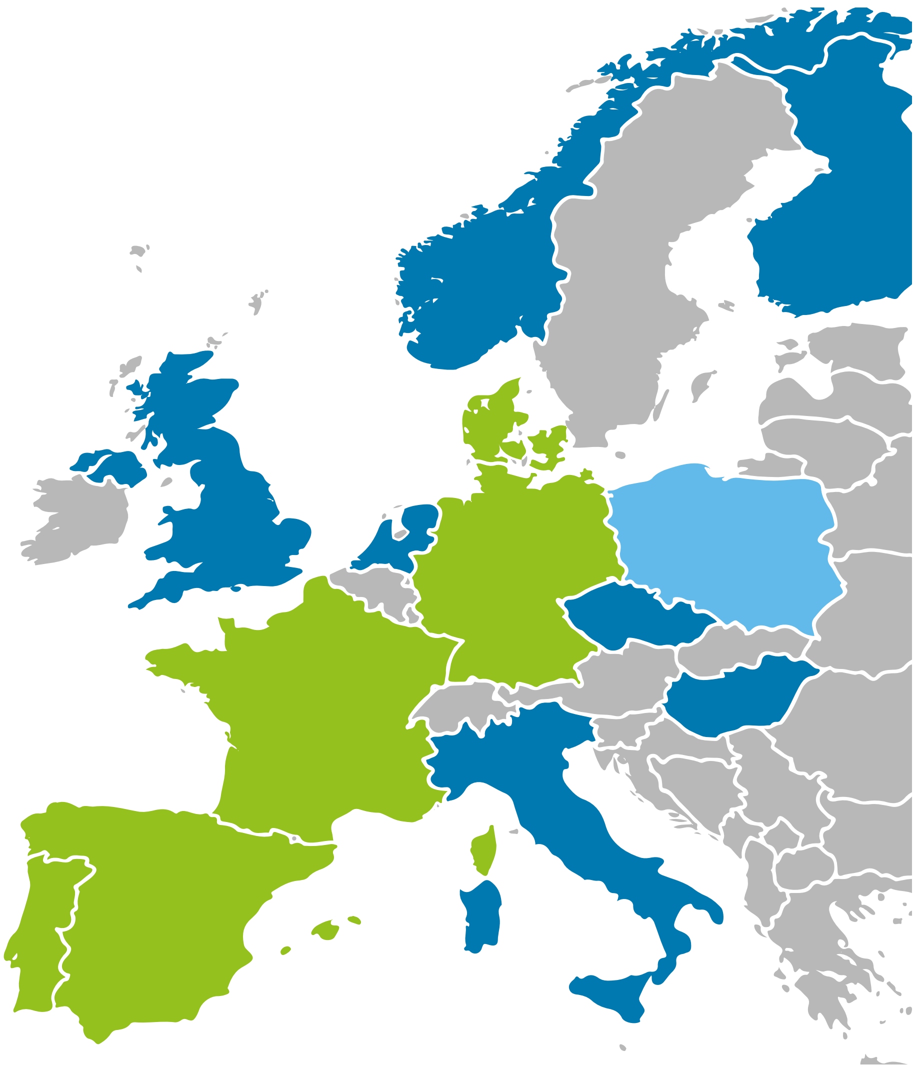
EU and national hydrogen strategies provide a diverse picture of regulatory choices

A policy foundation for growth

Hydrogen strategies provide investors and policymakers with a set of guidelines:

- **Targets to fulfil:** GW of capacity, Mt of hydrogen production, gas grid blending rates
- **Pathways to follow:** renewable only or a twin-track approach, which end-use sectors to prioritize
- **Public funds** to support riskier early investments

Fig. 3 – National hydrogen strategies by pathway



Preferred pathway

- Electrolysis-based hydrogen
- A combination
- Low-carbon hydrogen

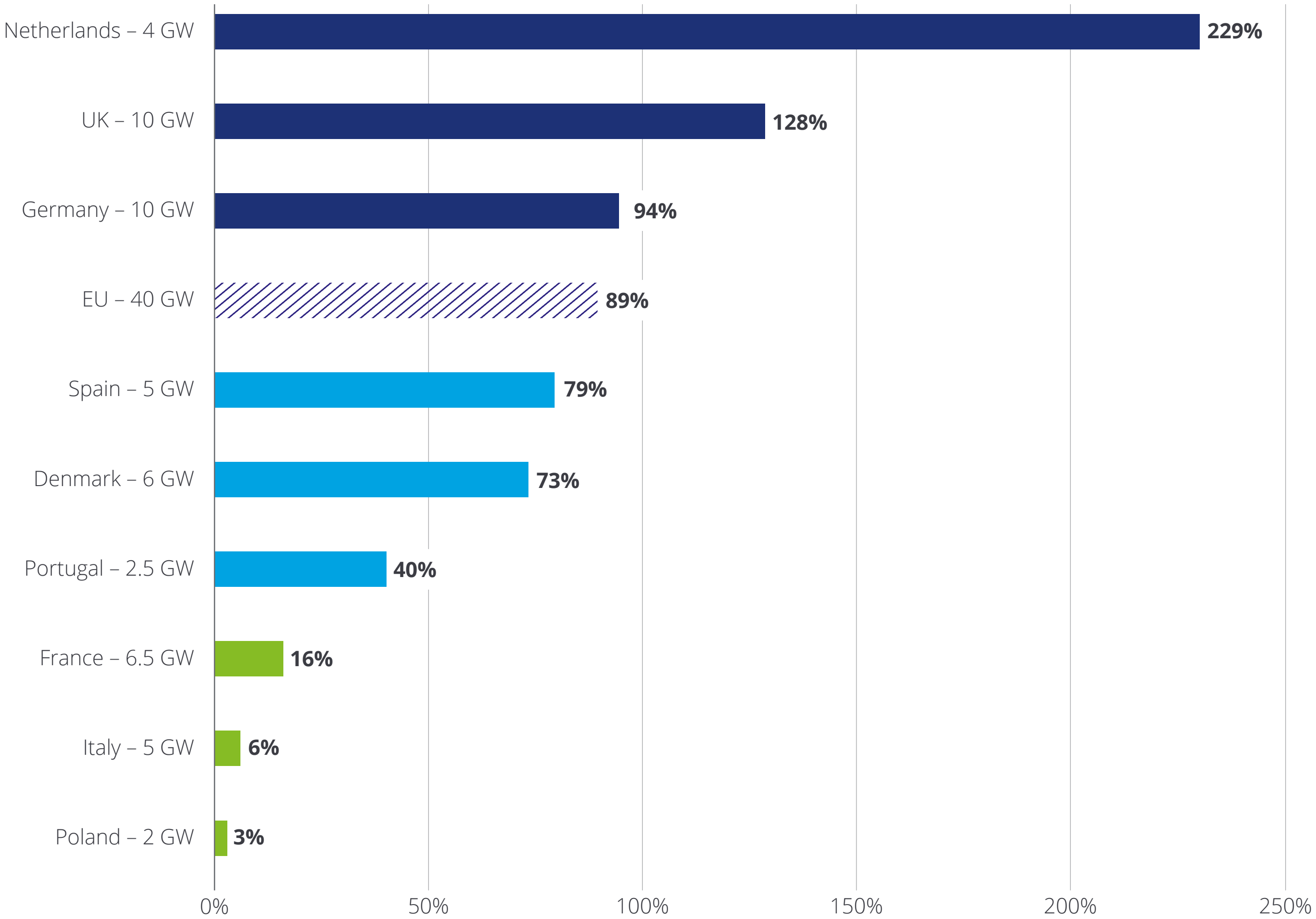
Tab. 1 – Strategic choices in the European clean hydrogen value chain

European Union	**40 GW** **10 MtH_2**	• Push for renewables • Promotes a "Hydrogen Valley" approach to facilitate local integration and growth • By 2024: **6 GW** electrolyzers, **1 MtH_2** • By 2030: **40 GW** electrolyzers, **10 MtH_2** • 2030-2050: large-scale deployment across all hard-to-abate sectors
Germany	**10 GW** **3 MtH_2**	• Push for renewables • Emphasis on imports of hydrogen (low-carbon hydrogen not excluded) • €8bn of public budget has already been allocated to 62 pre-selected projects • Up to €3.4bn to build refuelling stations
France	**6.5 GW** **€ 7–9 bn**	• Push for electrolyzers • Early allocation of the budget in 2020s • Policy focus on "gigafactories" & tech leadership in hydrogen manufacturing • Heavy-duty mobility among key priorities
Spain	**4 GW** **€ 9 bn**	• Push for renewables • 2030 target of fuelling 200 buses, 7.5k road freight vehicles, 2 commercial train lines • Regulatory measures including a guarantee of origin system
Netherlands	**4 GW** **10–20% blending**	• Technology-neutral push • Gas grid blending mandates • Hydrogen public funding diluted with other abatement solutions in € 30 bn SDE++ scheme • CCU/S infrastructure to be developed in parallel to hydrogen networks across the country
United Kingdom	**10 GW** **10 MtH_2**	• Twin-track approach: renewable and low-carbon hydrogen • Plans to build a hydrogen economy worth £900m by 2030 and £13bn by 2050 • Detailed roadmap to mid-2030s in 5-year steps

A progress snapshot on countries' 2030 hydrogen targets

The UK, the Netherlands and Germany are early-movers, on track to significantly overachieving their capacity targets for 2030

Fig. 4 – 2030 capacity targets completion rates*



* Based on a snapshot of installed capacity of announced projects as of 2030, filtered by technology according to national targets (electrolysis only/both...)

Early movers, twin tracks

- Hydrogen pioneers in Europe
- European industrial heartland: Rotterdam, Yorkshire, Ruhr...
- North Sea advantage: abundant gas, wind, and CO_2 storage resources
- Offshore wind enables large H_2 capacities and high load factors, but permitting procedures are slow

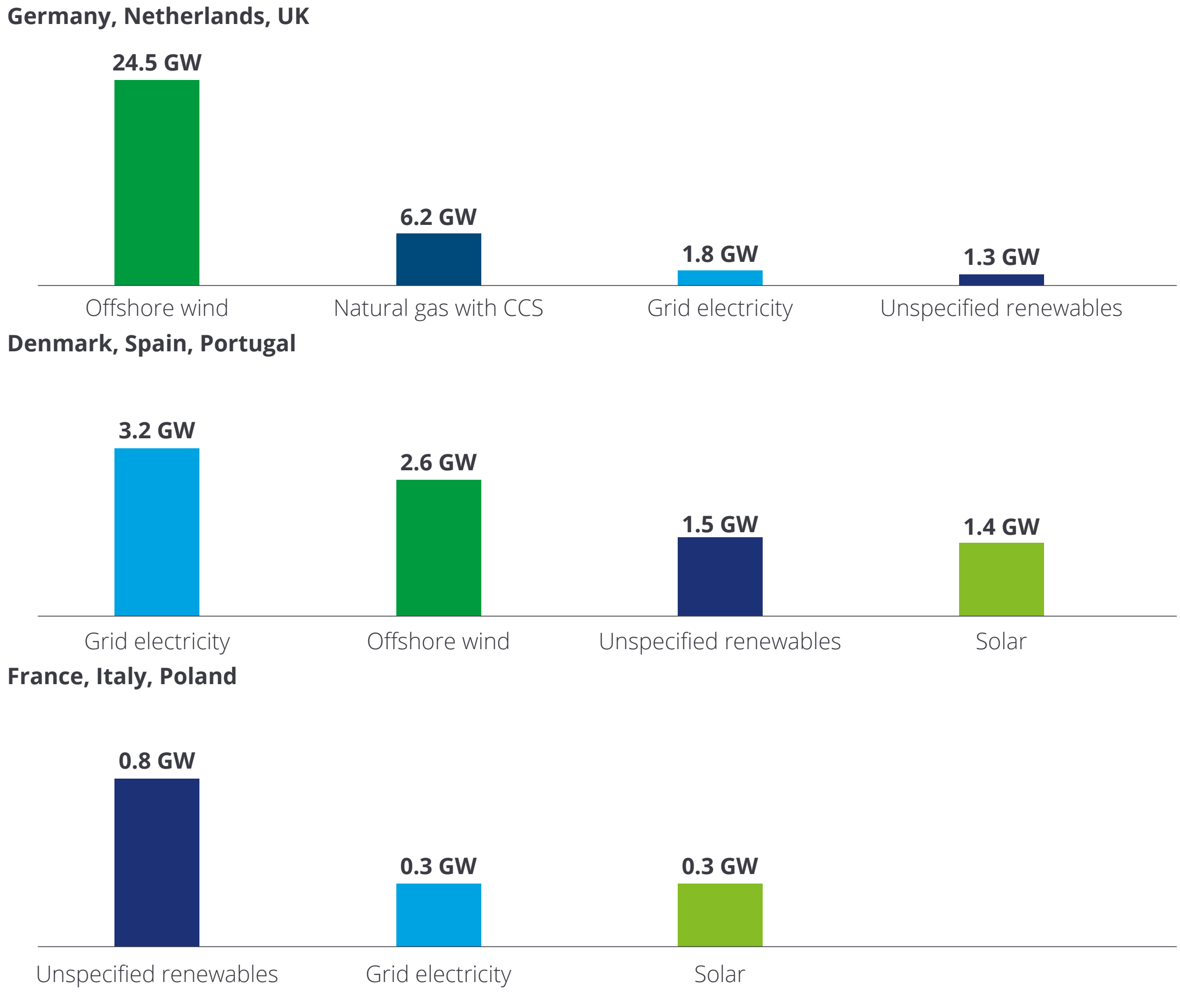
Strong contenders, electrolysis push

- Focusing on electrolysis but sourcing most tech from abroad
- These countries are rich in renewable energy sources, with solar PV potential in Portugal and Spain and offshore wind resources in all three
- Hydrogen guarantees of origin would help grid-based projects in countries with variable renewable generation

Big communicators and slower starters

- France pledged one of the highest 2030 electrolysis capacity targets and budgets but is still trailing behind other large European economies on projects
- Nuclear-based hydrogen projects are being slowed down by political uncertainty
- Italy eyes H_2 pipeline links to North Africa & promotes local blending
- Grid & presumed grid H_2 projects ("unspecified renewables") currently dominate the energy mix, with a push for solar in southern FR & IT

Fig. 5 – Installed hydrogen capacity in 2030*



*Based on a snapshot of installed capacity of announced projects as of 2030, filtered by technology according to national targets (electrolysis only/both...)

Overview of the current hydrogen growth pathway in Europe

Currently announced projects add up to 54 GW and 5 MTH_2 by 2030

Results for clean hydrogen in Europe (EU27 + Norway, UK...)

in 2030

54 GW
5.2 MtH_2

What this will entail

- Investments in H_2 supply, infrastructure, and end-uses
- Electrolyzers make up 45 GW or 85 percent of capacity, requiring a comparable increase in renewable capacity

+7 GW/year
+0.6 MtH_2/year

Putting this acceleration in perspective

- EMEA electrolyzer manufacturing capacity will be 8 GW/year in 2024[1]
- 0.6 MtH_2 = 1.7 Mtoe = Danish annual natural gas consumption[2]

Narrowing the focus down to renewable hydrogen in the EU27

- Announced renewable hydrogen supply projects in the EU exceed the EU's 2024 targets by 6 GW (double) and 0.1 MtH_2 (10%)
- However, they fall short of 2030 targets by 4 GW (10%) and 7 MtH_2 (70%), underlining the need to keep adding capacity to the EU project pipeline
- Volume targets are difficult to fulfill with offgrid electrolyzers making up 63 percent of capacity while depending on variable renewable power generation

Tab. 2 – Comparison of target and operational capacity

Year	Status	Renewable hydrogen capacity (GW)	Renewable hydrogen volumes (MtH_2)
2024	Operational	12	1.1
	EU target*	6	1
2030	Operational	36	3.1
	EU target	40	10

[1] IRENA (2022)
[2] IEA Sankeys (2021)
Both were last accessed early February 2022

* Source: Hydrogen strategy for a climate-neutral Europe, European Commission July 2020, accessed April 29, 2022

Fig. 6 – Clean hydrogen capacity ramp-up in Europe[3]

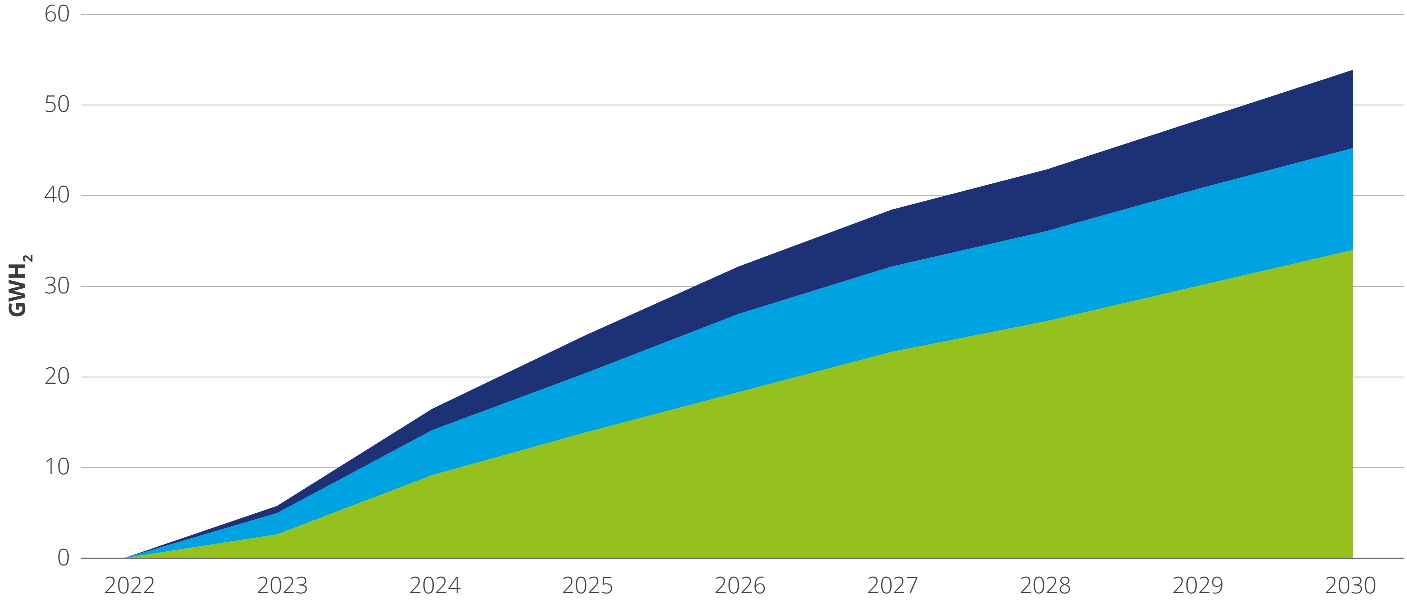
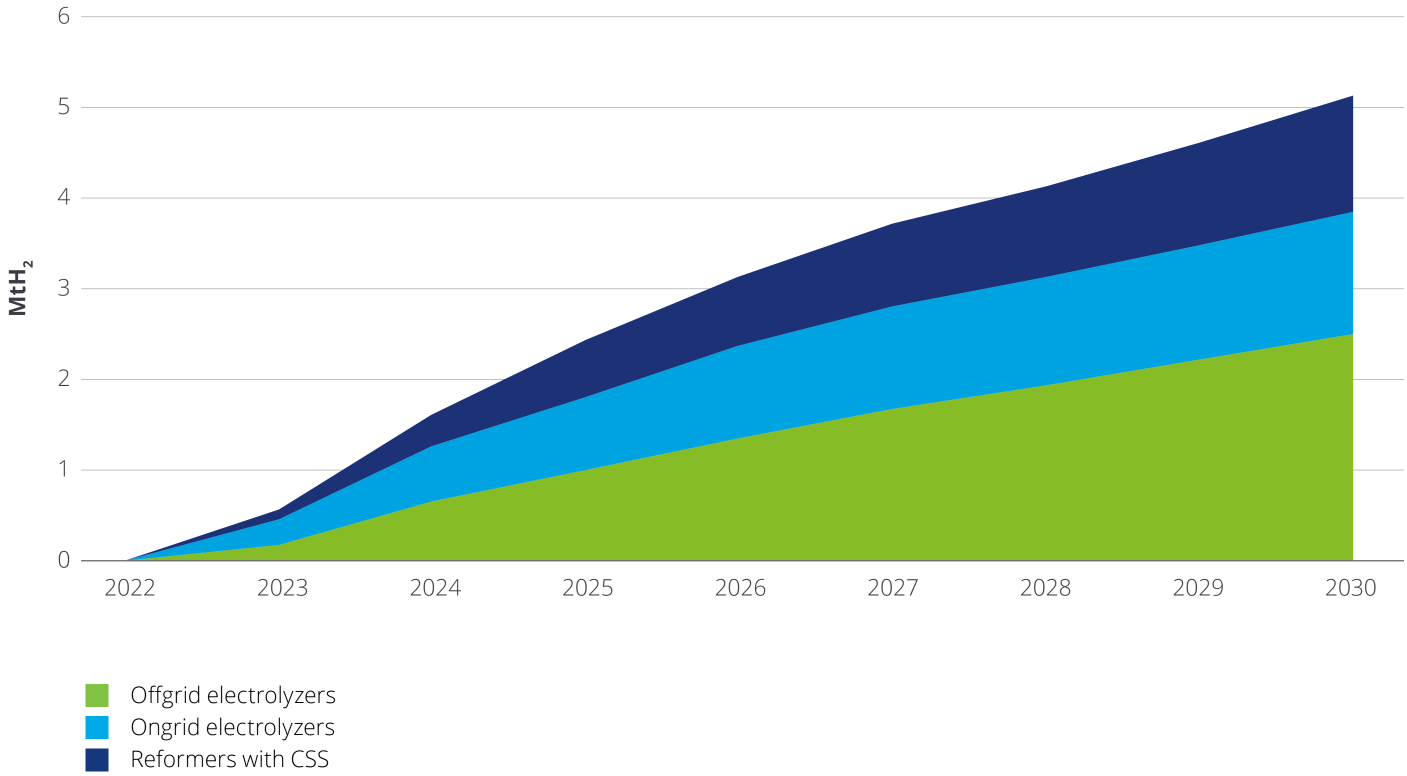


Fig. 7 – Clean hydrogen output ramp-up in Europe[3]

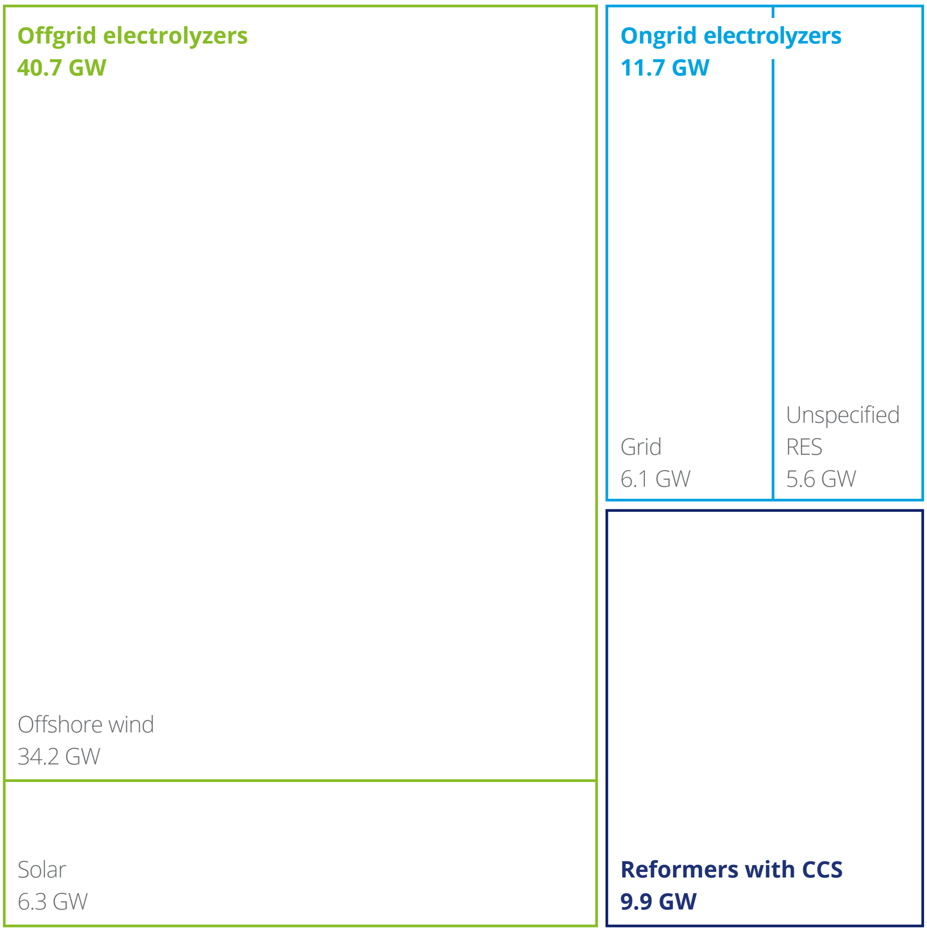


[3] Based on publicly announced projects

Technology breakdown

Electrolyzers will make up 85 percent of planned capacity by 2030

Fig. 8 – Planned clean hydrogen capacity by technology and energy source*



* For the sake of visual representation, onshore wind and hydropower-based offgrid projects, totaling 0.2 GW, have been omitted

Electrolysis is the preferred pathway in Europe

- Electrolyzers will account for 85 percent of installed capacity and produce 75 percent of hydrogen volumes in Europe in 2030
- Offshore wind-to-hydrogen projects total 50 percent of announced capacity for 2030 and will contribute 40 percent of volumes
- The EU's push for renewables will maximise the use of local renewable resources

Gas is treading lightly and trailing behind

- The European CCS value chain is largely underdeveloped
- "Not in my backyard" mentality: the social acceptability of fossil gas and of CCU/S is low in some EU countries
- Representing only 15 percent of capacity, reformers with CCS could produce 25 percent of hydrogen volumes
- Security of supply considerations could also have an impact on low carbon hydrogen technology deployment

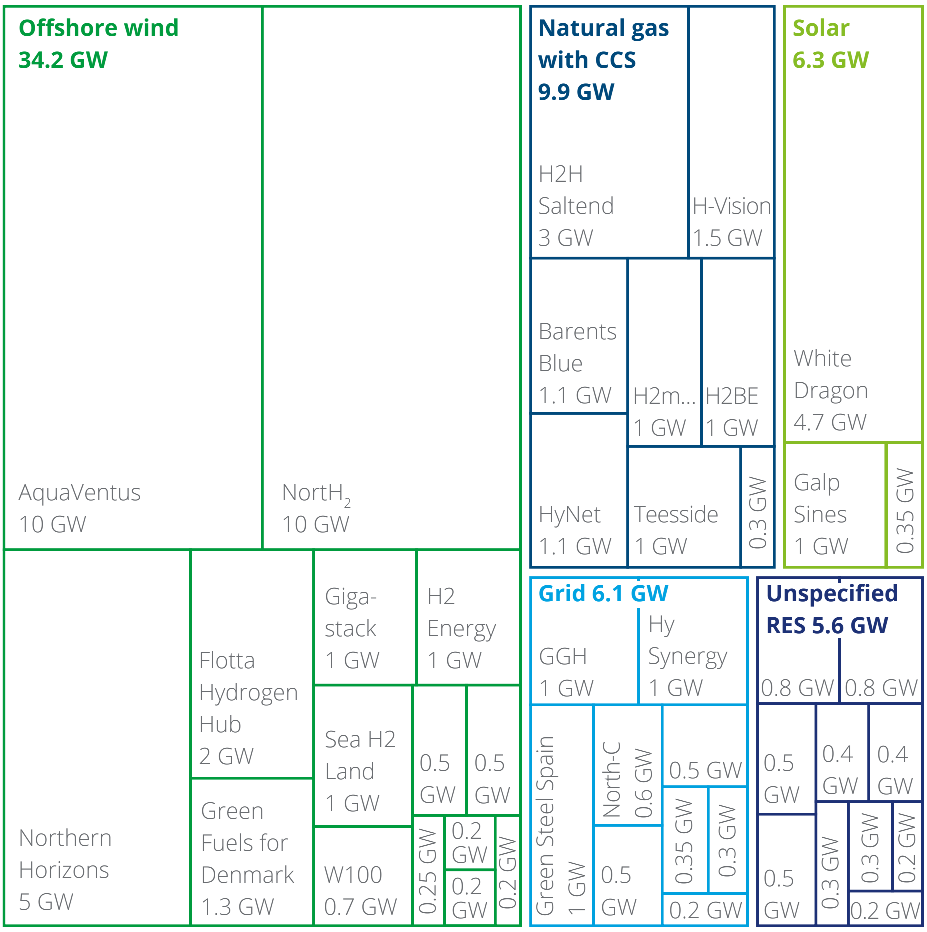
Policy, technical risks and uncertainties

- Lack of EU regulatory clarity hinders ongrid electrolyzers
- A key uncertainty is the capacity of European electrolyzer manufacturers to support strategic targets & to retain a degree of international technological leadership
- The transition away from oil & gas towards clean hydrogen could shift the focus of long-standing trade relationships.

Project breakdown

Europe is creating Hydrogen Valleys to foster the hydrogen economy

Fig. 9 – Planned clean hydrogen capacity by energy source and project*

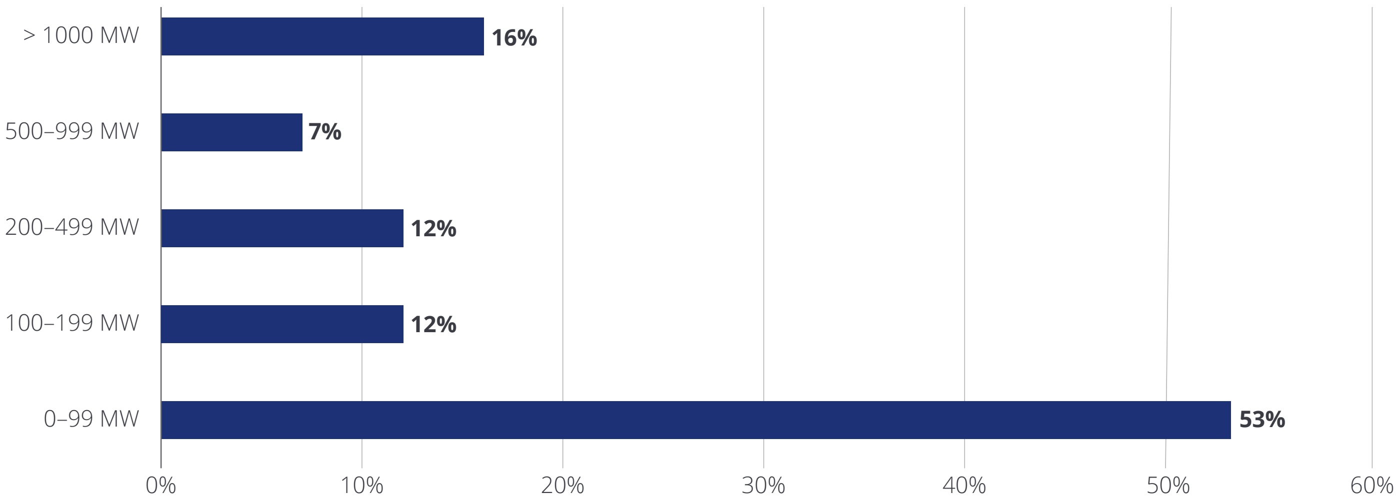


* For the sake of visual representation, this chart omits all projects below 0.2 GW, which does not alter the trends observed

Offshore wind to hydrogen in pole position

- Offshore-wind-to-hydrogen projects above 1 GW are the driving force of the European hydrogen supply pipeline
- Higher load factors and capacities bring favorable economies of scale and scope to offshore wind to hydrogen

Fig. 10 – Projects by announced capacity



Building ecosystems from large-scale projects

- A few large projects create localized hydrogen clusters around which many additional smaller projects can grow

Hydrogen Valleys are the future

- "Hydrogen Valleys" or clusters are the European approach to building a bottom-up hydrogen economy by securing locally-integrated hubs that minimize infrastructure costs in regions where renewables are cheap and plentiful

- At full scale, these hubs will attract enough investments to connect the dots and create a Europe-wide hydrogen backbone

A clear center of gravity is emerging

75 percent of the announced clean hydrogen projects concentrate around the North Sea

Quick facts
By 2030, projects in the area of the North Sea will make up the majority of projects in Europe by volume and by capacity

- Approx. 3.7 MtH_2

- Approx. 40 GW

- 70–75 percent of volumes & installed capacity

Harnessing local resources
- Offshore wind and natural gas

- Storage space for captured CO_2 or hydrogen in salt caverns and empty gas fields

- The area thus lends itself to offshore wind or natural gas projects

North Sea ports handle 50 percent of all European cargo by weight[1] and are well connected to gas infrastructure nodes, making cities such as Antwerp, Hamburg, or Rotterdam prime hydrogen import gateways.

Industrial perspective
The strong overlap between energy-intensive industrial clusters, international ports and hydrogen production hubs make a strong case for "Hydrogen Valley" business models, complemented by imports from outside Europe

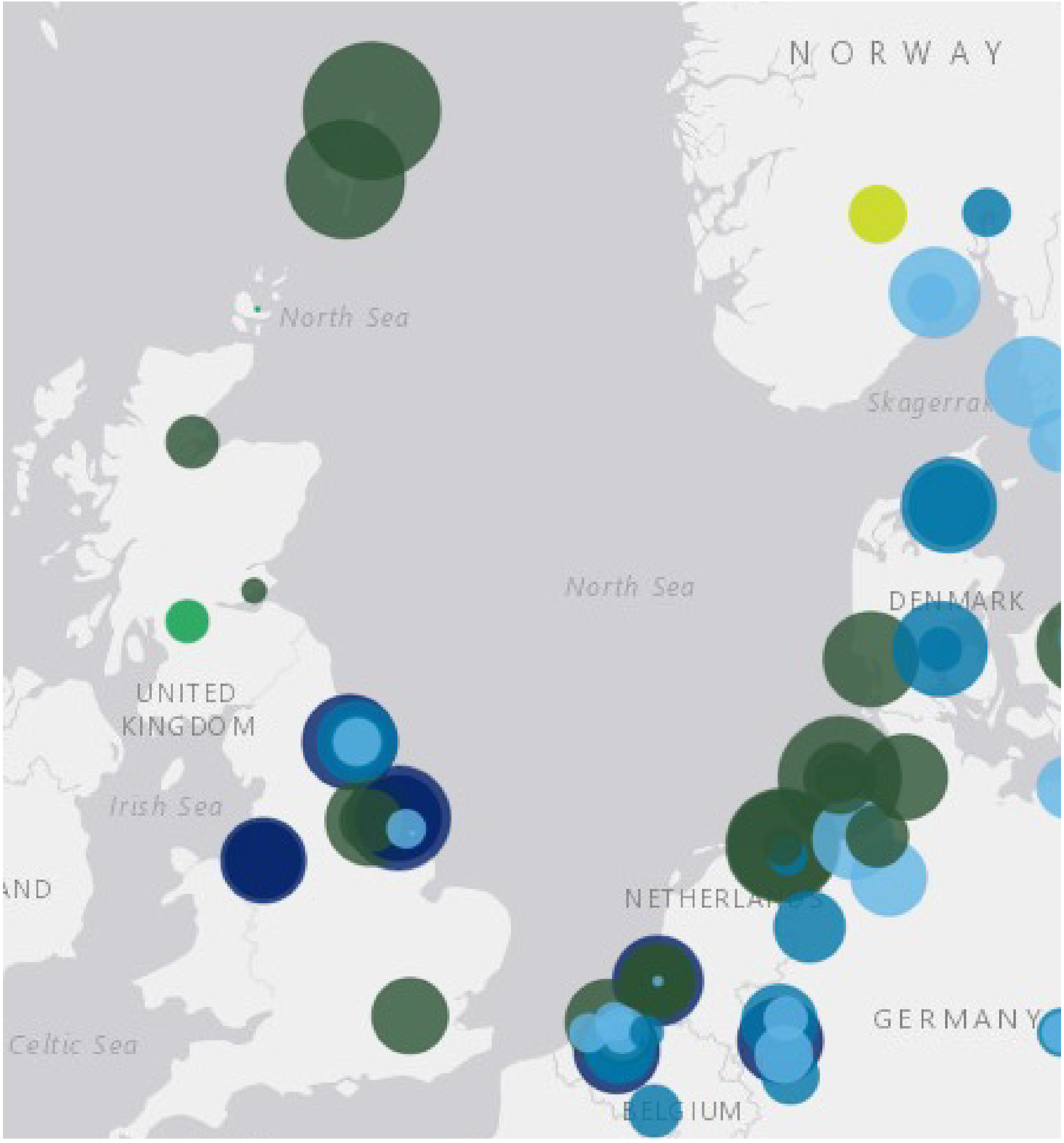
- Most projects have already signed end-user memoranda of understanding

- Energy-intensive industries have the lowest marginal switching costs due to their considerable consumption and the ease of replacing existing hydrogen feedstock with clean hydrogen

- These hubs are the largest emitters of GHG emissions in Europe and are the best places to begin decarbonization

[1] Based on data from Eurostat (2021); last accessed early February 2022

Fig. 11 – Map of announced hydrogen projects in the North Sea area



Capacity (log scale)

5 MW → 5,000 MW

Energy source

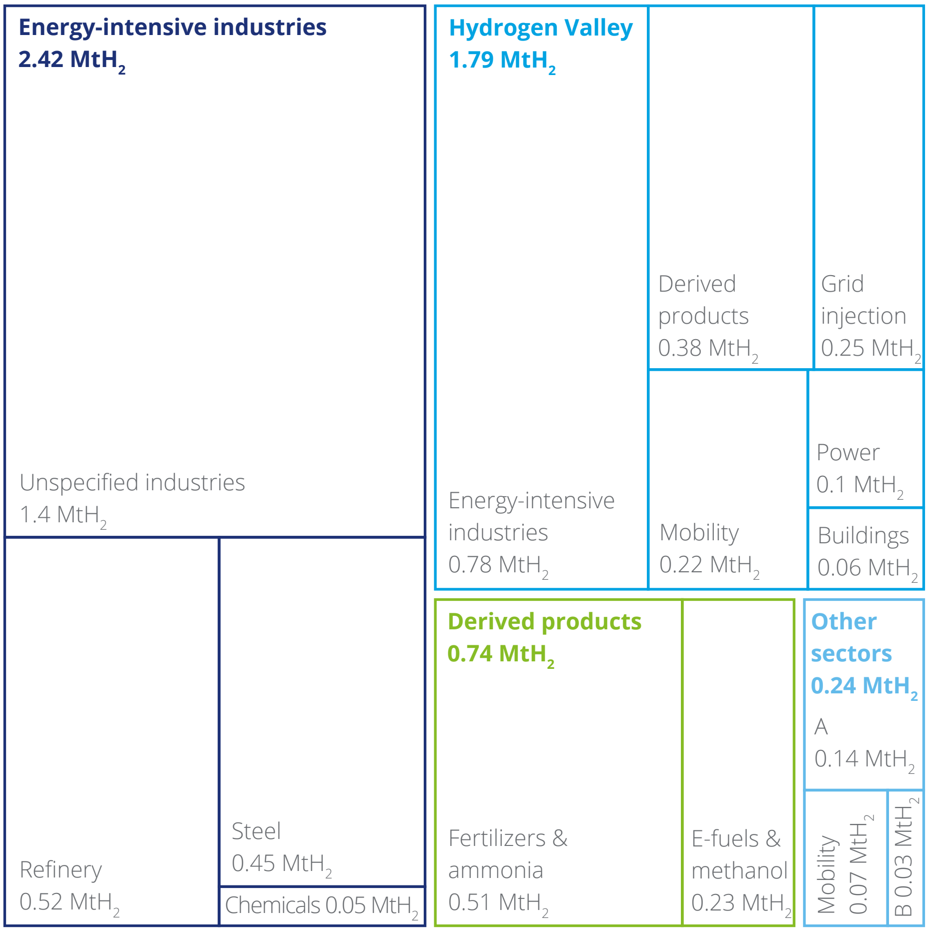
- Grid electricity
- Unspecified RES*
- Offshore wind
- Onshore wind
- Hydropower
- Natural gas + CCS

* Renewable energy source

Hydrogen supply by end-use off-taker

Industrial and Hydrogen Valley projects currently represent most of the demand for clean hydrogen, making localized integrated projects the main business model for now

Fig. 12 – Announced hydrogen volumes by end-use in 2030 in Europe



Energy-intensive industries
Energy-intensive industries are expected to consume nearly 50 percent of clean hydrogen volumes in Europe by 2030. The difficulty to electrify key emitting sectors such as steel or refining makes them priority targets for clean hydrogen

Hydrogen Valleys
The largest projects in Europe ($NorthH_2$, AquaVentus) are set up as "Hydrogen Valleys", usually supplying to a variety of end-uses (e.g. industry & mobility)

Derived products
The production of derived products is growing, spawning ammonia and e-fuel/methanol production projects around the North Sea and Spanish coastlines

Other sectors
Power and mobility-driven projects make up less than 1 GW of production capacity for now, most of which are legacy pilot projects from before 2020 that only expect low capacity

Economies of scale are driving the market

- The cost of switching to hydrogen is lower for industrial end-users than for sprawling networks of individual mobility users
- The industry is the first stepping stone before hydrogen is abundant & affordable enough to start penetrating other sectors

Unspecified end-use: 0.14 MtH_2
Power generation: 0.03 MtH_2

Estimated levelized cost of hydrogen (LCOH) of announced projects

OPEX are a significant cost component for reformers with CCS and ongrid electrolysis

A merit order of clean hydrogen sources

Electrolyzers make the bulk of clean hydrogen volumes

- Electrolyzers make 3.9 MtH_2, mainly composed of offshore wind, PV or ongrid power supply
- Offshore wind to hydrogen projects are among the most competitive sources of clean hydrogen in Europe, leveraging economies of scale

Reformers + CCS are a low-cost option

- The cost of reformers + CCS is sensitive to natural gas prices
- Natural gas forward prices currently trade markedly above long-term price estimates

Major drivers of hydrogen supply

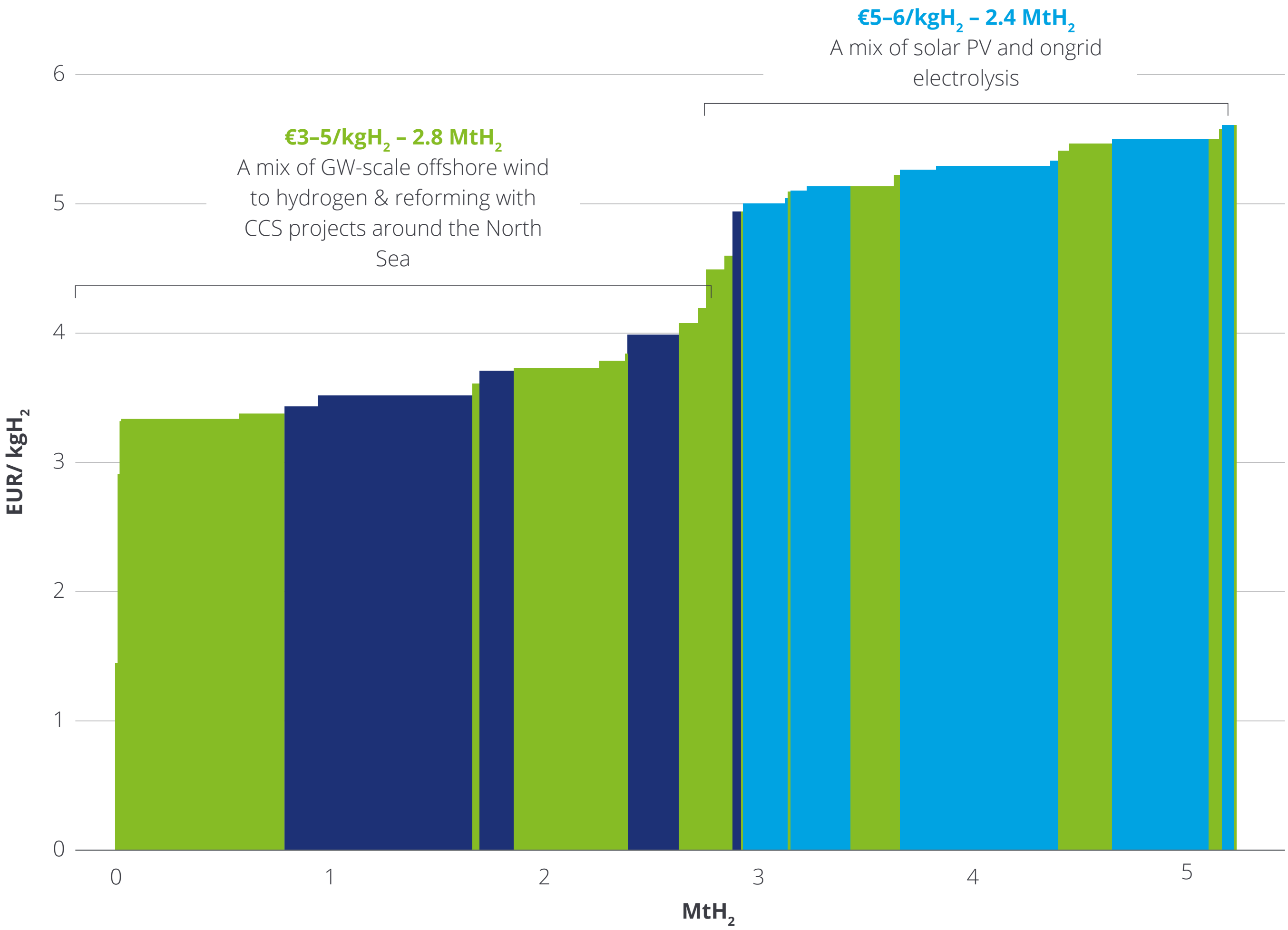
Load factors determine the economics of offgrid projects

A higher load factor brings a higher ROI, making offshore wind (~50% LF) more competitive than solar (~20% LF). However, the ~60% load factors for grid-fed electrolyzers come with a higher OPEX due to electricity procurement.

Regulatory barriers could limit renewable hydrogen

The regulatory uncertainty on the sustainability of ongrid electrolyzers holds back investment. Administrative delays for both electrolyzers & renewables can limit the ability of suppliers to deliver on the EU targets

Fig. 13 – Estimated LCOH by 2030 at current input energy prices*



*Based on forward energy prices as of April 2022

- Offgrid electrolyzers
- Ongrid electrolyzers
- Reformers + CSS

The drivers of levelized cost of hydrogen remain highly uncertain

Offshore wind and natural gas-based low carbon hydrogen are the least-cost options; substantial cost reductions – achieved via learning – can be expected for the future

The economics of hydrogen in 2030

All eyes on gas prices for low carbon hydrogen

- Investments in autothermal reformers (ATR) pay back over a long lifetime, reducing the annual CAPEX component
- At EU ETS prices of around €85/tCO_2, ATR is already today more cost-competitive with than without CCS
- However, as the current energy price crisis emphasizes, the variable cost component is strongly sensitive to gas prices

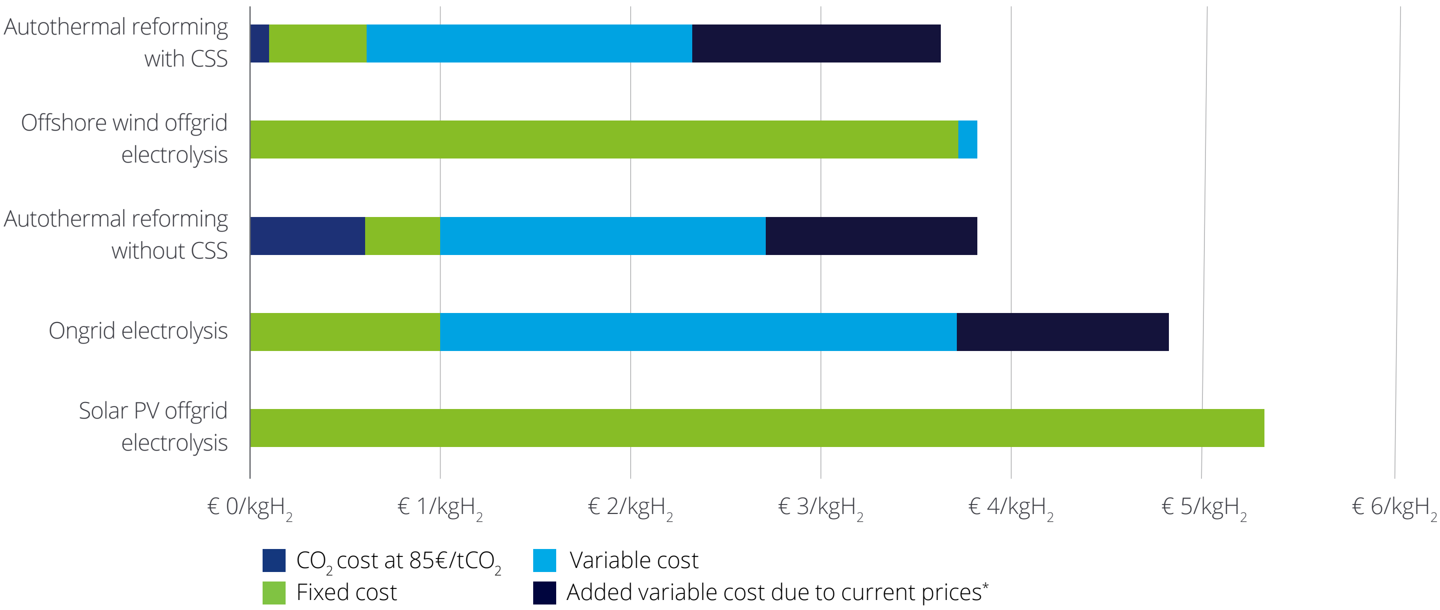
Renewable hydrogen stays above the €3/kgH_2 mark

- CAPEX is the main driver of LCOH for renewable hydrogen projects, with large variations across configurations
- Yet, the opportunity cost of selling the renewable power to the electricity market needs to be assessed too to fully understand project economics
- While offshore wind to hydrogen can compete in costs with autothermal reforming with or without CCS, solar PV does not generate enough ROI to be on par with fossil fuel-based alternatives, although cost decreases via learning effects could be a game changer

Grid-fed electrolyzers are the wildcard

- With relatively low CAPEX, the LCOH of grid electrolysis is highly sensitive to power prices
- At a power price of €55/MWh grid-fed electrolysis outcompetes most renewable hydrogen project. At €80/MWh, ongrid electrolysis becomes a high-cost source

Fig. 14 – Indicative LCOH breakdown for various configurations in 2030*



Configuration (colors indicate the technology groups)	LCOH (€/kgH2)**	Minimum CO_2 price (€/tCO_2) to equate LCOH to that of ATR without CCS
Autothermal reforming with CCS	3.6	55
Offshore wind offgrid electrolysis	3.7	83
Autothermal reforming without CCS	3.8	-
Grid electrolysis (€55/MWh electricity)	3.8	86
Grid electrolysis (€80/MWh electricity)	4.9	247
Solar PV offgrid electrolysis	5.3	313

* Based on forward energy prices as of April 2022
** Including a CO_2 cost of €85/tCO_2

Are we facing a clean hydrogen supply gap?

Keeping the current momentum would result in 20 MtH_2 of production by 2030 – not enough to position the EU energy sector on its path to net zero emissions

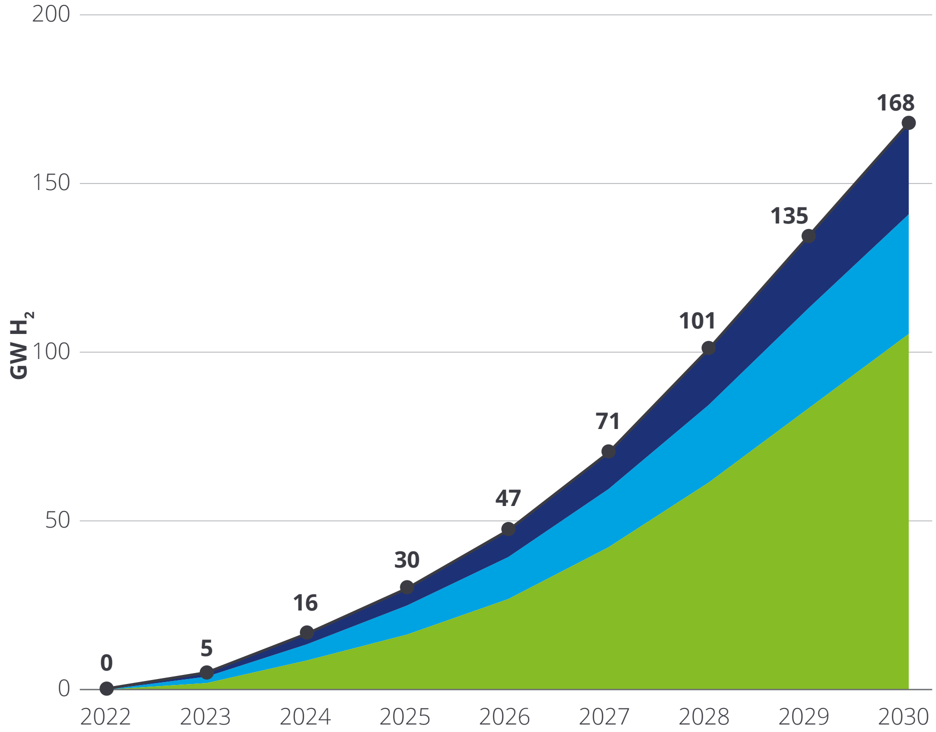
An outlook based on actual announcements

Looking back at the last 6 months of announced clean hydrogen production projects, we replicated their characteristics to make a forecast of future announcements while holding technological & other parameters constant

The results of the forecast in a nutshell

168 GW	**in/by**	**+21 GW/year**
20.3 MtH_2	**2030**	**+2.5 MtH_2/year**

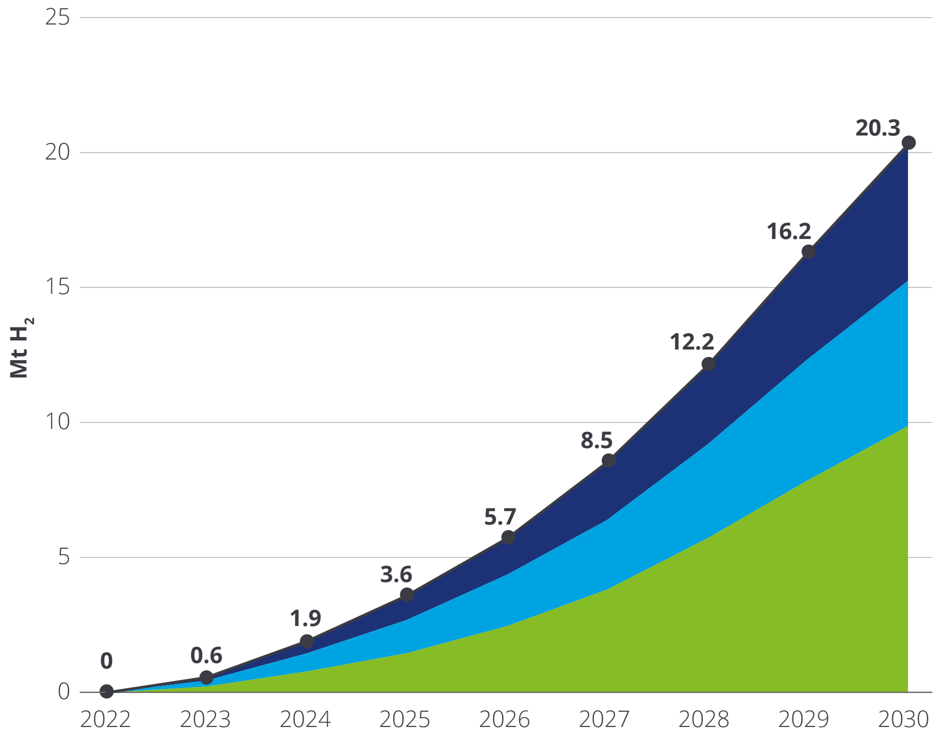
Fig. 15 – Forecast of clean hydrogen capacity in Europe



Methane reforming + CCS complements electrolysis

- Electrolyzers will make up 85 percent of capacity, or around 140 GW, which underlines the need to increase electrolysis manufacturing capacities
- Offgrid electrolyzers will total 63 percent of installed capacity in 2030 and produce around 50 percent of hydrogen volumes; ongrid electrolyzers & reformers will each produce 25 percent of volumes

Fig. 16 – Forecast of clean hydrogen volume in Europe



Putting volumes in perspective

- The EU currently consumes 10 Mt of unabated fossil-based hydrogen, mostly in refineries or ammonia/methanol production sites
- By 2030, clean hydrogen volumes will theoretically be sufficient to decarbonize the EU's entire unabated hydrogen demand & to supply other sectors, starting with industries such as steel. Yet, they are insufficient if we are to remain on track for net zero. As suggested by our Hydrogen4EU study, this would require a clean hydrogen volume of 30 Mt by 2030

Nearly half a trillion euros are needed to kickstart the hydrogen economy

Clean hydrogen presents tremendous opportunities for investors, but technological and regulatory uncertainty presents a challenge

Financing new technologies

Financing risk is a critical short-term issue for hydrogen

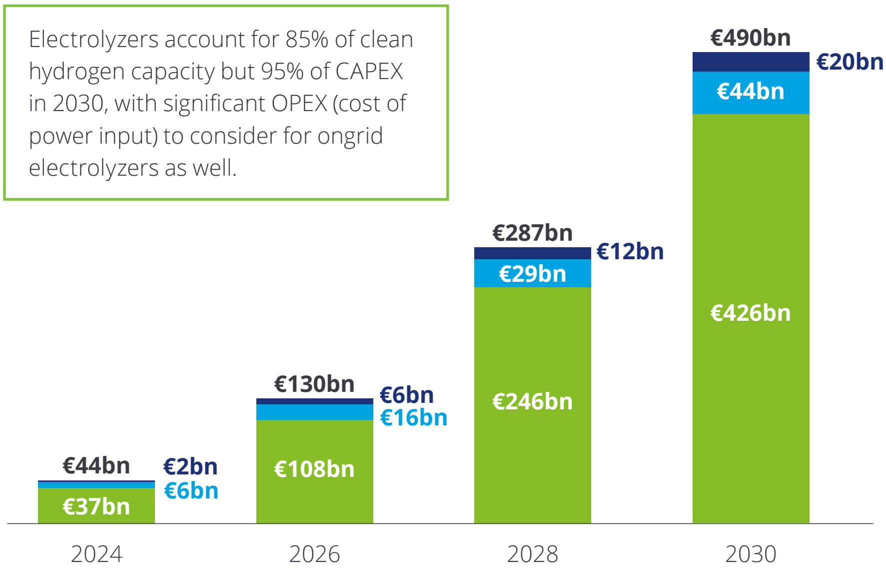
- An investment of €490 bn will be required to achieve the 168 GW of projected capacity, producing 20.3 MtH_2/year
- Investments are stymied by high uncertainty, on both the regulatory and technological fronts

Different technologies come at different investment costs

- Electrolyzers require additional investments in dedicated renewables or power grid extensions due to the principle of additionality, making them even more capital-intensive
- There are a variety of options to explore even within the same technology group. For example, PEM electrolyzers cost 40 percent more than alkaline electrolyzers, and ATR with CCS is cheaper than SMR without CCS

Fig. 17 – Cumulative CAPEX of projected clean hydrogen production projects (168 GW)

Electrolyzers account for 85% of clean hydrogen capacity but 95% of CAPEX in 2030, with significant OPEX (cost of power input) to consider for ongrid electrolyzers as well.



Technology	Average CAPEX (€/kW) in 2020*
Polymer electrolyte membrane (PEM) electrolyzer	1,750
Alkaline electrolyzer	1,250
Steam methane reformer (no CCS)	805
Autothermal reformer + CCS	800

* Hydrogen4EU. These are central values and not necessarily the ones used to compute the other figures displayed on this page.

Next steps & expectations

Guiding green finance money towards hydrogen solutions

- Instruments such as the EU taxonomy shoud attract investors
- Higher ratings unlock larger financing volumes & cheaper debt

Setting up sound policy and hydrogen support mechanisms

- Regulated Asset Base models must be designed & tested
- H_2 price support mechanisms need to be created with a progressive phase-out as the market grows (like in the UK)

Learning-by-doing & economies of scale to reduce average costs

- With time, innovations and increasing investments will lead to cost reductions
- The investment costs for electrolysis could decrease by 70 percent between today & 2050* through learning effects

* Hydrogen4EU. These are central values and not necessarily the ones used to compute the other figures displayed on this page.

Connecting the dots

The trans-European hydrogen infrastructure network connecting supply to demand is a work in progress with many buildings blocks still to come

Progress and milestones

A new institutional framework

- Creation of ENNOH, online by 2026
- ENNOH is an association of European hydrogen network operators tasked with designing ten year network development plans (TYNDPs) for hydrogen
- Unbundling and third-party exemptions in a transitional period of grace until 2030

Feasibility studies

- **Hydrogen Backbone**
  on a dedicated H_2 pipeline network across Europe
- **ReStream**
  on using the existing oil & gas infrastructure to transport H_2 and CO_2
- **HyStock**
  on hydrogen storage models
- **Various studies**
  on overseas imports

Ongoing infrastructure projects

- **Netherlands**
  Gasunie's country-wide gas grid repurposing project (due 2026)
- **H21**
  City-scale conversion of natural gas grids and appliances for hydrogen use in the North of England
- **Eni & Snam MoU**
  Transporting hydrogen from Algeria to Italy using gas pipelines

What are the next steps?

Budget, finance, & incidence

- Hydrogen4EU expects infrastructure investments to rise from €2bn/year in the 2020s to €25bn/year in the 2030s
- Financing volumes must increase and prices decrease to sustain this effort
- The questions of who will pay for the network and how to avoid stranded assets remain largely unanswered

Hydrogen blending in gas grids

- Blending hydrogen in gas grids would save the cost of creating new or repurposed pipelines while fostering initial demand
- Cost-efficient de-blending would avoid investing money in adapting networks and end-use, but its TRL remains low

Hydrogen and CO_2 storage?

- There is enough space in salt caverns & depleted gas fields in Europe to safely store around 2,500 MtH_2 underground[*]
- However, the storage infrastructure and regulatory regime for both H_2 and CO_2 are still underdeveloped & underfunded

[*] Source: Caglayan, Weber, Heinrichs, Linssen, Robinius, Kukla & Stolten (2020)

Fig. 18 – A pan-European 'Hydrogen Backbone'

— H_2-retrofitted existing pipelines
— Newly built hydrogen pipelines

Source: Gas for Climate (Hydrogen Backbone 2021 update)

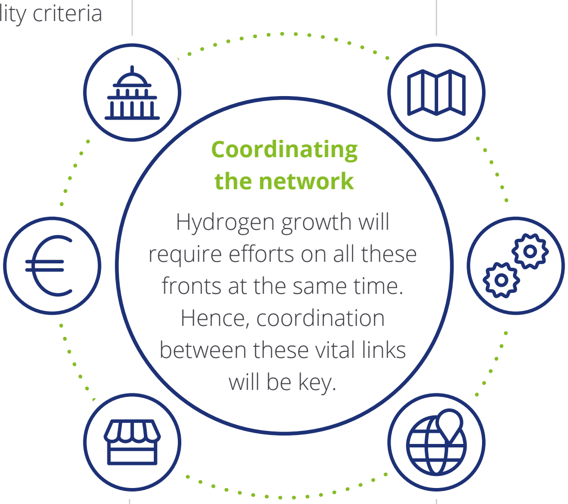
Implications for investors and energy companies

What needs to happen to close the gap?

Finalizing the policy architecture
Missing or incomplete building blocks include support schemes, CO_2 accounting & internalization, R&D funding, financing, & system integration. At the micro level national policy must translate high-level strategies into laws, and EU regulators must establish clear sustainability criteria

Building net positive business models
Be it at project, company or sector level, we need profitable business models. Projects must finalize feasibility studies, secure partners & clients, sort out supply conditions and cover against risks such as power price or natural gas price variability

Raising adequate financing
The industry will need large investments from public & private sources. Unlocking sufficient and affordable funding will be key to sustaining capital-intensive growth for hydrogen in Europe. Sustainable finance & the taxonomy are a good start, but hundreds of billions need to follow



Fostering European manufacturing
Technological sovereignty is one of the goals European policy-makers have set for hydrogen. Developing large-scale manufacturing of fuel cells & electrolyzers in Europe will ensure sufficient & affordable equipment for local projects and keep Europe in the global technological race for hydrogen

Bolstering the demand side
Demand & value for clean hydrogen and the necessary decarbonization strategies for end-users must be assessed, for instance in terms of feedstock switching, H_2 grid connections, H_2 blending in domestic appliances, or vehicle fleet replacement with FCEVs

Securing quantities
Hydrogen production in Europe alone will not be sufficient for deep decarbonization in line with our goal of net zero emissions. Securing local supply and international partnerships & trade links is essential to bridge the remaining supply gap

Our Deloitte hydrogen project tracker (H2-Tracker)

The tool in a nutshell

The H2-Tracker is a tailor-made dashboard that displays hydrogen trends in Europe and allows you to visualize the announced and projected supply and demand of hydrogen in Europe by technology, end-use sector, geography, and energy source

Automated data collection

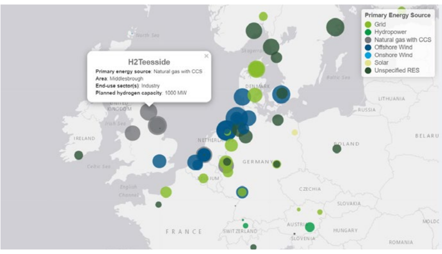
- A combination of programmatic data harvesting and text classification allows for rapid and accurate data collection in order to stay on top of an ever-growing pipeline of projects & announcements

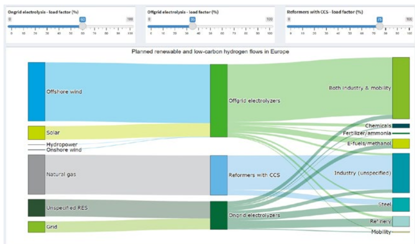
Database & modelling

- A wealth of frequently updated data on the industry's efforts in a dawning hydrogen economy, covering energy sources, capacities, costs, locations, project partners, funding calls and more

Visualization environment

- A strong emphasis on user interactivity to identify the trends of hydrogen in Europe
- Dynamic and customizable visualizations present easy-to-interpret overviews of the market data





- **Concrete numbers:** Projections of the future hydrogen production in million tonnes are drawn from a wide range of qualitative & quantitative inputs on announced projects
- **Based on science:** Estimation parameters are derived from, among others, our Hydrogen4EU research study
- **Adjustable:** The model enables the user to test the effects of underlying technical hypotheses on projected trends
- **Modular:** The tool easily incorporates improvements and can be coupled with new databases

Contacts

Dr. Johannes Trüby
Managing Director
Energy & Modelling – Economic Advisory
Deloitte France
Phone: +33 1 55 61 62 11
JTruby@Deloitte.fr

Christian Grapatin
Director | Monitor Deloitte
Power, Utilities & Renewables
Deloitte Germany
Phone: +49 211 8772 4352
cgrapatin@deloitte.de

Dr. Vanessa Grimm-Rohn
Manager | Monitor Deloitte
Power, Utilities and Renewables
Deloitte Germany
Phone: +49 211 8772 3662
vgrimmrohn@deloitte.de

Clément Cartry
Economist
Energy & Modelling – Economic Advisory
Deloitte France
Phone: +33 1 40 88 28 17
ccartry@deloitte.fr

Monitor
Deloitte.

Issue 05/2022