Challenges to the Future of Natural Gas: Decarbonisation and Affordability

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This article deals with two of the major challenges to the future of natural gas in global energy balances: the decarbonisation commitments which governments have signed at COP21 requiring them to progressively reduce their greenhouse gas emissions over the next several decades, and the problem of affordability of imported gas and LNG in countries where wholesale prices have historically been relatively low (below $6/mmbtu) over the past decade.

Changing the Natural Gas Narrative from Advocacy to Decarbonisation

For much of the past decade, the natural gas community has put forward an 'advocacy' position based on carbon emissions from the combustion of natural gas being 40% lower than coal and 20% lower than oil. This has been, and remains, an entirely logical position which emphasises the value of coal to gas switching and using gas to back up intermittent renewable energy, as the fastest and lowest cost way of reducing greenhouse gas emissions. However, in the carbon-centric countries of Europe (and some US states) this 'advocacy narrative' has gained little traction with governments, environmental campaigners and the media. The most important reason for this is because, as governments consider accelerating carbon reduction commitments beyond COP21 – towards achieving 'net-zero' emissions by 2050 (or earlier) – switching from higher to lower carbon sources fails to meet their requirements after 2030. The question which they are asking is not: does gas have lower emissions than coal? But rather: what are the carbon and methane emissions from gas that is being produced, imported and consumed in our countries; and how can these emissions be reduced, preferably to zero? So the challenge faced by the gas industry is to change its narrative from advocacy to decarbonisation.

In Europe, this is an immediate challenge, particularly if we make the assumption that governments in the seven major gas markets – which account for nearly 80% of European Union (EU) gas demand[1] – will remain committed to meeting (at least) their COP21 targets. Modelling studies show that in order to meet these targets, methane demand will need to remain flat or decline slightly, but the decline will accelerate in the 2030s and beyond (potentially faster if governments implement more aggressive decarbonisation).

In order for gas to fit into a convincing decarbonisation narrative, low and zero carbon gas

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[1] Germany, Italy, France, Spain, UK, Belgium, Netherlands.

projects must be developed at sufficient scale over a specific time period to fit with national COP21 targets. This will be essential to maintain natural gas markets, and hence the utilisation of natural gas infrastructure – pipelines and LNG terminals – anywhere close to current levels of demand. Most studies of the different ways that Europe can decarbonise its energy sector, suggest full electrification of energy balances – which would make redundant all gas infrastructure – would be a more technically difficult and expensive option than a combination of gas and electricity. There are a number of different categories of low and zero carbon gas projects:

- Biogas and biomethane from anaerobic digestion of waste and landfill gas;
- Hydrogen from electrolysis of renewable electricity – so-called power to gas (P2G) – which can (with the addition of CO_2) be transformed into synthetic methane (power to methane);
- Synthetic methane (syngas) from thermal gasification, or methanised hydrogen from P2G;
- Hydrogen from steam- or auto- reformed methane with carbon capture (utilisation) and storage (CC[U]S); or potentially from methane pyrolysis.[2]

While there are hundreds of operating biogas and biomethane projects in Europe, the volumes of gas produced by such projects are very small. Around 16 bcm/year of biogas is produced in Europe mainly for electricity generation. But virtually all of this is used in local networks (mainly in agricultural communities); it is not pipeline quality gas and is not injected into the natural gas network. Less than 2 bcm/year of biomethane – which is pipeline quality gas – is produced in Europe.

There are around 30 P2G projects, and 10 power to methane projects, around Europe but their capacity is extremely small. Hydrogen is produced by steam reforming of natural gas at refineries, but the CO_2 emissions are not captured or stored. If gas markets are to maintain anything close to their current size, while at the same time reducing their GHG emissions, the relatively small volumes of biogas/biomethane and hydrogen from P2G mean that, at least for the next two decades, large quantities of hydrogen would need to be produced from reformed methane with CC[U]S. But in many countries CO_2 storage is not possible because suitable storage structures are unavailable for political reasons.[3]

A major problem with all these options is that, with the exception of some local biogas projects, the gas they produce is substantially – often several times – more expensive than natural gas, particularly at 2019 prices. So in order for such projects to be commercially viable they will need significant financial support from governments either directly or through carbon taxes or prices on a scale which is not currently anticipated. The hope, and indeed the expectation, is that as these technologies make progress and become larger in scale, their costs will reduce (similar to what has been experienced with renewable energy projects); but the timescale for such cost reductions is uncertain.

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[2] Also known as methane ‘cracking’ or ‘splitting’ where natural gas is separated into hydrogen and solid carbon (carbon black).

[3] In European countries it is only possible to store carbon in offshore structures for political reasons.

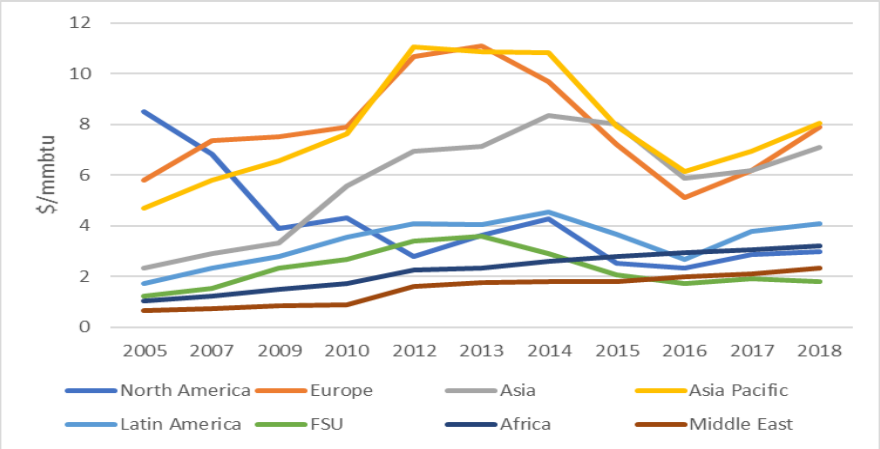
While decarbonisation presents difficult problems for all stakeholders in the gas value chain, networks face a particular problem. Producers and exporters can sell their gas around the world as LNG. Utility retailers can switch their customers from gas to electricity. But phasing out natural gas means that owners of networks face a potentially existential threat. Moreover, they are not in charge of their future as they will have to rely on other stakeholders to decide whether and when gas might be phased out, and whether or not their networks could be used for an alternative product such as hydrogen.

This decarbonisation agenda is particularly important in north west Europe, Spain, Italy and some US states. In many parts of Asia, former Soviet Union, Latin America and Africa, decarbonisation seems likely to be a much longer-term process, and the possibilities for gas, look more promising. In these countries air quality and especially affordability are more important issues than carbon reduction. This is not to say that there is no concern about carbon emissions, only that other issues have greater priority on energy and environment policy agendas.

Affordability

Affordability is particularly important in relation to imported natural gas and LNG. Fig. 1 shows wholesale prices in different regions of the world for the period 2005-18. In the 2010s, the world divides into two groups: consumers in Asia, Asia Pacific and Europe have consistently paid more than $6/mmbtu over the past decade and can be considered high wholesale price regions; all others have paid less than $4/mmbtu and can be considered low wholesale price regions. This serves as a rough guide to the profitability of LNG delivered to high price and low price markets.

Fig. 1　Wholesale Gas Prices in Different Regions 2005-18



Source: International Gas Union, *Wholesale Gas Price Survey 2019 Edition,* Figure 4.5, p.48.

If we look at individual country prices in Asia – where much of the increase in LNG imports is expected over the next two decades – we find that prices in China and some south east Asian

countries (especially Singapore and Philippines) have been substantially above $8/mmbtu while others (Pakistan, Bangladesh and Malaysia) have been at $4/mmbtu and below. One way to look at the affordability problem is that in order for countries which have been paying low prices to increase their imports of LNG wholesale prices will need to rise, or their governments will need to subsidise imports. Another way to look at this problem is that, if low prices markets are to become profitable destinations for much larger volumes of LNG, project developers will need to reduce the cost of delivery to those countries.

Summary and Conclusions

As decarbonisation becomes an increasingly urgent policy priority, all fossil fuels will need to show how they can reduce their GHG footprint in order to retain their place in energy balances. For the gas sector this will mean investments in low and zero carbon gas – biogas/biomethane, hydrogen from renewable energy (P2G) and various type of synthetic methane (syngas). The relatively small volumes likely to be available from these sources will mean that, if gas markets are to be maintained, hydrogen from reforming of methane with CCS will need to become a major source of decarbonised gas for at least the next two decades. Costs of all low and zero carbon gas sources are several times greater than current natural gas prices, and this will a significant obstacle for the future affordability of gas even in countries with relatively high wholesale prices.

Fossil methane projects will increasingly require certification of emissions, particularly for imported gas and LNG. Pipeline and LNG projects will need to certify their (CO_2 and methane) emissions throughout the value chain: exploration and production, transportation, storage and distribution; and for LNG projects also: liquefaction, shipping and regasification. Governments in both exporting and importing countries are likely to impose certification requirements and emission standards on gas projects. Those which fail to meet those standards may find that they are unable to obtain regulatory approval in exporting countries, and/or that the gas they deliver will be of reduced value in importing countries (because they will either need to purchase carbon offsets, or buyers will need to pay increased carbon prices or taxes).

Development of low and zero carbon gas projects, and reducing the GHG footprint of gas and LNG imports, will raise the cost of gas which will negatively impact its affordability both in absolute terms and relative to other decarbonised energy options. These will be difficult challenges, but they must be addressed without delay if gas is to continue to play a substantial role in energy balances over the next several decades.

Writer's Profile

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