WHY WE STILL NEED TO TALK ABOUT NATURAL GAS **IN 2019**

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FOREWORD

The continued uncertainty surrounding Brexit really should focus the minds of the public and politicians on domestic energy supply and how best we can keep prices affordable, homes warm, business powered and the country resilient.

That doesn't mean abandoning our commitments to carbon emissions reductions and defending the future of the planet, far from it. It's about finding the right formula for our energy future that delivers environmental change, meets public need and secures supply.

GMB believes the energy debate lacks nuance. It is increasingly polarised between "leave it in the ground" and "maximum economic recovery" at best and green fundamentalists and climate change deniers at worst. Few people talk about finding a balance or seem interested in finding one.

Scotland is no different. The furore around Oil & Gas UK's recent "Roadmap 2035" is a case in point. Weeks after the Scottish Government declared a climate emergency the oil and gas industry put forward proposals for maximum extraction from the North Sea, prompting the green lobby to call on the Scottish Government to immediately sever its support for oil and gas.

But it's often overlooked, however, that our gas needs in 2050 will be similar to what they are today. In a net-zero environment we'll still need gas. So the big question posed by GMB to everyone in the debate is not whether we need gas, but where are we going to get it from?

That's why this paper produced by the respected Centre for Energy Policy is a timely and much needed offering of reality in a debate all too often dominated by rhetoric. It sets out the basic facts concerning our use of natural gas and our supply versus the global picture on carbon emissions.

We believe it is a time for choosing. On the journey to a low-carbon economy we can either become an exclusive net importer of gas or we can consolidate a domestic gas supply to help meet our needs. And as a trade union which priorities jobs and work, we ask decision-makers for honesty on what our energy future holds for the workers and their families currently employed within our gas and gas-related industries.

GMB Scotland believes that tackling climate change and defending our energy and economic interests are not contradictory issues, but we need an open and reasoned discussion about how best to play our part in the global response to the climate emergency.

We hope this paper contributes to such a process here in Scotland, and across the rest of the UK.

GMB Scotland Secretary, Gary Smith

Why we still need to talk about natural gas in 2019

Professor Karen Turner and Mark Lappin of the University of Strathclyde Centre for Energy Policy

INTRODUCTION

This paper provides an update to the document published in 2017 called 'Natural Gas in the Energy Policy of the UK and Scotland'¹. It is timely to update this report because many aspects of natural gas in UK have changed. This report will review these changes by posing and answering a series of questions with reference to facts and data from government reports, various analysis and press release:

- 1. Given the growing focus upon alternative fuels in our energy supply, this report will ask "What is natural gas?" and "How do we use natural gas?" and comparing with "How do countries other than UK use natural gas?" as this is increasingly a global matter.
- 2. Given our continued and growing dependence upon natural gas to heat homes, cook food and produce electricity this report will ask and answer the question "Where do we get natural gas from?".
- 3. With the growing concern over global climate change, this report will ask and answer the question: "How may gas fit into a net zero greenhouse gas emissions society?" consistent with UK Government policy.

Answering these questions leads to the conclusion that the UK is highly dependent upon a supply of natural gas as a reliable and relatively affordable form of energy; that, after almost 50 years of domestic production, a dwindling offshore supply makes us highly dependent upon imports which has implications for jobs, national balance of payments and for the environment.

THE PRODUCTION, SUPPLY AND USE OF NATURAL GAS

What is 'natural gas'?

Natural gas is the term usually given to a flammable gas that is colourless and odourless. The smell we associate with gas is introduced into the pipeline grid in order to allow detection in the event of a leak. Natural gas can be a mix of hydrocarbons but is dominantly methane (CH_4), comprising a carbon atom and four hydrogen atoms. When it is burned, the carbon and hydrogen atoms combine with oxygen to create Carbon Dioxide (CO_2) and Water (H_2O) as well as energy.

The term 'natural gas' comes from the fact that it used to occur as a by-product from generating coke from coal for the steel industry. The by-product, useful for heating homes and generating electricity, was called 'Town Gas' and the old gas storage 'gasometers' are still visible around towns of the UK today.

Natural gas is generated when large volumes of organic material, typically plant matter, decay over long periods of time and the methane given off during decomposition is buried by layers of sediment. Much of the gas we produce from the UK was generated from decay of plants which grew over 300 million years ago in rainforest when the UK was positioned over the equator.

Geologists know this prehistoric period as the Carboniferous as it is a source of Carbon (coal and gas) and iron. Carboniferous coal for energy, and iron, as a raw material for steel, along with a growing workforce, provided the foundations of the Industrial Revolution, which began in the UK and other parts of Europe in the 18th Century.

How do we use natural gas in the UK energy mix?

The flammable nature of natural gas largely defines its usefulness. It can be used to cook food in kitchen appliances and heat homes through gas central heating systems. It is also burned in order to generate electricity. Heat makes steam and steam drives turbines which generate electricity.



Chart 1: UK Gas Demand 2005-2017 Source: UK Government Department for Business, Energy and Industrial Strategy

> The UK consumed approximately 100 billion cubic meters annually until the global recession in 2008. Gas consumption has steadily dropped since 2008 and is now at approximately 80 billion cubic meters, or less than 3% of global demand².

The Digest of UK Energy Statistics produced annually by the UK Government published in 2018 states that "...in 2017 gas met nearly two thirds of total domestic energy demand". It shows how gas demand is allocated across the various uses: approximately 37.5% is used to generate electricity; a similar volume is provided to approximately 24 million homes for central heating and cooking. Approximately 25% is provided to industry and non-domestic customers, such as hospitals and schools, which are typically heated by gas central heating.

The dominance of gas in UK energy is clearly seen in the chart below produced by Birmingham University Energy Institution, responding to high demand through winter and lower demand in $summer^3$



Chart 2: UK energy mix by energy type 2015-2018 Source: Dr Grant Wilson University of Birmingham Energy Institute



Comparing different contributing parts of the total energy mix on an annual basis since 1970 shows the diminishing role of coal and the growing contribution of natural gas along with renewable energy, particularly bioenergy ⁴.

Chart 3: Annual Energy Mix breakdown Source: UK Government Department for Business, Energy and Industrial Strategy



How do countries other than UK use gas?

The world used approximately 3.5 trillion cubic metres of natural gas in 2016 according to US Independent Energy Agency ⁵, which predicts a steady rise for the future. The US is the biggest producer and consumer of natural gas but almost half of the growth is expected to be for Chinese consumption.

For comparison with UK demand for gas, Germany uses a similar level but still has a high dependency on coal ⁶. France has approximately half this level of demand due to a high level of nuclear power for electricity including for heating.

The USA consumed approximately 1 trillion cubic metres of natural gas in 2017, which is approximately 10 times more than the UK 7 .

China's demand for natural gas is rising (as is Chinese domestic supply of renewable energy). In 2018 China burnt more than 4 billion tonnes of coal. The entire rest of the world consumes less than this volume. Severe levels of air pollution in Chinese cities and commitment to the global response to climate change set the recent government on a track of replacing coal with natural gas and renewables including wind and solar ⁸.

In 2017 China converted almost 4 million homes from coal to natural gas with a further 5 million homes converted during 2018 ⁹.

Where do we get natural gas from?

Since 1969, when gas was first produced from the Hewett Field off the coast of Norfolk, the UK has had natural gas from reservoirs thousands of feet beneath the surrounding north sea and east Irish sea. At its peak in 2000, production was 15 billion cubic feet per day ¹⁰ but production has been in steady decline since then. Over recent years it has stabilised to some degree at about 4 billion cubic feet per day.

Total UK gas production since the first field came on-stream in 1969 has been 98 trillion cubic feet or 3.25 trillion cubic metres (recall that UK demand is 2.4 trillion cubic feet or 0.08 trillion cubic metres of gas per year)¹¹.



Chart 4:UK production of natural gas 1970 to 2018 Source: UK Oil and Gas Authority

This meant that the UK was self-sufficient for its supply of natural gas for decades. Indeed, for most of the period, UK was a net exporter of natural gas, which along with oil, delivered almost £300 billion in production tax alone ¹².

On top of revenues earned for the public purse, the industry brought jobs. A 'Work Force Report' published by Oil and Gas UK ¹³ showed that in 2008 around 450,000 UK jobs were supported by offshore oil and gas activities with about 34,000 being directly employed by oil and gas exploration and production companies. The report estimates that 44% of the jobs supported by the oil and gas sector, almost 200,000 jobs, are in Scotland. There are no figures available which break these numbers down to natural gas versus oil exploration and production as many facilities and companies deal with both.

The same report showed that, for the same year, salaries in the sector averaged £50,000 and contributed an average of £19,500 per head in income tax.

The decline trend for UK domestic gas production is clear and, while consumption has dropped over recent years, particularly since the global recession in 2008, production is dropping at a greater rate meaning UK has become highly dependent upon imports of natural gas for about a decade ¹⁴.



Chart 5: UK production compared with demand 1998 to 2017 Source: UK Government Department for Business, Energy and Industrial Strategy

In 2008 UK domestic production met two-thirds of UK demand. In 2018, imports met more than half UK demand ¹⁵. Imports are expected to rise over the years to approximately 85% by 2050 ¹⁶.

Cost of importing gas to the UK has risen dramatically over the previous decade. In 2018, UK paid approximately £10 billion, approximately £200 million per week to import natural gas in order to meet its energy needs ¹⁷.



Chart 6: Net value of fuels on balance of payments 1970 to 2018 Source: UK Government Department for Business, Energy and Industrial Strategy

Which countries are exporting gas into UK?

UK Gas imports divide into 3 groups

1. <u>Pipeline imports direct from the Norwegian North Sea</u> production arrive at Easington on the east coast of England and Saint Fergus on the east coast of Scotland. These are supplied by Ormen Lange and Heimdal gas fields respectively. The Ormen Lange pipeline is over 1000 kms

long and has annual capacity to deliver almost a trillion cubic feet of gas per year (recall UK annual demand is approximately 2.4 trillion cubic feet per year). The Vesterled pipeline brings natural gas from Norwegian offshore Heimdal field.

60% of 2017 gas imports were from Norway ¹⁸, making up 39% of UK supply overall. If UK government figures quote two thirds of UK energy being from gas and Norway gas is 39% of UK supply then it follows that more than a quarter of the UK's total energy supply is from Norway.

Chart 7: UK natural gas imports by country of origin 2017 Source: UK Government Department for Business, Energy and Industrial Strategy



Norway has received approximately £20 billion per year for gas exports over the last decade from UK and other European countries according to official Norwegian Government figures released in 2017¹⁹.

- 2. <u>Pipeline from continental Europe</u>. While volumes vary from various sources, a significant but relatively small proportion (less than 10%) of gas imports arrive into Bacton on the Norfolk coast from Belgium and the Netherlands. The origin of the gas is from production at fields throughout Europe, including nearby countries such as Netherlands and Denmark or as far away as Turkey or Russia.
- 3. <u>By ship as Liquefied Natural Gas (LNG)</u>. Although liquefying methane or natural gas has been understood since the nineteenth century, it has only been a significant part of the global gas business since the early 21st century. The growth of liquid natural gas has come about in order to allow large gas production regions such as Australia, Qatar, USA and Russia to ship natural gas to other regions of the world in need of gas imports such as China, Europe, Japan, without having to construct a pipeline, which is expensive and ties both supplier and importer into an inflexible long-term deal. There is more than one method for causing methane gas to become liquid but all methods involve chilling the gas to below -250 degrees Fahrenheit ²⁰.

Changing the gas to a liquid causes its volume to reduce 600 times. This makes long-distance transportation by ship more efficient.

A further point to consider when discussing imports of gas by LNG is that, in 2019, a UK Government report from Department of Business, Energy and Industrial Strategy (BEIS) estimated greenhouse gas emissions from LNG are approximately double those of domestic supplies of gas ²¹.

How have imports changed over time?

During 2018, LNG supply and demand changed a great deal for UK and globally ²². During the first three months of 2018 the UK received 8 shipments of LNG to the UK. The first three months of 2019 saw landing of 41 shipments.

Prior to 2018, imports to the 3 UK LNG terminals in southern England and Welsh coast, came almost exclusively from Qatar. However, during 2018 and up to time of writing, UK received a large proportion of liquid natural gas from USA, Russia, Egypt, Angola, Cameroon and from beneath the rain forest of Peru.

Prior to 2018, UK received no LNG from Russia. In 2018, 17% of UK LNG was supplied by Russia. This is happening because new supplies are becoming available as regions with higher levels of natural gas supply than demand are building plants in order to become gas exporters. Australia and Qatar are other examples.

This increase in diversity of supply is causing the price of gas to drop around the world. International Energy Agency report estimates Europe paid \$8 billion less in 2018 due to new global LNG supplies competing with Russian supplies by pipeline ²³.

However, this shift has the potential to increase volatility. As LNG prices drop, new import plants are being built in China, Germany, Poland, for example. In China, the government has embarked on a programme to convert millions of households per year from coal to natural gas for heating ²⁴ and growth in demand from China is anticipated to put pressure on price and availability.

Norway, which has supplied UK by pipeline since the country became dependent upon imported gas, opened an LNG supply terminal in 2007 25 .

WHAT DOES USE OF GAS MEAN FOR THE PUBLIC AND FOR THE CLIMATE?

What are the implications for households?

Within the UK there are approximately 24 million gas meters in the homes of England, Scotland and Wales combined. Just over 2 million homes in Scotland out of approximately 2.5 million homes ²⁶ have a gas meter.

Some areas of the UK have a relatively high proportions of homes without a mains gas supply. These areas tend to be the more remote part of the British Isles, typically with relatively sparse and scattered populations. This means that Scotland and Wales have a relatively high proportion of homes without access to a mains gas supply. In Scotland one in five homes have no mains gas supply, which is almost double the figure for England.

The map below shows regions of the UK in the context of proportion of properties connected to the grid. The darker colours indicate a relatively high proportion of properties without a connection to the gas mains grid, mainly in remote areas such as Scottish Highlands, Islands and Border Region; Wales, East Anglia and Cornwall.



Chart 8: Map of UK showing relative proportion of gas grid connections Source: UK Government Department for Business, Energy and Industrial Strategy

> The UK Government recognises that not having a mains gas connection is a contributory factor to fuel because poverty alternative fuels are more expensive than natural gas. The UK Government Committee for Fuel Poverty in November 2018 said "The Gas Distribution Networks have a target to deliver 91,000 new gas connections by 2021. This provides important support to connect low income households to the mains gas grid, which can deliver considerable heating cost reductions when compared to electric heating." 27

A UK Government report stated that, for those households experiencing fuel poverty, the level of fuel poverty is double the average when comparing those without access to mains gas to those with mains access ²⁸. A report from European Commission body, Eurostat, tasked with providing statistical information to EU states shows that, for equivalent energy, cost by electricity is 3 to 4 times that of from natural gas ²⁹

In addition to the implications of alternative fuels such as coal and heating oil for fuel poverty, they also cause more pollution including greenhouse gas emissions.

What role can natural gas play in a net zero carbon economy?

Natural Gas, for an equivalent level of energy produced, generates about half of the greenhouse gas emissions of coal ³⁰ though, clearly, greenhouse gas emissions, in the form of Carbon Dioxide, are higher than from renewables and from nuclear power.

Chart 9: UK Carbon Dioxide emissions 1960 to 2017 Source: World Bank



UK Carbon Dioxide emissions have fallen over the previous decades for a number of reasons including the switch to natural gas but also as a result of shifts in manufacturing, increased levels of renewables and increased energy efficiency ³¹.

The effect of the shift away from energy-intensive manufacturing is apparent in the increased rate of decline since global financial crisis of 2008.





Global Carbon Dioxide emissions have risen sharply over the same period, largely reflecting growth in demand for coal in developing nations, particularly China but also India and others ³²

The UK Government's Independent-appointed Committee on Climate Change recently published a report proposing UK aims to reach net-zero for greenhouse gas emissions by 2050. This report ³³ acknowledged both that natural gas dominates the UK energy mix and that, for heating particularly, this would be a hard problem to solve. The Committee proposed that a significant part of heating would come from using hydrogen which does not generate greenhouse gas emissions. Further, the Committee proposed that hydrogen would be generated from natural gas with associated Carbon Dioxide captured and stored centrally rather than being generated in tens of millions of dispersed gas boilers and ovens.

The Committee for Climate Change concludes that, while the total volume of natural gas demand in the UK is expected to drop from 875 Terra Watt Hours to 600 Terra Watt Hours, continuing decline in

offshore domestic production of natural gas means that imports of natural gas will rise from 400 Terra Watt Hours to almost 500 Terra Watt Hours (25% increase).

The Committee on Climate Change had a great deal of other proposals which will be required to meet a net-zero target by 2050 outside the remit of a paper on natural gas and its role in providing energy to the UK.

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