# IOGP input to the Roadmap on the EU strategy on hydrogen in Europe

## General remarks

The International Association of Oil & Gas Producers' (IOGP) member companies account for approximately 90% of oil and gas produced in Europe. IOGP supports the goals of the Paris Agreement and the EU's objective of climate neutrality by 2050 upon the implementation of enabling measures in particular to avoid carbon leakage. Many challenges must be overcome to meet this objective, and the energy transition requires significant investments, new technologies and behavioural changes.

IOGP welcomes the European Commission's intention to present the strategy on hydrogen in Europe and appreciates the opportunity to provide our input at this stage. We agree that clean hydrogen, as defined in the Roadmap, has strong potential to play a vital role in decarbonisation, in particular for hard-to-abate sectors (e.g. heavy-duty transport and energy-intensive industries) as they require high-temperate heat and cannot easily be electrified. We support a strategy which comprises all clean hydrogen production pathways, including from renewable electricity, natural gas reforming with CCS (carbon capture and storage) and methane pyrolysis. We also recognise that different technologies might play different roles depending on the timeline, with natural gas reforming to lead in the near term, allowing other emerging technologies to develop and scale up. What matters is the ability to cost-effectively reduce GHG (greenhouse gas) emissions at scale and contribute to reaching the EU 2050 climate-neutrality objective. It is in this perspective that 22 Member States' National Energy and Climate Plans (NECPs) foresee a role for hydrogen in the decarbonisation of their energy systems.[1]

IOGP is in favour of using existing (e.g. the Madrid Forum, the Infrastructure Forums) and future platforms to share experiences and best practises and to further contribute to the definition of an integrated energy system which should include all forms of clean hydrogen. In this context, we welcome the Commission's proposal to establish a European Clean Hydrogen Alliance as part of the EU Industrial Strategy and would be pleased to contribute to it with our ongoing research projects. Last year, we commissioned *"the Hydrogen for Europe pre-study"* which assessed the potential benefits of hydrogen in the energy transition.[2] To build up on this work, with 17 industry actors from the oil and gas, gas transmission and hydrogen sectors, IOGP is participating in the Hydrogen for Europe study. *'Hydrogen for Europe'* is a research project carried out over the course of 2020 by research institutes IFPEN and SINTEF and managed by Deloitte. The aim is to assess how hydrogen can contribute to the EU's goal of reaching climate neutrality and the milestones on the path to 2050.

We are certain that in addition to contributing to climate neutrality, hydrogen can also help to stimulate economic development. Today, 70% of hydrogen production comes from natural gas; if decarbonised with CCS, it will accelerate the establishment of clean hydrogen value chains. Such a development would create a new low-carbon industry and jobs, with the potential to account for 24% of final energy demand and 5.4m jobs by 2050[3]. For this reason, IOGP calls on policymakers to create a solid framework that incentivises development of clean hydrogen and other low-carbon gases. Scaling up all forms of clean hydrogen is an opportunity to demonstrate Europe's commitment to decarbonising the economy while creating high-quality jobs for citizens.

1 See IOGP (April 2020) Assessment of National Energy & Climate Plans: https://www.oilandgaseurope.org/news/iogp-assessment-of-national-energy-and-climate-plans/
2 IFPEN & SINTEF (2019) 'Hydrogen for Europe' pre-study: https://www.sintef.no/globalassets/sintef-energi/hydrogen-for-europe/hydrogen-for-europe-pre-study-report-version-4_med-omslag-2019-08-23.pdf
3 FCH JU (2019), 'Hydrogen roadmap Europe: https://www.fch.europa.eu/sites/default/files/Hydrogen%20Roadmap%20Europe_Report.pdf.

To maximise this potential, we would like to outline the following:

## Market based & technology neutrality as driving principles for the EU Strategy on hydrogen: focus on production[4]

Today, hydrogen produced from natural gas delivers the lion's share of industrial hydrogen, while hydrogen from renewables is produced in smaller volumes – 1% (Figure 1). Scaling up clean hydrogen from renewables requires large amounts of renewable electricity. To put this into perspective, for example, the German chemical industry sector alone would need more than 600 TWh renewable electricity to meet its potential future clean hydrogen demand in order to decarbonise its production. This is three times as much as the current total German renewable electricity production.

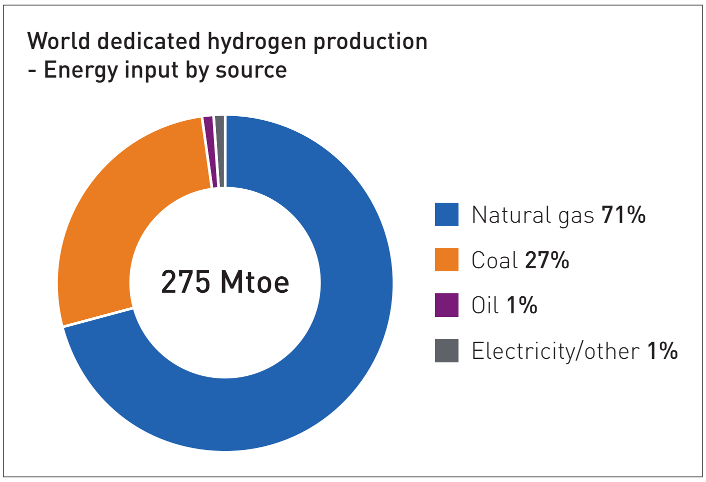


**Figure 1**. *Source: IEA (2019)*

Given the above, there is no doubt that meeting the EU carbon neutrality objective by 2050 will require large volumes of hydrogen with a low $CO_2$ footprint[5]. For this reason, clean hydrogen produced by methane pyrolysis and natural gas reforming combined with CCUS will play an important role in scaling up clean hydrogen and contribute to the development of infrastructure and markets cost effectively. Also, using sustainably sourced biogas as feedstock in gas reforming processes with CCS would even result in hydrogen production processes with negative emissions.

As far as the cost is considered, according to the IEA report, production of hydrogen from natural gas reforming combined with CCUS is much lower than those for hydrogen using renewable electricity and electrolysis of water (Figure 2).

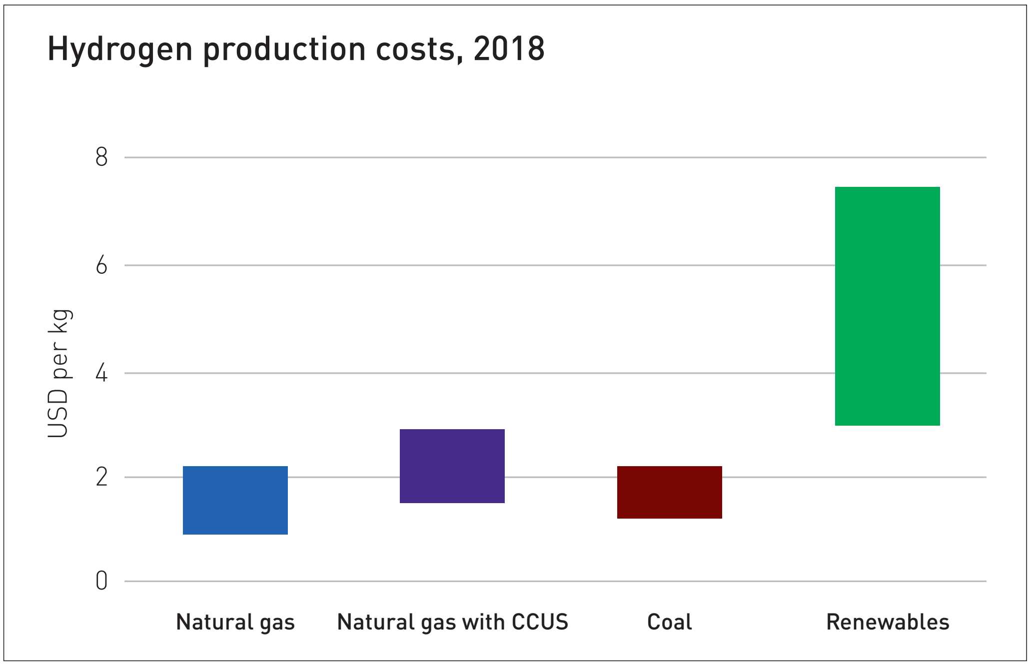


**Figure 2**. *Source: IEA (2019)*

[4] The Hydrogen for Europe pre-study has been undertaken with the purpose of assessing current knowledge about the potential hydrogen has to decarbonise the European economy. http://www.oilandgaseurope.org/wp-content/uploads/2020/01/IOGP_Hydrogen-for-Europe-Final-report-of-the-pre-study_reportstudy.pdf

[5] See the High-Level Group on Energy Intensive Industries (2019), 'Masterplan for a competitive transformation of EU energy intensive industries enabling a climate-neutral, circular economy by 2050': https://ec.europa.eu/docsroom/documents/38403/.

But the cost of hydrogen from renewables is expected to reduce over time due to reductions in renewable power costs and improved economies of scale. Third party studies[6] suggest that over time, hydrogen from renewable electrolysis could become cost-competitive with hydrogen produced from natural gas reforming combined with CCUS.

## Key recommendations:

- If the EU wants to accelerate the production of clean hydrogen, the EU regulatory framework needs to be technology neutral and market-based.
- Include all technology production options within the definition of clean hydrogen (hydrogen from renewables, methane pyrolysis and natural gas reforming with CCS).

# Hydrogen applications

**Hydrogen** is an energy carrier, a fuel which **can be used in a wide range of industrial applications** as an alternative to current fuels and inputs, or as a complement to the greater use of electricity in these applications. In transport (in particular in heavy-duty vehicles and in the maritime sector), heating, energy intensive industries such as steel production and in electricity generation – hydrogen can be directly used or converted to hydrogen-based fuels, including synthetic methane, synthetic liquid fuels, ammonia and methanol.

**Power generation offers many opportunities for hydrogen and hydrogen-based fuels**: Hydrogen and ammonia can be flexible generation options when used in gas turbines or fuel cells. At the low capacity factors typical of flexible power plants, hydrogen costing under USD 2.5/kg (Figure 2) has good potential to compete. In the longer term, hydrogen can play a role in large scale and long-term storage to balance seasonal variations and the intermittency of renewables.

## Hydrogen in transport:

- Hydrogen fuel cell electric forklifts are already commercially viable as complementary options for existing battery electric forklifts and it is estimated that already today 25,000 forklifts run on fuel cells globally.
- Hydrogen can be used as fuel in several different ways, i.e. in fuel cells; in a dual fuel mixture with conventional diesel/heavy fuel oils (HFO) engines; and lastly as a replacement for HFO for use in combustion machinery. So far, there is no standardized design and fueling procedure for hydrogen-powered ships and its bunkering infrastructure. Furthermore, remaining safety design issues with regards to the volatility of the fuel need to be carefully looked at.

## Hydrogen in heating:

- The largest near-term opportunity in buildings is blending hydrogen into existing natural gas networks. The potential is highest in multifamily and commercial buildings, particularly in dense cities, where conversion to electric heat pumps is more challenging than elsewhere. Longer-term prospects in heating could include the direct use of hydrogen in hydrogen boilers or fuel cells, but both of these would depend on infrastructure upgrades and on measures to address safety concerns and provide public reassurance.
- European decarbonisation scenarios point to a remarkable potential for hydrogen in residential, commercial and industrial heating. For example, the FCH JU Hydrogen Roadmap Europe sees a potential of up to 465 TWh hydrogen for heating households by 2050[7], whereas research institutes IFPEN and SINTEF sees a potential demand for up to 1503 TWh hydrogen in the residential and commercial sectors combined in addition to 470 TWh hydrogen for medium- and high-grade heat in the industrial sector by 2050[8]. Importantly, such scenarios include both hydrogen produced with renewables and hydrogen produced from natural gas reforming with carbon capture and storage or utilisation (CCUS).

[6] 8 Navigant 2019, Acatech 2018
[7] FCH JU (2019). Hydrogen Roadmap Europe: https://www.fch.europa.eu/sites/default/files/Hydrogen%20Roadmap%20Europe_Report.pd
[8] IFPEN & SINTEF (2019). Hydrogen for Europe pre-study: https://www.sintef.no/globalassets/sintef-energi/hydrogen-for-europe/hydrogen-for-europe-pre-study-report-version-4_med-omslag-2019-08-23.pdf

- The parallel development of a dedicated hydrogen infrastructure and the ability to blend hydrogen with natural gas is important, as blending provides already available outlet and builds on existing natural gas assets. In their NECPs, 22 Member States foresee a role for hydrogen in the decarbonisation of their energy systems[9]. The Dutch long-term renovation strategy (LTRS) already refers to hydrogen as one option for sustainable heating[10]. Trials for hydrogen blending in residential and commercial heating systems are already ongoing in the UK,[11] and further research and development will be needed to scale up this solution up in Europe.

**Key recommendations:**

- Support industrial applications of clean hydrogen through projects like the Clean Steel Initiative.
- Consider clean hydrogen or fuels derived from hydrogen, such as ammonia or methanol, as options to reduce carbon emissions in the shipping industry – this should be reflected in the FuelEU Maritime Initiative
- Assess and propose how to overcome barriers of using clean hydrogen in the heating sector in the upcoming Renovation Wave.
- Alongside natural gas, support the development of hydrogen refuelling infrastructure in the review of the Alternative Fuel Infrastructure Directive (AFID).

## Building an infrastructure fit for $CO_2$ and hydrogen

In the context of the European Green Deal, it is important that the framework for energy infrastructure is reviewed to take into consideration the transformation required by various sectors. Therefore, the priority should be to include the energy transition objectives while safeguarding the already substantial achievements of the internal gas market.

### a) Removing barriers for Hydrogen and $CO_2$ transport and storage to develop the entire CCS and hydrogen value chains

A number of planned CCS projects in Europe aim to transport $CO_2$ from one country to another for storage, by pipeline or other modes of transport such as by ship or truck. They will take place in hubs and clusters where different industries will share infrastructure for transport and storage, allowing for economies of scale through a cross-sectorial and cross-border industrial system. In this context not only $CO_2$ transport but also $CO_2$ storage will have a cross-border dimension, therefore helping those industrial players that cannot store $CO_2$ locally. For this reason, it is key to have in place a robust policy framework enabling the entire CCS and hydrogen value chains.

In a 2050 perspective, the following areas will contribute to climate neutrality while making use of the existing infrastructure in a cost-effective way:

- the production of clean hydrogen from renewables, methane pyrolysis and natural gas reforming with CCS,
- the technical adaptation of the EU gas infrastructure to carry clean hydrogen, and
- the transportation of $CO_2$ across borders will contribute to climate neutrality while making use of the existing infrastructure in a cost-effective way.

The full CCUS value chain should be integrated into the TEN-E Regulation. Additional methods of $CO_2$ transport, such as by ship, should be recognised in key EU legislation like the EU ETS and TEN-E, in order to facilitate a greater range of $CO_2$ transport solutions in Europe.

By creating a cross-border network of open-access $CO_2$ transport and storage infrastructure, EU industrial plants and clusters can connect their $CO_2$ emissions to shared infrastructure– and this common approach should be supported.

[9] See IOGP (April 2020) Assessment of National Energy & Climate Plans: https://www.oilandgaseurope.org/news/iogp-assessment-of-national-energy-and-climate-plans/
[10] See Dutch LTRS: https://ec.europa.eu/energy/sites/ener/files/documents/nl_2020_ltrs_en.pdf
[11] See HyDeploy: https://hydeploy.co.uk/why-hydeploy/

## b) Leverage the existing assets

The EU should leverage from the existing natural gas system as a key enabling step to meet its climate objectives. The use of existing gas infrastructure for clean hydrogen can save time and costs while reducing the requirement to dramatically expand the power transportation infrastructure, which is an issue in some Member States that faces public acceptance challenges.

The parallel development of a dedicated hydrogen infrastructure and the ability to blend hydrogen with natural gas (so called "hythane gases") are important. Blending can provide an initial demand, and should be accepted in the natural gas system provided that this is compatible with quality requirement of end users.

Rapid deployment of a hydrogen market and infrastructure at scale based on natural gas can also facilitate and support the development of hydrogen-related technologies such as power-to-gas technology and the production of synthetic methane. Larger amounts of hydrogen from electrolysis can enable electricity storage using the gas infrastructure such as storage facilities.

IOGP supports the work undertaken by CEN on gas quality to define an acceptable Wobbe Index range for H-gas. We welcome the suggestion by CEN of a wider range at EU entry points and a classification system for exit points to gas consumers; however, the currently discussed range is still too restrictive for certain domestic gas fields. Gas quality ranges should both increase the diversity of the upstream supply of gas and provide the vast majority of gas consumers—those connected to exit points with a specified class—with a predictable and stable gas quality. This should be supplemented with tailor-made solutions for extended class exit points. It is important to maintain the capacity of the transportation system to blend and commingle gas of different sources as it avoids undue quality restrictions at system entry points. This is especially important in regions where gas supply is not sufficiently diversified, and indigenous gas production is a critical contributor to supply security. The Network Code on Interoperability and EN16726 currently do not explicitly limit the possible blending of hydrogen with natural gas. Setting a minimum tolerance level for hydrogen that should be agreed on in Interconnection Agreements between relevant TSOs (such as say 2 vol%), depending on their grid technical limitations, will be helpful to enable cross-border transport.

### Key recommendations:

- Create investment framework under the TEN-E Regulation the entire CCUS value chain. Additional methods of $CO_2$ transport, such as by ship, should be recognised in key EU legislation like the EU ETS and TEN-E,
- Recognise multimodal transport of hydrogen in the TEN-E Regulation, including hydrogen (and possibly ammonia) pipelines, ships and whatever else could possibly contribute to a fully-fledged network development.
- Public support on national and EU level (CEF) should be aligned with long-term network planning and mutually reinforce large-scale hydrogen project financing.
- Set a minimum tolerance level for hydrogen blending with natural gas which should be agreed in Interconnection Agreements between relevant TSOs.

## Creating only one market and one standardised system for Guarantees of Origin for low-carbon gases including all forms of clean hydrogen

Any proposal for new legislative initiatives should maximise the use of market-based instruments for achieving European climate objectives while safeguarding the substantial achievements in the internal gas market.

The existing regulatory framework for gas has enabled the trade of gas separate from the physical flow of molecules. Transmission of gas molecules is assigned to unbundled TSOs, and gas is traded separately—as energy—without tracking the molecules. This has opened the gas market to new participants and has increased market liquidity. The development of low-carbon gases (such as hydrogen) can benefit from this successful experience by facilitating the trade of GHG emission certificates separate from the molecules. Unbundling the emission benefits would create a common market for GHG emission certificates from all low-carbon gases, which would enable consumers to set their own pace of decarbonisation without the need to be physically connected to a source of low-carbon gas, and should also help to leverage market efficiencies to significantly reduce costs of decarbonisation.

In our view, trying to expand the use of hydrogen by setting technology specific targets would not promote the most cost-effective and sustainable solutions for meeting decarbonisation targets. Specific technology targets would avoid direct competition between different sources of hydrogen, ignore that each technology has various GHG intensity and costs which will not be monitored and stewarded and would therefore be detrimental to end consumers.

Furthermore, splitting the internal gas market into different products would damage the success of completing the EU gas market and reverse the gains made by EU citizens in terms of more efficient, competitive and lower costs energy supplies. In this context, all forms of clean hydrogen should be rewarded for their contribution to decarbonisation goals.

Therefore, we support only one standardised system for Guarantees of Origin and subsequent certification for renewable and non-renewable low-carbon gases (including all forms of clean hydrogen), which include the remaining GHG emissions of the product based on a standardised life-cycle basis. Certified emission savings due to low-carbon gases could be recognised under the EU Emissions Trading System (ETS) as reductions of GHG emissions. This will ensure a technology neutral approach. Such a technology-neutral approach will accelerate the deployment of all forms of low-carbon gases and clean hydrogen and deliver the most cost-effective solutions for the decarbonisation of gas.

We also support a limited review of EU gas legislation and network codes to determine whether the provisions are fit for purpose for new gases, including hydrogen. As an example, 'transmission' and 'distribution' are defined in the current Gas Directive as 'the transport of natural gas'. This appears to be too restrictive and should be expanded to include new gases. However, any review should not roll back the achievements of the natural gas market. The amendments should be strictly limited to their purpose.

### Key recommendations:

- Ensure that contributions of low-carbon gases (including all forms of clean hydrogen) to GHG emissions savings are measured on a consistent basis applying a standardized life-cycle analysis for each technology option.
- Develop a common system for Guarantees of Origin including based on a standardised life-cycle GHG emissions certification for clean hydrogen and other low-carbon gases
- Carry out a limited review of EU gas legislation and network codes to determine whether the provisions are fit for purpose for clean hydrogen.

## Establishing an adequate policy framework on financing R&D and innovation

**In the revised Guidelines on State aid for Environmental protection and Energy (EEAG):**

- Clean hydrogen or low-carbon gases in general are not specifically covered under any of the outlined sections of the EEAG. Therefore, the revised EEAG should establish conditions that would encourage Member States to make energy infrastructure ready to be able to capture, transport and store $CO_2$ as well as transport hydrogen/low-carbon gases (including gas blended with hydrogen) and generation adequacy projects, where GHG emission abatement potential is one of the most relevant criteria for granting policy support.

**TSOs and DSOs should be enabled to undertake a reasonable level of R&D activities and pilot projects focusing on the hydrogen injection in the gas system as part of their regulated activities, without compromising the general unbundling principles:**

- This could include projects for transmission and distribution of hydrogen/natural gas blends and $CO_2$ pipeline transport projects linked to CCUS initiatives. Where the EU provides funding for network-related R&D and pilot projects to reduce $CO_2$ emissions, we believe the funding mechanisms should not discriminate between sectors and technologies. This ensures that the most cost-effective measures are developed and that public money is spent wisely, a factor which is even more important given the COVID-related economic downturn. R&D support should provide the opportunity for multiple technologies to develop their potential towards decarbonisation.

**The upcoming delegated act (DA) on climate change mitigation stemming from the EU Taxonomy Regulation:**

- We support the classification manufacturing and storage of all forms of clean hydrogen[12] as environmentally sustainable activities. Any threshold proposed by the DA should be impact assessed to ensure that hydrogen from natural gas reforming with CCS, methane pyrolysis and from renewables will be covered.
- With gradual technical adaptation, **hydrogen can be transported** in existing EU gas infrastructure, thereby cost-effectively using current gas infrastructure and avoiding the need to duplicate transportation infrastructure. For this reason, we also encourage the Commission to incorporate a section on **transportation of hydrogen** to link to the manufacture of hydrogen and storage of hydrogen.

**We welcome the proposed European Partnership for Clean Hydrogen building on the success of the existing FCH 2 JU[13], and propose the following:**

- While fuel cells may become important, it will be equally important to **focus on the development of hydrogen fuelled furnaces, gas turbines and engines within the proposed partnership**. This will contribute to scaling up the production and open up for the use of hydrogen in all energy sectors and thus a wide range of energy end-uses, such as in heating, power generation or propulsion, can be covered by hydrogen without relying on fuel cells only.
- **Incorporate a wide range of clean hydrogen production technologies** (hydrogen from natural gas reforming with CCS, methane pyrolysis, hydrogen from biomass and biogas and from electrolysis from renewables).
- **Involve a wide range of stakeholders along the hydrogen value chain**, including providers of natural gas feedstock and $CO_2$ capture, transport and storage solutions: Cross-sectorial collaboration is key for successful development and deployment of new technology, and this needs to be reflected in the proposal to ensure cooperation with the strategic programme and other partnerships.
- Include not only technological innovation, but also **innovation in business models, processes and market creation** for clean hydrogen in the scope of the proposed partnership would contribute to the further uptake of clean hydrogen technologies in the broader energy system.

## Key recommendations:

- Ensure that CCS and all forms of clean hydrogen are included into the scope of the revised EEAG.
- Guarantee that TSOs and DSOs could undertake R&D activities and pilot projects on clean hydrogen and $CO_2$ as part of their regulated activities.
- Ensure the recognition of all forms of clean hydrogen and CCS activities in the upcoming Delegated Acts on climate change mitigation.
- Expand the scope of the European Partnership for Clean Hydrogen, and ensure the involvement of all stakeholders as well as focus on business models, processes and market creation.

12 Section 3.5 "Manufacture of Hydrogen", Section 4.12 "Storage of hydrogen" in the Taxonomy Report: Technical Annex, March 2020.

13 IOGP contribution to the consultation on the proposed European Partnership for Clean Hydrogen: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/11902-European-Partnership-for-Clean-Hydrogen/F472583

## International cooperation on hydrogen

International cooperation is essential to accelerate the growth of all forms of clean hydrogen around the world. If governments work to scale up hydrogen in a coordinated way in the COVID-19 crisis and establish this energy carrier as part of the recovery package, it can help to stimulate investments across the value chain that will bring down costs and enable the sharing of knowledge and best practices. Trade in hydrogen will benefit from common international standards.

### Key recommendations:

- Encourage G7/G20 partners to develop strategies on hydrogen covering all forms of clean hydrogen, other low-carbon gases and CCUS.
- Establish the Clean Hydrogen Alliance bringing high-level representatives from the entire value chain, and create a dedicated group to CCS.

## Projects focussing on hydrogen – examples:

**H21 North of England Report**[14]: As a concrete project for an integrated energy system, the North of England project is a detailed analysis of hydrogen production and distribution in Northern England for heating purposes. This study was conducted by Northern Gas Networks, Cadent and Equinor to study the decarbonisation of the heating sector. All fossil-fuel-based production pathways include CCS. Hydrogen production technologies analysed include natural gas reforming in both a steam methane reformer and an autothermal reformer, coal gasification, offshore wind-powered electrolysers and storage of hydrogen in the form of ammonia. Furthermore, the required hydrogen transport network and the seasonal storage of hydrogen were investigated. The results of the different production routes can be compared due to similar assumptions in the report.

**CCUS Infrastructure for Clean Hydrogen in Port of Rotterdam**[15]: The Rotterdam CCUS project Porthos (Gasunie, EBN, & Port of Rotterdam Authority) aims at collecting the $CO_2$ from multiple industrial installations in the Rotterdam port area and transporting it in an open-access, public pipeline for offshore storage to a depleted gas field 25 km from the coast at a depth of around 3 km. Under the plan, around 2.5–5 Mtpa $CO_2$ from the refineries and chemical plants in the port would be captured and stored. A relatively small amount of $CO_2$ from Rotterdam industry is already being used (CCU) by greenhouse horticulture in South Holland, where it enables plants to grow faster. The Porthos infrastructure will also be suitable for transporting $CO_2$ for use by industry, if there is demand for this in the future. In February 2019, companies were invited to participate in an 'Expression of Interest' to signal their potential readiness to supply volumes of $CO_2$ into the planned public collector pipeline. As of December 2019, Porthos signed an agreement with companies ExxonMobil, Shell, Air Liquide and Air Products to work on preparations for the capture, transport and storage of $CO_2$. The capture is to take place at the companies' refineries and hydrogen production sites in Rotterdam. Transport to and storage beneath the North Sea is being prepared by Porthos. Sharing a common infrastructure between several industrial sites, the Porthos project aims to drive cost efficiencies relative to old CCS business models based on a single industrial emitter. The project was awarded CEF funding in January 2019 and has enjoyed the status of PCI since 2017. Finally, the Dutch government has put in place a financing scheme, SDE++, which is a kind of contract for differences between the current ETS price and the needed $CO_2$ price to make the project economically viable.

14 'H21 North of England' report: https://www.h21.green.
15 Rotterdam CCUS project Porthos information: https://www.rotterdamccus.nl/en/.

## Annex I – Supporting materials:

- **IOGP response to Consultation on the Energy System Integration**:
  https://www.oilandgaseurope.org/wp-content/uploads/2020/05/IOGP_Energy-Sector-Integration-__response-consultation.pdf

- **IOGP response to the Roadmap on FuelEU Maritime**:
  https://www.oilandgaseurope.org/wp-content/uploads/2020/04/FuelEU-Maritime-Paper.pdf

- **Initial views on TEN-E Guidelines**. Regulatory changes will be necessary to enable the roll-out of infrastructure for CCS and hydrogen. This paper outlines our initial feedback to the upcoming evaluation and review of the Regulation on guidelines for Trans-European Energy Infrastructure (TEN-E):
  https://www.oilandgaseurope.org/wp-content/uploads/2020/04/IOGP-initial-views-on-TEN-E-guidelines-paper.pdf

- **New and old CCS projects in Europe**: CCS failed to live up to its potential during the previous investment cycle (2009-2015). This paper outlines what has changed since then in terms of regulatory context and the development of new business models for CCS, making the case for CCS as a key component in reaching the EU's long-term climate objectives:
  https://www.oilandgaseurope.org/wp-content/uploads/2020/04/New-and-old-CCS-projects-in-Europe-paper.pdf

- **Policy matrix: key recommendations on CCS in the current and future EU legislative framework**: This document provides an overview of existing EU legislative measures, highlighting for each of them the key changes needed to enable the development of CCS in Europe at larger scale:
  https://www.oilandgaseurope.org/ccs-in-the-current-and-future-eu-legislation-paper/

- **Factsheet - NECPs**: IOGP assessed the final National Energy & Climate Plans (NECPs) of EU Member States. The factsheet shows what role Member States see for exploration and production, the use of oil and gas, and CCS and hydrogen technologies in the 2030 perspective:
  http://www.oilandgaseurope.org/wp-content/uploads/2020/04/NECPs-Factsheet-v2.pdf

- **IOGP coordinated report 'The potential for CCS and CCU in Europe'**: The 31st Madrid Forum invited IOGP to coordinate a report on the potential of Carbon Capture and Storage (CCS) and Carbon Capture and Utilisation (CCU) technologies, including technical, economic and public acceptance considerations, working with all interested stakeholders.
  A Taskforce composed of interested stakeholders was subsequently established, and this group began regular discussions, including on current regulatory barriers and incentives.
  https://ec.europa.eu/info/sites/info/files/iogp_-_report_-_ccs_ccu.pdf

- **IOGP CCS Map** which provides An overview of existing and planned Carbon Capture and Storage facilities in Europe
  http://www.oilandgaseurope.org/wp-content/uploads/2020/02/IOGP_Map-of-EU-CCS-Projects.pdf

- **The Hydrogen for Europe pre-study** has been undertaken with the purpose of assessing current knowledge about the potential hydrogen has to decarbonise the European economy.
  http://www.oilandgaseurope.org/wp-content/uploads/2020/01/IOGP_Hydrogen-for-Europe-Final-report-of-the-pre-study_reportstudy.pdf

**Registered Office**: City Tower, Level 14, 40 Basinghall Street, London EC2V 5DE, United Kingdom
T +44 (0)20 3763 9700 / reception@iogp.org

**Brussels Office**: Avenue de Tervuren 188A, B-1150 Brussels, Belgium
T +32 (0)2 790 7762 / eu-reception@iogp.org

**Houston Office**: 19219 Katy Freeway, Suite 175, Houston, TX 77094, USA
T +1 (713) 261 0411 / reception@iogp.org

www.iogp.org
www.oilandgaseurope.org