ViewPoint

Destination Gas: securing a role in a decarbonised Europe

Gas Strategies

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Introduction

Natural gas network businesses were long regarded as akin to government bonds: a low-risk investment with an assured long-term stream of revenue, underpinned by predictable utilisation, stable price regulation and planned network expansions. The need to move to a low-carbon energy future has undermined this assurance and predictability and left businesses facing new uncertainties – particularly in Europe where the decarbonisation agenda is being pushed most strongly.

This raises fundamental questions about the future of gas transmission and distribution businesses:

- *Will gas networks be required at all in future?*
- *Which gases will networks be transporting: natural gas, hydrogen, bio/synthetic methane – or some mixture of these?*
- *What should shareholders be looking for from the management of their gas network businesses to give them confidence in future profitability and value?*
- *How should shareholders assess and price the risk of owning gas network businesses in the current environment?*
- *How will different competing future outcomes for a low-carbon energy system resolve and what should the network operators and their shareholders be doing today to be ready for and influence the outcome?*
- *What do consumers want, and will they be willing to pay?*
- *How does the regulatory model need to change to facilitate the energy transition?*

These questions imply a significant threat to the value of gas network businesses and a requirement for these businesses to be ready to change; potentially quite radically.

This paper does not seek to answer all of these questions but rather to identify the critical uncertainties and challenges facing gas network businesses from the decarbonisation process, and identify some of the responses shareholders should be seeking to protect business value.

Gas and gas infrastructure is not guaranteed a role in the future energy mix, with a variety of alternative technologies being developed to meet future low carbon energy needs. Despite the perceived benefits of gas it may be leapfrogged by new technology working to a different business model unconstrained by its legacy business.

Recent history does not bode well for the likelihood of Europe's gas network businesses being able to change and adapt rapidly to a new reality; some of Europe's energy giants have lost billions of Euros in value as they have sought to adapt to the triple challenge of liberalisation, recession and renewable generation, and even today face uncertain futures. Why will gas network businesses – thus far protected by regulated returns – be different?

Looking to governments and regulators for support – even if an economic case for "decarbonised gas" can be made – is unwise. Governments and regulators have not demonstrated a willingness to take a lead in mapping out the future of energy over the last 20 years leaving it instead to consumers, suppliers and network operators.

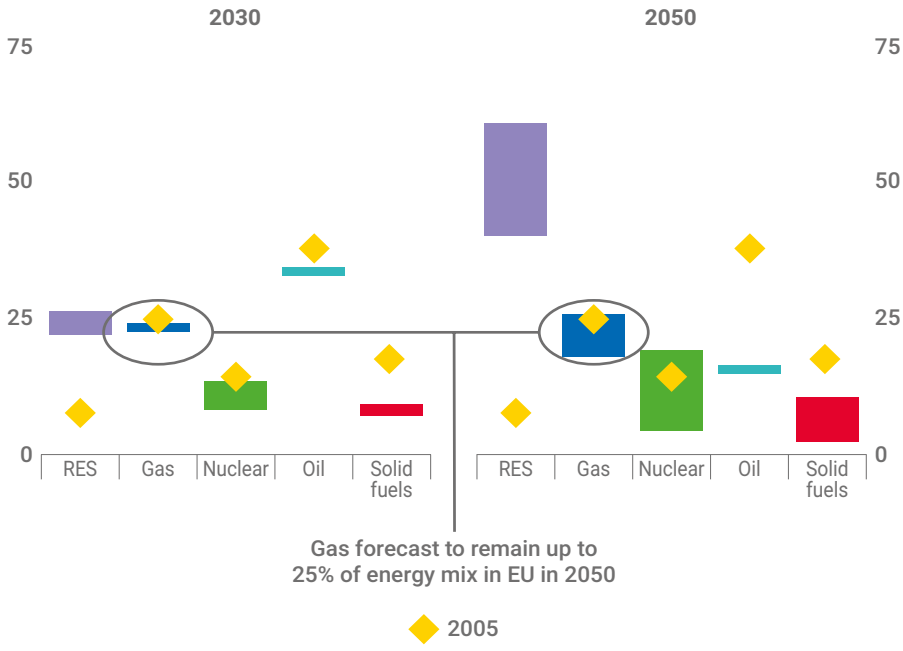
The regulatory model is no longer fit for purpose; designed to control prices and drive access to existing infrastructure, it is ill suited to enable the wholesale change and investment in the energy system that will be required to decarbonise. Changing the model will require governments

and society as a whole to recognise that gas has an essential role to play in the future, that to play that role gas networks will need to adapt and invest and that they will need to do so in collaboration with suppliers, customers and electricity network operators. Regulators may even need to recognise and enable the business models of networks to change to reflect a more interconnected distributed and digital world where the boundaries between network operator, gas supplier and customer may not be as clear cut as they once were.

Despite the need for business change, the complexity and competitive threat, the investment requirement and the need for regulatory reform, gas still has a good chance of becoming a part of a zero-carbon energy system.

As yet, insufficient research has taken place to map the pathway from the fossil gas present to the fossil free future but gas network businesses and their investors need to wake up other stakeholders to the importance of gas because almost all scenarios – not least those of the Intergovernmental Panel on Climate Change (IPCC) and indeed the EU's own projections – include it as a crucial part of the energy mix to 2050 and beyond.

Figure 1 EU decarbonisation scenarios – 2030 and 2050 range of fuel shares in primary energy consumption compared with 2005 outcome (%)



Energy Roadmap 2050, European Commission, 2012, pg. 6

1 The Decarbonisation Debate Today

The decarbonisation debate has moved on, even in the months since our previous Viewpoint, "The Challenge for European TSOs: Transporting Natural Gas in a Decarbonising World" was published in May 2018.

The release, in October 2018, of the IPCC's special report on the impacts of global warming of 1.5°C above pre-industrial levels[1] has brought the effect of fossil fuels on the planet sharply into focus. This will be further underlined at the upcoming COP24 meeting in Katowice in December at which it is intended that governments agree the implementation plan for the emissions reduction targets set at COP21 in Paris. Whatever countries have done to date to curb emissions (and some successful actions have been taken) is clearly not seen by the IPCC as sufficient.

The IPCC's special report, October 2018

The IPCC report warns that there are only twelve years for global warming to be kept to a maximum of 1.5°C. Carbon emissions would need to be reduced by 45 per cent from 2010 levels by 2030 and to around net zero by 2050. The IPCC report's scenarios or "pathways" to achieve this target include (for the world) the following targets to be met by 2050:

- The great majority of electricity (70-85%) coming from renewable sources.

- The use of coal reducing sharply to close to 0% (0-2%) of electricity.

[1] *Source: IPCC - Intergovernmental Panel on Climate Change.*

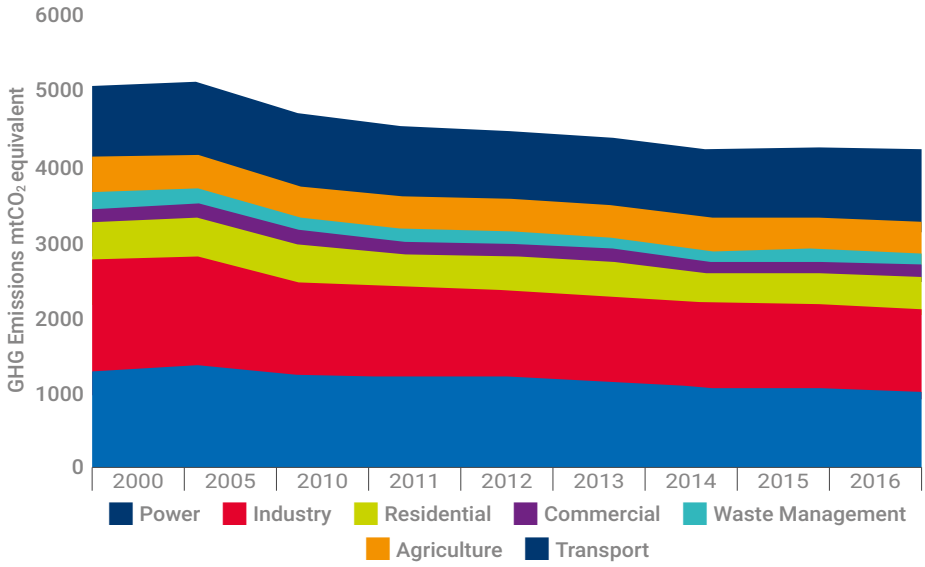
- Gas supplying 8 per cent of electricity when coupled with carbon capture and storage (CCS).

- 75% - 90% reduction in emissions from industry and very significant reductions in emissions from buildings and transport.

Greenhouse Gas Emissions: The Current Position

The scale of carbon emissions reductions proposed by the IPCC report represents a radical shift from the past. In the years from 2000-2016, there has been only a 1.1% compound annual reduction in greenhouse gas emissions by the 28 countries of the European Union (EU28), according to the European Environment Agency. Much of this reduction occurred in the years following the global financial crisis in 2008, since when overall emissions have changed little.

Figure 2 EU 28 Greenhouse Gas Emissions 2000-2016 eCO_2



Source: https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer

Progress in reducing GHG emissions has been piecemeal. There have been some successes – the compound annual growth rate (CAGR) from 2000-2016 in emissions from power in the UK is -4.1%, for example, while the CAGR over the same period in emissions from transport in Italy is -1% (an achievement as the EU overall has seen an increase in transport emissions) – but these are small victories. The dates at which each European country's national decarbonisation strategies were launched varies by up to a decade, there is minimal agreement on the approaches adopted, and no substantive European-wide approach to the technological advances required to produce zero carbon energy.

Divestment

The pace of change has been slow – for some people, too slow. Since 2011 there has been increased momentum behind a campaign for divestment from fossil fuels as part of a transition to clean energy from both the private and public sector. It is estimated that nearly 1,000 institutional investors with $6.24 trillion in assets have committed to divest from fossil fuels, up from $52 billion four years ago[2]. The primary drivers of this recent growth are insurers, pension funds, and sovereign wealth funds. The public sector too has made announcement and set out policies to reduce its exposure to fossil fuels.

[2] *The Global Fossil Fuel Divestment and Clean Energy Investment Movement, Annual Report 2018.*

Divestments From Fossil Fuels: *Actions By Legislators*

In 2017, the European Parliament passed a resolution calling "….on governments and public and private financial institutions, including banks, pension funds and insurance firms, to make an ambitious commitment to aligning lending and investment practices with the global average temperature target of well below 2°C, in line with Article 2(1)(c) of the Paris Agreement."

European Parliament resolution on the 2017 UN Climate Change Conference in Bonn, Germany (COP23) (2017/2620(RSP)

In September 2018 Bill de Blasio (New York) and Sadiq Khan (London) in a joint statement declared that "…in both London and New York – we are taking all possible steps to divest our city pension funds from fossil fuels" and further called "on other cities to stand with us to divest their assets from fossil fuel."

Guardian, 10th September 2018

Divestments From Fossil Fuels: *Actions By Investors*

Danish Pension Fund PKA

"… with some $46 billion under asset management, [PKA stated] it has excluded 35 oil and gas companies from its investment portfolio over failure to live up to the goals of the Paris climate agreement."

Reuters, 12th April 2018

Legal & General Investment Management (LGIM)

"We have made a commitment to address climate change by engaging directly with the largest companies in the world who hold the key to meeting the 2°C Paris target. The companies will be assessed rigorously for the robustness of their strategies, governance and transparency. Companies that fail to meet our minimum standards will be removed from our Future Fund range at LGIM."

LGIM, Press Release 11th June 2018

The World Bank announced that, beginning in 2019, it would no longer finance upstream oil and gas development:

"Current projects in our portfolio would continue as planned. However, no new investments in upstream oil and gas would be undertaken after 2019, unless under exceptional circumstances as noted in the decision."

North American Energy News, 13th December 2017

Fossil Fuel Companies' Response

The trend towards divestment has been noted with concern by leading fossil fuel companies:

"…some groups are pressuring certain investors to divest their investments in fossil fuel companies. If this were to continue, it could have a material adverse effect on the price of our securities and our ability to access equity capital markets."

Shell: Strategic Report 2017

"Chevron recognizes that climate change is a growing area of interest for our investors and stakeholders. We have listened to your concerns, and we are responding."

Climate Change Resilience, a framework for decision making, Chevron March 2018

Faced with a sustained, multi-faceted attack on fossil fuels, some producers are re-emphasising the distinction between gas and other fossil fuels, and planning to reduce their carbon footprints consistent with IPCC targets.

Ben van Beurden, the Shell chief executive, is convinced that gas, which makes up a growing share of the firm's portfolio, will continue to have a role, both as a transition and a destination fuel when combined with CCS, as the world adjusts to the realities of climate control. He also emphasises a renewed commitment by Shell to the production and sale of renewable electricity.

2 Gas as a Transition or Destination Fuel – or Both?

Gas as a transition fuel

It is widely understood by policy makers that gas has a lower CO_2 footprint than other fossil fuels. Further, gas complements fluctuating power supply from renewables: gas-fired power stations (unlike coal) can switch from idle to full output within minutes when solar and wind power are in short supply. Nonetheless, there is no single European-wide policy or agreed, funded detailed plan to use gas as a transition fuel.

While gas, together with renewables and nuclear, has replaced coal in the UK and Belgium (and may act as a substitute for nuclear in transition in Belgium in the coming years), Germany has been slow to name an end date for coal, aware of the economic harm to lignite and hard coal mining regions that the elimination of coal-fired power generation would bring. Poland is proud of the central role of coal in the country – and currently has 3.2GW of new coal fired generation under construction.

Nonetheless, it seems likely that the combination of higher emissions prices (European ETS prices have averaged over €20/tonne in quarter 4 2018 versus €7.5 in quarter 4 2017) and increasingly policy action against coal will support gas' role as a transition fuel in power generation over the coming decade as governments recognise the need to act sooner rather than later to drive emissions down in line with COP 21 targets.

Figure 3 European Emission prices 2012 to 2018

Source: sandbag.org.uk

Gas as a destination fuel

Although the long-term, post transition, role that gas will play in Europe remains unclear CO_2 reduction targets make it impossible for the use of gas to continue unabated. For example, even were gas to replace all coal in the EU's generation mix it would still only bring down total CO_2 emissions by 10% of current levels – significant but nothing close to the 80% to 95% reduction on 1990 levels required by 2050.

Policy makers have begun to recognise that the all-electric future based on renewables will be technically challenging and extremely expensive to deliver. For example, Germany which through the Energiewende had been set on an electric future, was planning a total of nearly 5,000 kilometres of new transmission power lines by 2025, of which only 900 kilometres

have so far been built[3]. New overhead power lines faced citizen protests against large new pylons and their impact on the landscape; when the federal government decided to prioritise (more expensive) underground cables in 2015, it was faced with further protests because of concerns over the impact of such cables on arable land.

Difficulties such as these are prompting governments to see that using existing gas infrastructure to provide energy to industry, households, power generation and increasingly to transport could potentially offer a lower cost and sustainable alternative if the gas supplied can be carbon free.

There is no doubt that this can be achieved but there is a fundamental choice to be made; remain with methane or switch to hydrogen – and as yet there is no clear preferred pathway.

Remaining with methane limits the need to change customer appliances but requires a substantial ramp up in the production of biomethane or synthetic methane to meet demand from consumers where Carbon Capture and Storage is impossible (e.g. household boilers). By switching to hydrogen, CO_2 emissions are eliminated before arrival at the customer site, but transmission and distribution grids must be adapted to transport the gas safely and customer appliances must be replaced – a significant challenge in Europe where millions of householders have methane fuelled boilers.

It will also be necessary to generate a large volume of hydrogen (most likely through methane reformation combined with Carbon Capture and Storage) supplemented by supply from Power-to-Gas projects using electrolysis. The hydrogen solutions being considered include using natural gas produced by current supply countries (e.g. Norway

[3] *Source: https://www.cleanenergywire.org/dossiers/energy-transition-and-germanys-power-grid.*

and Russia) converting it to hydrogen at source, sequestering the CO_2 in depleted reservoirs and transporting hydrogen through existing (albeit modified) infrastructure to Europe. Other alternatives include CO_2 removal and storage closer to customers (e.g. at the entry to distribution grids) and of course large-scale Power-to-Gas projects.

All come with their own challenges and risks; in particular, if Europe switches to an all hydrogen network supplied primarily from current pipeline suppliers (Norway and Russia) it will make it impossible for Europe to access the international LNG market creating greater import dependence; unless of course a global liquified hydrogen market begins to develop.

> *"Japan's Kawasaki Heavy Industries Ltd will use a power station owned by top Australian electricity producer AGL Energy Ltd for a trial of coal-to-liquid hydrogen conversion" with the aim of testing the viability of creating hydrogen and shipping it in liquid form to Japan.*
>
> *Australia's AGL to host coal-to-liquid hydrogen export trial for Japan's Kawasaki Heavy, Reuters, 12th April 2018*

Whilst the industry is investing in studies to test the different pathways and support governments in understanding the options, they still have a very long way to go.

For example, the Gas for Climate group of leading European gas transport companies and two renewable gas industry associations (European Biogas Association and Consorzio Italiano Biogas) has commissioned a study into the future role of gas in a net-zero emissions energy system. The study concluded that it may be possible to scale up renewable gas production between now and 2050 to more than 120 bcm annually, including both renewable hydrogen and biomethane.

Other initiatives being pursued by Operators include:

Carbon Capture Utilisation and Storage and Hydrogen Networks

The H21 project envisages the conversion of the gas distribution grid in Leeds (in the North of England) to hydrogen: domestically produced natural gas or natural gas from Norway will be converted to hydrogen through methane reformation and the carbon will be sequestered in offshore caverns or depleted fields.

Fluxys, in Belgium, together with Antwerp Port Authority, is studying the feasibility of solutions for capturing CO_2 from industry in the port, transporting it by pipeline or ship and finally re-using or storing it.

Power-to-Gas

A Wind2Hydrogen pilot facility converting power from wind turbines into transportable, storable hydrogen in Auersthal, Lower Austria operated for three years until the end of 2017.

The BioCat Project in Denmark plans to design, construct and test a commercial-scale power-to-gas facility at a wastewater treatment plant.

Open Grid Europe together with electricity network operator Amprion are planning to develop the largest yet Power-to-Gas projects in Germany to facilitate the storage of surplus renewable energy – plants are expected to be the scale of 50 to 100 MW orders of magnitude larger than anything yet seen.

Biogas and Bio -Synthetic methane

Austria has over 350 biogas plants; After processing, the biogas produced is injected into the gas grid and used by consumers for electricity and heat generation.

Cadent is developing a test waste to Bio-methane plant in Swindon that takes household waste as feedstock and converts it through a pyrolysis process to synthetic methane that can be injected into the gas grid. The plant is expected to start up in 2019 and will provide enough gas to meet the needs of 1600 homes.

The Challenge for Network Operators and Investors

There are obvious weaknesses in the establishment of gas as a destination fuel. The initiatives described above can appear fragmented and sporadic, suffer from lack of funding and face regulatory hurdles before implementation.

Fragmentation
There is substantial co-operation amongst TSOs (the role of ENTSOG (the European Network of Transmission System Operators for Gas) is "to facilitate and enhance cooperation between national gas transmission system operators (TSOs) across Europe").

Nonetheless, the very different nature of each country in the EU28 by virtue of their geographic position (transit plays a much greater role in countries in Central Europe than those further west), resource

endowment (countries with significant coal reserves naturally are reluctant to swap domestic fuel for imports), and the demands of owners (municipally-owned TSOs may see a more social role with longer time horizons than those with financial investors) does mean that the individual needs, interests and activities of Operators with regards to decarbonisation are not identical.

Funding

Substantive, sustained pilot projects would require significant funds – the small Wind2Hydrogen pilot facility in Austria referred to above had a budget of only €2.8 million. To deliver projects of scale that will really test the viability of decarbonisation options will require much larger levels of investment. For example, Cadent's Hynet project (a large-scale hydrogen network in the North West of England) would cost around £900 million to implement[4]) and Northern Gas Networks H21 project which plans to convert the whole of the Leeds area gas distribution system to Hydrogen would cost £2.504 billion[5].

Similarly, CCS has been demonstrated technically but its cost is often regarded as prohibitive.

The level of funding required for major pilot projects may be difficult for many operators to do on their own and certainly in recent history they have had very little experience of investing in projects where there is no guaranteed rate of return. Operators will need to learn again how to assess and take risk, plan investment returns on the basis of rigorous scenario planning and make contingency plans for downside outcomes.

[4] *Utility Week 11 May 2018.*
[5] *https://www.northerngasnetworks.co.uk/wp-content/uploads/2017/04/H21-Report-Interactive-PDF-July-2016.*

Regulation

The key to unlocking the funding and regulatory blockages to a continued place for gas in a carbon-free Europe may rest in Brussels and with policy makers and regulators across Europe. ENTSOG is rightly making an effort to lobby the European Commission (EC), explaining the need for Power-to-Gas and other technologies, and the European Union Connecting Europe Facility may open up to Power-to-Gas.

However, small changes to regulation will not be enough; the whole model needs to be rethought from one designed to force access to networks and control prices to one which incentivises investment in the "greening" of gas. Given the complexity of the transition this will require network operators (gas and electricity), suppliers and customers all to collaborate blurring the lines between infrastructure providers and market actors.

3 How can gas secure its future?

Fragmentation, funding and regulation are all obstacles to be overcome in securing the future of gas in a decarbonised world. All the while, gas infrastructure businesses, for so long stable with large asset bases and regular revenue streams, are faced by ever increasing uncertainty.

As has been outlined above, the uncertainty is not binary (i.e. a choice between gas and electricity) but much more complex with different outcomes having very different implications for different network operators – and they are very different, by virtue of their geographic position, main business activity (transit, transmission or distribution), history and the demands of owners.

The decarbonisation of energy can be regarded as the ultimate challenge for gas infrastructure businesses to recognise that their obligations to shareholder value may not always align with a responsibility as stewards of sustaining their heritage natural gas business model. With any of the processes of change in European energy in the past 20 years, sustaining the status quo has been the appropriate course of action to a point, so long as the legacy energy player is well positioned to pivot strongly and effectively to a new world. This has applied in the case of liberalisation from monopoly to competitive markets and indeed in electricity in the reshaping to renewables from fossil fuel generation.

The legacy energy industry has generally up to now not performed strongly in protecting shareholder value through market and technology changes. It has a poor track record in performing a pivot! There is no guaranteed role for existing gas infrastructure: while the slow battle between alternative gas technologies plays out, innovations in other

energy solutions proceed without being constrained by the challenges of retrofitting to an industrial age industry approach. Mobile telephony doesn't sit on a copper wire platform.

Shareholders in network businesses are faced with the challenge of understanding for themselves whether management of their infrastructure investments have the plans, capabilities and resources to transition their organisation and asset base to a high value long term role for their infrastructure. The alternative is a significantly shorter life as the only bridge in transitioning to other energy solutions, and decommissioning.

Faced with this challenge there are some key assumptions that shareholders and investors cannot afford to make, and things that they need to ensure are happening:

Assumptions you should not make:

- Do not assume that governments and regulators will "see the light" and act to secure gas' future even if a case can be made that it provides the lowest cost solution.

- Do not assume that existing long-term planning methodologies are fit for purpose.

- Do not assume that even if your business has the right ideas and plans on how to pivot that it will be able to execute – history is littered with examples of businesses that saw the future long in advance of the competition and still failed to transform.

- Do not assume that a technology change from "gas" to another form of "gas" will not fundamentally disturb your business model.

Things you need to ensure are happening:

- Keep running safe reliable networks transporting and distributing gas for customers – maintaining the track record of reliable safe operation is essential in having a "right to play" in the energy future.

- Understand the relative value and risk of alternative policy and technology adaptions by different industry stakeholders in different countries.

- Have detailed gas flow forecasting models that integrate scenarios for power, distributed energy solutions and, critically, trans-European market developments to build robust business and contingency plans and quantify the timing and reality of business risks.

- Ensure you have a real understanding of the latest developments in the alternative energy solutions to gas, how the business models that will deliver them differ from your own and how you would need to adapt organisationally and culturally to pivot and compete.

- Prove and then communicate the long-term benefits of gas as a low/zero carbon energy source to governments, regulators and society at large.

Whatever pathway to a low or zero carbon world that Europe takes, gas network operators and their shareholders will be required to change and adapt to new realities. Being ready for these realities will not just be a question of understanding and adopting new technologies but will require a fundamental rethink of business model, rigorous analysis of gas flows and wider market developments to plan adequately for change, reform of regulation, and new relationships with other industry participants and the customer.

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