# Gas In The European Union – An Unpredictable Future?

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The Abdullah Bin Hamad Al-Attiyah International Foundation for
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# INTRODUCTION

## THE EU'S UNCERTAIN GAS MARKET: WILL RENEWABLES TAKE OVER?

Although natural gas consumption spiked in 2018-19, while domestic production declined, reflecting EU's growing import dependence, EU policymakers suggest that gas will not play a satisfactory role in the decarbonisation process, urging the need for electrification and renewable gases.

At the same time, new pipelines and LNG terminals are reshaping gas supply to the bloc and facilitating the replacement of coal. This poses the questions: how will natural gas contribute to the EU's future energy mix, how much and where?

## Energy Industry Report

This research paper is part of a 12-month series published by the Al-Attiyah Foundation every year. Each in-depth research paper focuses on a prevalent energy topic that is of interest to the Foundation's members and partners. The 12 technical papers are distributed in hard copy to members, partners and universities, as well as made available online to all Foundation members.

# EXECUTIVE SUMMARY

- Gas demand in the EU is expected to decline by 2040 but domestic production will plunge even further, raising required imports.
- Russia will further increase its role as the primary external supplier to the EU, followed by the US (as LNG).
- New pipeline projects, including the Trans-Adriatic Pipeline, Nord Stream 2 and TurkStream, change supply routes but do not drastically affect the EU internal gas market.
- Algeria will continue supplying southern Europe with natural gas, but at reduced volumes and contract durations.
- Renewables already produce significantly more European power than fossil fuels. Gas is replacing coal in western European power plants, but less so in central and eastern Europe.
- Gas can be “squeezed out” by renewables from power generation and to an extent buildings, but it would be difficult to do so in the industrial sector.
- The European gas business and industries have recently begun to show more interest in decarbonised gases (hydrogen, synthetic methane and biogas/biomethane).
- The current share of renewable gases in the energy mix is still very limited and, thus, would require the adoption and implementation of support schemes.

## IMPLICATIONS FOR LEADING OIL AND GAS PRODUCERS

- The pressure on EU gas suppliers and consumers is to move from fossil-fuel gas to decarbonised types.
- Governments need to introduce standards focused on low-carbon gas as well as incentivise the use of low carbon forms of gas.
- European countries must evaluate the investment needs for gas infrastructure as to preserve its energy security and, in the meantime, to achieve environmental objectives.
- Renewable gases’ producers need to improve the waste management process and reduce the overall costs of biomethane. But feedstock constraints may limit its overall potential in Europe.
- Current gas/LNG suppliers to Europe need to cut their greenhouse gas footprints in the near term and consider a shift to decarbonised gases in the longer term.
- A carbon footprint benchmark for EU gas imports would favour cleaner producers, but a border tax on countries with no carbon pricing policy might challenge Qatar’s LNG exports to the EU.
- Gas users in the EU will eventually have to implement decarbonised gases and/or carbon capture, use and storage (CCUS) technology.

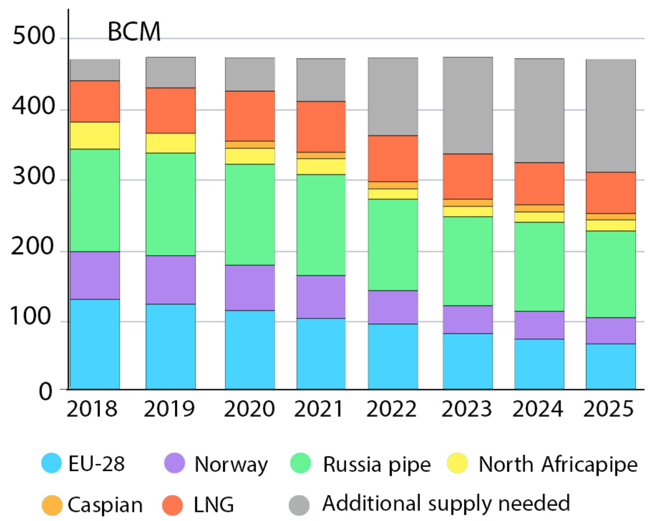
## RUSSIA WILL REMAIN THE LARGEST GAS SUPPLIER TO THE EU

As coal and nuclear are retiring in the EU, gas production declining, and around 100 BCM of long-term contracts expiring by 2025, additional gas imports to meet 33% of expected consumption are likely (A major influence on this is the shutdown of the Netherlands' giant Groningen field by 2022 due to earthquake concerns, reducing European production by 54 BCM compared to 2013.

(FIGURE 1[i]). By 2025, the additional supply requirements stand at 162 BCM and 386 BCM by 2040[ii]. A major influence on this is the shutdown of the Netherlands' giant Groningen field by 2022 due to earthquake concerns, reducing European production by 54 BCM compared to 2013[iii].

In Q2 2019, Russian pipelines supplied 45% of imports to the EU, while Norway and LNG (from various ¬sources) delivered 25% each along with pipeline imports of 5% from North Africa (Algeria and Libya).

FIGURE 1 ADDITIONAL SUPPLY REQUIREMENTS IN THE EU AFTER DOMESTIC PRODUCTION AND CONTRACTED IMPORTS, 2018-2025




Russia provides the EU with massive pipeline gas volumes, while its exports via LNG are lower but set to increase. Due to the limits in import infrastructure, with half of its pipelines operating at peaks above 80% on a monthly basis, Russian imports are constrained if Ukrainian infrastructure is not available.

In the long run, Russia is expected to remain the main source of gas in the EU, and Gazprom is investing to produce another 250 BCM by 2025 (not all to the EU: part is covering declines in existing fields, and part will supply China).

Gazprom announced the launch of the Nord Stream 2 pipeline to Germany by end-2020, with almost 100% construction completion, though this has been held up by US sanctions on pipelaying. TurkStream was inaugurated in January 8, 2020, bringing additional volumes from Russia to Turkey and on to south-eastern Europe. Both pipelines replace transit through Ukraine, but Russia will still need to use some Ukrainian capacity. At the end of 2019, a five-year deal was reached for continuing flows through Ukraine.

Although Algeria's natural gas balance is fragile, raising uncertainties about its ability to maintain its current position as a strong EU gas supplier, the newly renewed contracts with Southern Europe signify that the country will still play a role as gas supplier to the EU (TABLE 1). It is estimated that Southern Europe will remain reliant on Algerian gas exports until at least 2030.

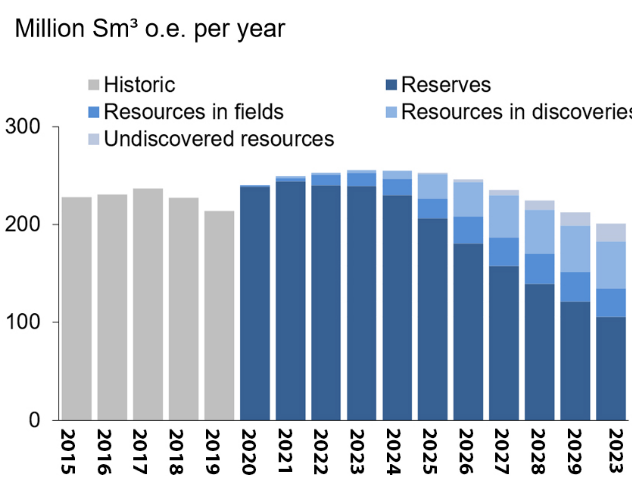
# RUSSIA WILL REMAIN THE LARGEST GAS SUPPLIER TO THE EU

TABLE 1 ALGERIA – SONATRACH'S RENEWED GAS EXPORT CONTRACTS (JULY 2019)

| Company | Renewal date | Duration (yr) | Vol. BCM/y | Export mode |
|---|---|---|---|---|
| Enel (Italy) | 26/6/19 | 8-10 | 3 | Pipeline |
| Galp Energia (Portugal | 11/6/19 | 10 | 2.5 | Pipeline |
| Eni (Italy) | 6/5/19 | 8-10 | 9 | Pipeline |
| Botas (Turkey) | 04/9/18 | 5 | 4.4 | LNG |
| Naturgy (Spain) | 14/6/18 | 9 | 9 | Pipeline |
| **Total vol** | | | 27.9 | |

The renewal of contracts is reduced given Algeria's constrained gas supply (FIGURE 2). Algeria included hub indexation as well as offtake flexibility to its contracts to advance its gas's competitiveness, but the terms of the contracts are still uncertain[iv].

FIGURE 2 ALGERIA'S GAS BALANCE: 2019 - 2030




Norway's gas production is estimated to decrease from 122 BCM in 2018 to 90 BCM between 2030 and 2035[v]. According to Wood Mackenzie, it is expected that Norway will continue to pursue a strategy focused on value over volume, which requires withholding gas sales from markets when prices are low. This reduction will occur mostly at Equinor's giant Troll field, with Total and Shell likely to follow the same pattern. The reduction is expected at 4 BCM from different flexible fields (FIGURE 3)[vi] . The Baltic Pipe will be operational by 2022 and will carry gas from Norway to Denmark, Poland and other neighbouring countries, diversifying northern Europe's options.

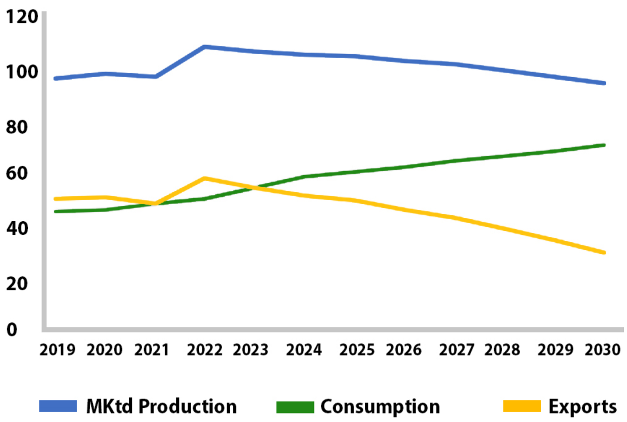
The Southern Gas Corridor was intended to bring supplies from the Middle East and Caspian/Central Asia. The construction of the Trans Adriatic Pipeline (TAP) was completed and tested in December, with operations likely starting in 2H 2020. TAP connects to the Trans-Anatolian Pipeline from Azerbaijan through Georgia and Turkey, and will bring that gas to Greece, Albania and Italy. However, more ambitious plans to bring in additional gas through this corridor from Azerbaijan, Turkmenistan, Iran and Iraq will likely be limited by political barriers, insufficient new reserves in Azerbaijan, and difficult economics of long-distance transport when EU border prices are low.

The East Mediterranean has been touted as a possible growing supplier to the EU due to new deepwater discoveries in Egypt, Israel and Cyprus. Egypt's gas production rebounded to 6.66 bn cfd (the second highest on record) and LNG exports jumped to an 8-year high, 1.02 bn cfd, in November 2019[vii], because of development of the giant Zohr field. Egypt could also re-export Israel's gas to Europe through the underutilised Idku and Damietta LNG plants (discussed recently by the Israeli Energy Minister Yuval Steinitz.[viii] ) However, a planned East Med pipeline to Greece looks expensive and new LNG plants will struggle to be competitive, while political problems make a pipeline route through Turkey unlikely. This will limit the ability of the Eastern Mediterranean countries to export to the EU.

LNG imports are expected to increase, with growing suppliers including the US in particular, along with north-west Africa (Mauritania/Senegal), Qatar following its 2024-27 expansion, Russia from the Arctic-2 liquefaction project, and possibly Nigeria LNG's Train 7. More EU countries (Germany, Ireland, Lithuania, Croatia and others) will develop/increase their regasification capacity.

The expansion of renewables and energy efficiency are not the only factors that determine the future of gas. The level of internal market integration determines the flow of gas throughout the EU countries.

FIGURE 3 PRODUCTION HISTORY AND FORECAST DISTRIBUTED PER RESOURCE CATEGORY, 2015-2030




The internal market in the EU is functioning at a reasonable level, with 75% of gas consumption in a competitive liquid market, where supplies can be easily redirected across borders.

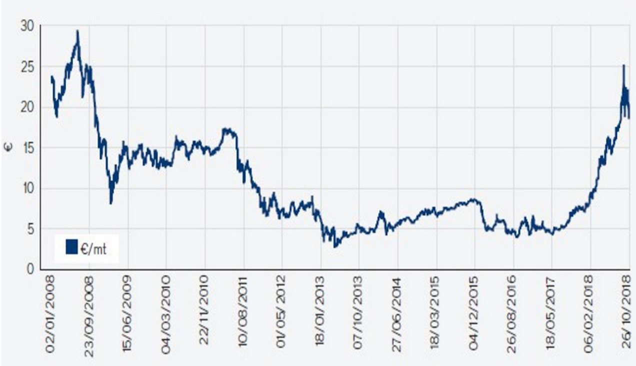
However, further development is required in a few areas (i.e. 40% of the Europe's LNG regasification capacity is not accessible by neighbouring countries, especially those in central and southeast Europe). Other challenges are related to sequencing of pipelines (Bulgaria-Serbia without Greece-Bulgaria); coordination between LNG regasification terminals (Greece and Croatia terminals require interconnectors to distribute to other markets); small market size; and political resistance hampering interconnectors' progress[ix]. Small pipelines need to be expanded if they are to support the transition to renewable gases in the future, while the low-calorific gas system in the Netherlands, Germany, Belgium and France needs to be reconfigured or converted to deal with the shutdown of Groningen[x]. Thus, if these gaps are not addressed, more countries will turn to other sources of energy to provide feedstock for their power generation needs.

Due to the global LNG supply glut, and as LNG prices achieved a level of convergence between Europe and Asia, they enabled a massive LNG influx to the EU. In Q2 2019, Europe's LNG imports went up by 102% YoY, accounting for 25% of total gas imports and becoming the EU's second gas import source in April and May, after Russia and ahead from Norway, temporarily. Even after the winter of 2019/20, storage was 63% full[xi], suggesting limited capacity to absorb more during the summer. Qatar continues to be the main exporter of LNG to Europe, raising its share to 30% in the EU's total imports in Q2 2019, while Russia's share stood at 19%, and the US at 12%. Russia is expected to account for one third of the EU's LNG supply till 2040.

In the first half of 2019, the EU hit a ground-breaking 19% YoY fall in coal-fired power generation, with a 22% decline in Germany and up to 79% in Ireland, representing less than 2% of Ireland and France's electricity generation, while the UK shut down all of its coal power plants in May[xii]. This fall is mainly due to the low price of gas, and the EU's emissions trading system, with the carbon price rising from 5 to 25 Euro ($27.5) per tonne of $CO_2$ (FIGURE 4), forcing coal plants to close. Meanwhile in Central and Eastern Europe, this decline is smaller due to the limited gas import capacity and low levels of solar and wind installations.

As carbon prices increased, with gas prices averaging between $3.2-4 MMBtu, the EU has seen a transition from coal and lignite (419.6 TWh of generation in 2019, down 198 TWh from 2015) to natural gas (500.5 TWh, up 234.8 TWH from 2015).

FIGURE 4 EU CARBON ALLOWANCES PRICE 2008-18 [xiii]




Meanwhile, renewables extended their lead as the largest power producer in the EU, generating 1029.1 TWh in 2019 (15.5% from hydro, 13.9% from wind and the rest from solar, biomass and waste[xiiv]. The cost for developing new solar PV, onshore wind, biomass or geothermal energy is below $0.10 per kWh, followed by offshore wind at an approximate $0.13 per kWh, though these are falling rapidly[xiv].

However, the shift to gas-fired power generation is considered a short/medium-term solution for countries moving away from coal. Up until 2030, the demand for gas in the EU is expected to remain stable or decrease slightly, as renewables replace coal and efficiency measures lower building heating requirements. Gas has the potential to support variable renewables to create more flexibility in the power sector. The new ETS target is 40% greenhouse gas emissions' reduction below the 1990 levels by 2030 [xivi], which cannot be met solely by cutting coal.

## LONG-TERM EU GAS DEMAND DEPENDS ON CLIMATE AMBITIONS AND GAS DECARBONISATION

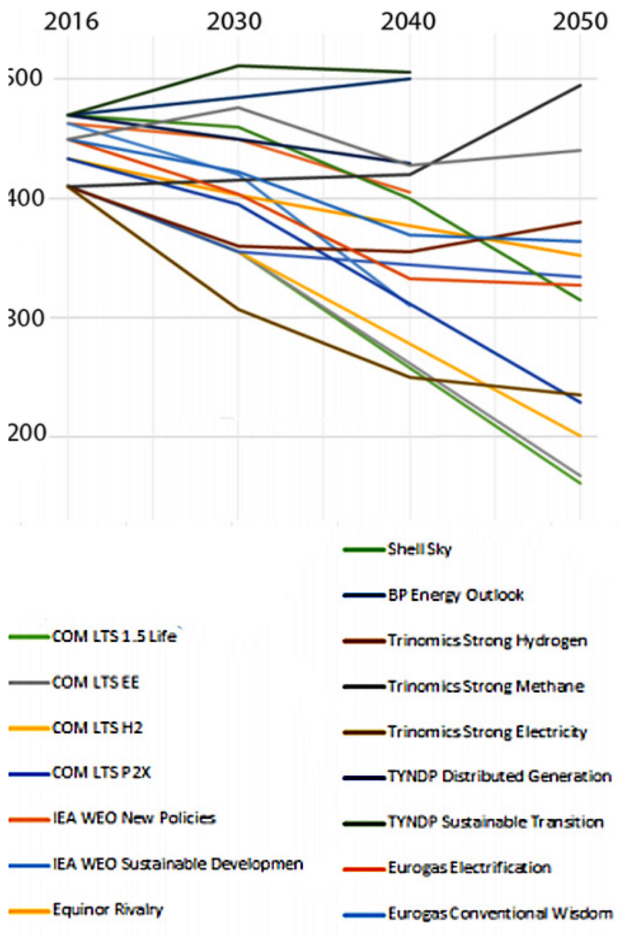
Gas demand for 2050 is even more contingent upon the EU's greenhouse gas emissions target. That is, the stricter the assumed target, the more likely demand for gas is to decline (Additionally, the EU is discussing plans for a carbon border tax on imports from countries that apply no carbon price domestically, the decision of which will be announced late 2020 or early 2021. There is also discussion of a carbon footprint standard for gas imports and domestic production. At the moment, Qatar's LNG and Norway's offshore gas would be among the cleanest sources to the EU and they would gain from such a measure, while Russia, Algeria, Libya and the US (high methane leakage and flaring) would lose out. Apart from Norway, none of the leading gas exporters to the bloc has a domestic carbon price, so in principle all would be affected, but such a policy would face major international political and WTO pressure. If implemented, it may encourage exporters to the EU to adopt their own domestic carbon prices to retain market access and keep the revenues within their own economies.

## COMPLETE ELECTRIFICATION IS CHALLENGING

This gives a range of 2050 demand anywhere from 150 BCM to about 500 BCM, i.e. a market a third of today's up to a market slightly larger than now.

Most projections show a decline in gas demand by 2040-50, although there might be increases within specific sectors (mainly industry and transport). The transport sector is the best hope for gas's future, particularly with the use of LNG in heavy trucks and marine transport as well as switching from oil products to LNG or concentrated natural gas (CNG), also reducing air pollution[xviii].

FIGURE 5 EU'S PROJECTED GAS DEMAND (BCM/YEAR) [xivii]




This overall decline is primarily attributed to energy efficiency measures along with the electrification of end-uses (industry, home-heating and cooking), which will put immense pressure on future gas demand.

For this reason, it is not advisable for gas producers to invest in large-scale gas infrastructure[xiix], as all future gas demand can be supplied using the existing infrastructure. Yet the EU's plans to decarbonise contradict its recent vote to fund 55 new natural gas infrastructure projects.

## COMPLETE ELECTRIFICATION IS CHALLENGING

This clash has become more evident as the EU developed the Green Deal Investment Plan in December 2019, aiming to achieve carbon neutrality by 2050. The European Investment Bank issued a policy to stop funding oil, gas and coal projects by 2021, cutting €2bn of finance. Under this policy, any project applying for the Bank's funding will need to demonstrate an emissions intensity less than 0.25 $kgCO_2e/kWh$, which excludes coal- and gas-fired power plants. Yet, natural gas projects are still a possibility as long as CCS is implemented, heat and power generation are combined, or natural gas and renewable gases are mixed[xix].

Additionally, the EU is discussing plans for a carbon border tax on imports from countries that apply no carbon price domestically, the decision of which will be announced late 2020 or early 2021. There is also discussion of a carbon footprint standard for gas imports and domestic production. At the moment, Qatar's LNG and Norway's offshore gas would be among the cleanest sources to the EU and they would gain from such a measure, while Russia, Algeria, Libya and the US (high methane leakage and flaring) would lose out. Apart from Norway, none of the leading gas exporters to the bloc has a domestic carbon price, so in principle all would be affected, but such a policy would face major international political and WTO pressure. If implemented, it may encourage exporters to the EU to adopt their own domestic carbon prices to retain market access and keep the revenues within their own economies.

### THERE IS STILL A LONG-TERM ROLE FOR SUSTAINABLE ENERGY GASES

The transition to a carbon-neutral future requires a system that (1) overcomes the difficulty of finding publicly accepted and appropriate locations to generate vast amounts of renewable energy, (2) stores massive volumes for a long period of time to match renewable supply with demand patterns (winter peaks) and (3) transports low-carbon energy from where it was generated to where it is consumed.

For these needs, gas infrastructure offers an already established and cost-effective solution to overcome these obstacles. Gas infrastructure links distant points of production and those of consumption with low energy losses. In fact, gas cross-border transport capacities exceed those of electricity's. Likewise, the existing 550 TWh gas storage capacity in different EU countries (sufficient for three months) also exceeds electricity's 0.6 TWh, enough for less than 4 hours (October 2018 cross-border capacities). Long cold, windless spells in winter in north-western Europe would demand huge amounts of electricity storage to meet heating demand. There are also technical challenges of grid management to drive non-inertial electric heating, and deal with the sudden arrival of cold fronts. To some extent, electric heat pumps can address these challenges, but they require a massive job of retro-fitting, and become less effective at low temperatures.

Furthermore, with an existing transport capacity along with internationally expanded infrastructure, gas infrastructure can provide access to sources of renewable energy outside Europe's territory, which preserves the EU's global energy markets and avoids price divergence that can negatively impact EU's competitiveness. €30-40 billion per year can be saved if gas networks continue to be used till 2050 in eight countries (Belgium, Czechia, Denmark, France, Germany, Netherlands, Sweden and Switzerland). At an EU-28 level, using the same per capita savings assumptions, €76-125 billion per year would be saved by 2050[xxi].

Synthetic methane/biomethane can be used in existing natural gas grids without problems. 5-15% hydrogen by volume can probably be blended into natural gas without major modifications to pipelines[xxii] and appliances . Higher levels can cause problems with leakage, increased ignition risk, and pipeline cracking. In January 2020, the UK began using hydrogen in a natural gas grid for the first time, at 20% concentration at Keele University. UK appliances sold after 1996 are already required to be able to run on 23% hydrogen[xxii]i. Such pilots need to be scaled up quickly to build confidence in the technical and economic viability of hydrogen.

As decarbonisation advances, the future of natural gas in the EU is highly determined by the ability of markets to deliver other types of gas with lower emissions reliably.

Gas in power and industry can be decarbonised by employing carbon capture and storage (CCS, or CCUS including 'use and storage'). CCUS is also required for the production of 'blue hydrogen'. Whether hydrogen (or other synthetic fuels such as ammonia or synthetic methane) is produced within the EU or imported, the EU is likely to require that it have a low carbon footprint.

Equinor stresses that without new CCS developments, we should require an additional 9% increase in wind and solar and further energy efficiency measures to be able to compensate. Also, without such technology, reaching the Paris Agreement target of no more than 2°C warming would be twice as expensive. However, the adoption of CCS can only be possible if the carbon price is raised to encourage gas producers and consumers to implement it. The main European countries with established and planned CCS projects are UK, Norway, Netherlands, Sweden, France, Belgium and Ireland (FIGURE 7) .

CCUS, though, cannot address gas used in buildings and transport, where the small point sources would not make capture viable. For these, any gases used either have to be decarbonised, or be renewed with a zero-carbon footprint over the life-cycle (made from bio-feedstocks or atmospheric $CO_2$).

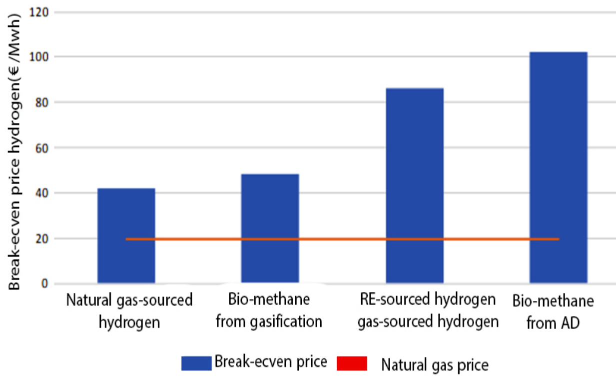
A distinction can be made between renewable gases (hydrogen made using renewable electricity; biogas; biomethane) and decarbonised gas (hydrogen from any source including natural gas reforming with CCS; synthetic gases made from atmospheric carbon dioxide; as well as biogas and biomethane). The two categories overlap but are not identical. Decarbonised gases have the attraction of using the existing gas infrastructure (with some modifications for hydrogen). Synthetic methane and electrolytic hydrogen can be storage media for surplus renewable energy.

In the wholesale market, the current production costs of various renewable gases range from 2-5 times the present price of natural gas. This will make it difficult for renewable gases and hydrogen to enter the market without serious institutional and policy support. The potential for renewable gases produced by anaerobic digestion and gasification is estimated at 75 BCM per year in Belgium, Germany, France, Italy, Netherlands, and UK, while EU-28's total potential is estimated at 124 BCM per year[xxv], compared to current production of about 1.5 BCM of biogas and 1.94 BCM of biomethane, a tiny fraction of the continent's natural gas consumption. The long-term potential is about a quarter of the EU's current consumption, and this full potential is probably not economically achievable. So, without imports, renewable gases from biological sources would only support a European gas market much smaller than today's. The IEA estimates that 15% of gas in China and the EU by 2040 will be low-carbon gas[xxvi].

European hydrogen demand today is about 25 BCM of natural gas equivalent. Renewable electricity-sourced hydrogen from spare generating capacity would raise hydrogen supply to 18 BCM by 2050. This volume can be expanded with the help of solar and wind resources along with electricity or hydrogen imports from outside Europe, which can potentially supply the continent's demand for hydrogen estimated at 157 BCM by 2050. Two main determinants of this potential supply are the electricity demand and the future development of renewable electricity. The demand for decarbonised gases is contingent upon the level of $CO_2$ emissions target that the EU is setting (FIGURE 8 annexed), but also on level of deployment of CCS, and on policy measures to establish the required infrastructure and markets.

Currently, low-carbon hydrogen is costly, at a minimum of $12-25 per MMBtu (with natural gas prices, at the time of writing, having fallen to around $3 per MMBtu and long-term LNG prices around $6 per MMBtu). The IEA expects the cost of hydrogen to drop by 30% by 2030 as renewables' cost falls and hydrogen production ramps up. The most common way to produce hydrogen is Steam Methane Reforming (SMR), which is a technique that produces H2 from natural gas. H2 can also be produced from water electrolysis (H2O). The natural gas-sourced hydrogen and renewable electricity-sourced hydrogen's break-even price is around EUR 40-85 per MWh (FIGURE 6). In the case of natural gas-sourced hydrogen, the upgrading of methane from hydrogen would be inefficient owing to the associated energy losses[xxvii]. Major hydrogen projects in the EU are located in Germany (Auto-Stack-Sub Project 1; Auto-Stack Core-Sub Project 1), UK (AutoRE-Sub Project 1; Alkammonia-Sub Project 1) Denmark (Asterix3-Sub Project 1) and Italy (Artiphyction-Sub Project 1)[xxviii].

FIGURE 6 BREAK-EVEN PRICE FOR HYDROGEN AND BIO-METHANE PER MWH BY TECHNOLOGY




Biomethane's cost is slightly lower than hydrogen at $10-22 per MMBtu. This cost can be reduced with efficient waste management to about $10-17 per MMBtu[xxix]. However, the reductions will not be equivalent to those of solar and wind power.

EU leaders signed off on a climate neutrality pledge to be reached by 2050, rejecting natural gas as a transition fuel and stressing the role of renewable gases as critical to carbon neutrality[xxx]. This does not, however, imply that natural gas has reached its end, as hydrogen and biomethane will, in the EU plan, account for 30% and 70% respectively of total gas use by 2050.

# CONCLUSIONS

There is a sharp divergence between estimates of the EU's gas demand out to 2040, and the levels required by decarbonisation. The IEA's figures imply an additional 386 BCM by 2040, replacing declining domestic production and expiring import contracts. This poses a challenge for policymakers and gas companies considering new infrastructure. But with the completion of Nord Stream 2 and TurkStream, major external pipelines to the EU are probably adequate to maintain expected supplies of Russian and other gas. Further internal interconnections, and new LNG terminals, continue to be required and/or justified on the grounds of security of supply and diversity.

Coal-to-gas switching has substantially reduced emissions in western European countries such as the UK, but still has a long way to go in eastern Europe. At the same time, renewables are making inroads into the market for gas in power. For external suppliers, European policy will make it increasingly hard to export high greenhouse-gas footprint fuels to the EU. Such suppliers will be encouraged to clean up their production and transport processes, implement national carbon markets or taxes (possibly linked to the EU ETS), use offsets, and eventually introduce a larger share of decarbonised gases to their exports. Gas exporters who cannot meet EU specifications will have to look for other markets, a big challenge for countries such as Algeria without ready access to alternatives.

Full electrification of industry and buildings will be very challenging, so there is still a major potential role for decarbonised gases, including hydrogen, and/or natural gas with CCS. However, the required infrastructure will not be built without large commitments by the gas industry, backed up by government policy and strategic funding.

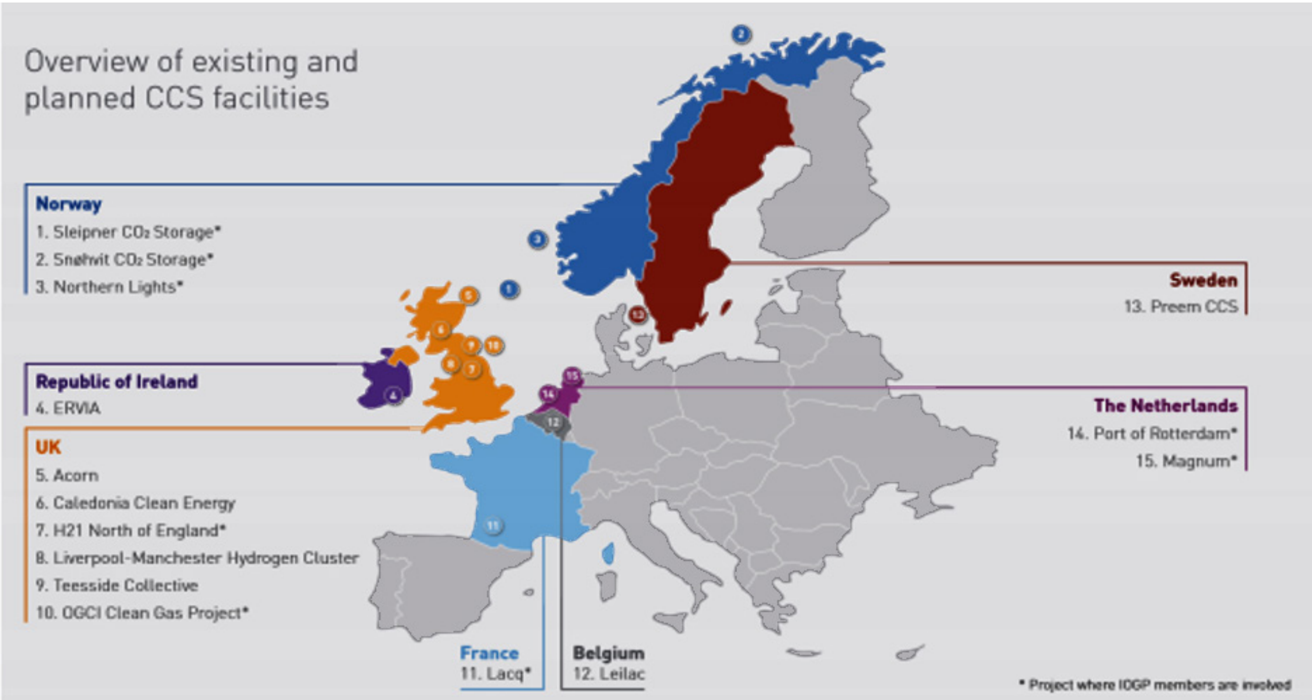
Despite their substantial production potential in Europe, renewable gases are not likely to gain significant market share unless they receive adequate support. The cost difference between natural gas, LNG and renewables gases is very likely to impede low-carbon gases' competitiveness and market entry in Europe. Biomethane and hydrogen's production capacity is rising, but not at the level required to supply a level of demand close to today's. The estimated European potential for biomethane should be viewed with scepticism because of cost and land-use challenges.

Even for this, EU policymakers would have to set renewables gas targets by 2030 and 2050, with biomethane set to reach 10% by 2030 and between 30-50% by 2050. Standards for renewables gases at a European level can include rendering certificates for the Guarantee of Origin (GOs) interchangeable between EU countries while guaranteeing compatibility with the Emissions Trading Scheme (ETS).

Biogas, biomethane and hydrogen from SMR with CCS are relatively mature technologies, while hydrogen from electrolysis has more room for improvement. But it is hard to justify any of them as infant technologies requiring special support. Government and the gas industry may have to invest in some key pieces of infrastructure, such as upgrading natural gas networks and appliances to use hydrogen. Otherwise, decarbonised gases will have to justify their adoption via a carbon price, and compete on cost with alternatives, the main one being electricity for heating and cooking.

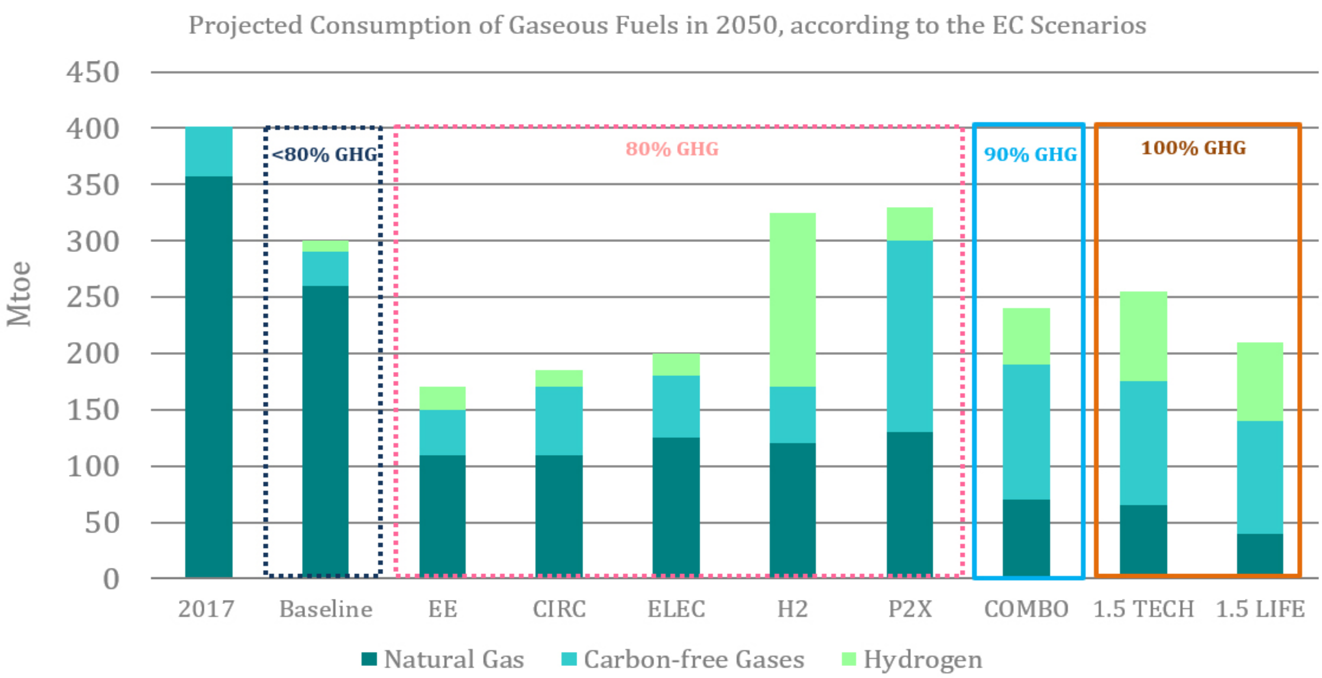
The reshaping of the European gas market is a massive challenge for the domestic gas business and for external suppliers. It is also a test-case for the future of gas in an overall decarbonising world.

FIGURE 7 OVERVIEW OF EXISITING AND PLANNED CCS FACILITIES IN THE EU




Russia, Norway, Qatar, the US, Algeria and other suppliers are pursuing quite different approaches. Partnerships with European companies and governments will be essential for them to capitalise on the evolving European gas scene while avoiding massive stranded investments.

FIGURE 8 PROJECTED CONSUMPTION OF GASEOUS FUELS IN 2050, ACCORDING TO THE EC SCENARIOS



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# OUR MEMBERS

Currently the Foundation has over fifteen corporate members from Qatar's energy, insurance and banking industries as well as several partnership agreements with business and academia.

**Our partners collaborate with us on various projects and research within the themes of energy and sustainable development.**

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