GMB
SCOTLAND

NATURAL GAS IN THE ENERGY POLICY OF THE UK AND SCOTLAND

---

www.gmbscotland.org

@GMBScotOrg /GMBScotland

FOREWORD

The future of affordable energy in our country is at risk. Action is needed now to save Scotland from misguided decisions, made in Holyrood, that will risk more fuel poverty.

The Scottish economy is floundering and people across the land are dealing with insecure employment and struggling to get by. It is a worrying time for many, affordability does matter, yet it seems that too many politicians are prepared to ignore this reality of daily life and are instead undermining the central source of so much affordable, Scottish energy – natural gas.

This report, prepared by Professor Karen Turner and Mark Lappin, Centre for Energy Policy at the University of Strathclyde, shows the importance of gas for Scotland, both today and in the future. The vast majority of us use gas to heat our homes, in large part because it is three times cheaper than electricity. Gas is vital to thousands of businesses who provide jobs for our fellow Scots. It is essential to the production of chemicals that are indispensable to every aspect of modern life, including transport, food, health and even the clothes we wear. And it is key to new technologies like Combined Heat and Power, and fuel cells. Gas is a fuel of the future.

Despite everything that is, rightly, said by most Scottish politicians about maximising extraction of the remaining resources off our own coasts, it appears that the Scottish Government doesn't want a future for gas in heat or power. Their energy strategy calls for 80% of domestic buildings to be heated through low carbon technologies by 2032. In practice this means people will see their gas boilers being torn out and replaced by electric heating at the rate of 1 home every 4 minutes of every hour, of every day, of every year for the next 15 years.

The justification used for this is tackling climate change and, rightly, the environment is a huge concern to everyone. But the idea that people are going to

tolerate the prospect of ripping out their gas boiler, replacing it with expensive electric heating at a cost of thousands of pounds and then watch the bills to heat their homes go up threefold is just pie in the sky.

Instead of attacking our gas industry the Scottish Government should be looking at the challenges around how we secure its domestic future. Scotland is already heavily dependent on imported gas, including from places such as Siberia. This throws up big ethical issues and, of course, there are also huge implications for security of supply. Neither should we ignore the climate implications of transporting gas around the world to feed key industry here.

GMB was forged in the struggle of the gas workers. We remain the gas workers union and from the back breaking days of stokers piling coal into retorts to the high tech industry of today, GMB has been a constant. We make no apologies for standing up for our members and those who work in the gas industry, where they do highly skilled, well remunerated jobs. I want a bright future for energy in Scotland. One where we take a balanced approach to our energy sources and alongside legitimate climate concerns, we recognise the importance of security of supply, of good employment for working people and, most importantly, for affordability.

The Scottish people want such a future and we can have it with a continuing role for gas.

Gary Smith
GMB Scotland Secretary


Scotland
Gas Networks
A Scotia Gas Networks Company
Scotland
Gas Networks
TRANSIT
LG12 XFA

INTRODUCTION

This paper considers the current and future role of natural gas in the energy mix of the UK and Scotland. The aim is to identify and highlight fundamental perspectives that must be considered in designing energy policy going forward. The paper begins by considering the current energy mix and the role and presence of gas alongside other energy sources, both renewable and non-renewable. It then sets the discussion in the context of natural gas production in the UK before discussing the role of gas in the energy costs faced by consumers, with particular attention to the important policy concern of fuel poverty.

Attention then moves to climate policy as a second key policy concern, but one where the impact of gas production and use in Scotland and the UK must be set in a global context.

The paper concludes that gas must continue to play an important role in the energy mix of Scotland and the UK, with a potential continued role in the context of 'game changers' such as hydrogen and CCS. The main question, then, is whether the gas we use should be produced at home or abroad.

Karen Turner and Mark Lappin
Centre for Energy Policy

University of Strathclyde Glasgow

THE ENERGY MIX TODAY

UK and Scotland's energy serves 3 main purposes. For 2015, the UK split was;

Table 1: 2015 division of energy by purpose (1)

	THOUSAND TONNES OF OIL EQUIVALENT	PROPORTION
Transport	54,810	41.3%
Heating	58,801	44.3%
Electricity (excl heat)	17,454	13.2%
Other	1,548	1.2%
TOTAL	**132,613**	**100.0%**

70% of UK heating is provided by natural gas (2). 8 out of 10 UK households use natural gas for heating (3). Those which do not use natural gas are burning coal or heating oil (kerosene) with a small proportion using firewood as a supplement. Electric heaters are used in homes and businesses also. Peak demand for power in Winter reaches around 50 GW. Demand for gas for heating in equivalent units reaches 300 GW meaning we will depend upon gas at least for heating for the foreseeable future. (4)

For transportation the fuel is almost exclusively hydrocarbon liquid such as petrol, diesel or aviation fuel.

Electricity is generated from natural gas (~30%), nuclear power (~20%), renewables (~20%) and coal (~30%). These numbers reflect historical trends but are shifting rapidly, particularly with drop-out of coal being replaced largely by gas (5).

Natural Gas was the biggest contributor to electricity generation in 2016. It is less expensive than power generated by renewables and nuclear and more reliable than renewables. Electricity generated from natural gas produces less greenhouse gas emissions than electricity generated from burning coal and is the most responsive to changes in demand. Combustion of natural gas for generation of electricity produces more CO2 emissions than nuclear or renewables.

Nuclear power provides base-load running at, or close to, capacity of between 7 and 8 GW continuously. UK power demand varies between 30 and 50 GW.

Renewable power generation is dominated by wind from approximately 6000 onshore and offshore wind turbines. Wind is highly intermittent and contributes between zero and 5 GW to the grid.

While it is hard to estimate the contribution of solar power as it is mostly off-grid, estimates, based on demand drop and volunteer sites providing data, suggest it produces up to 5 GW in the middle of the day but this is for short periods. For most of the 24 hour day, contribution is negligible. (6)

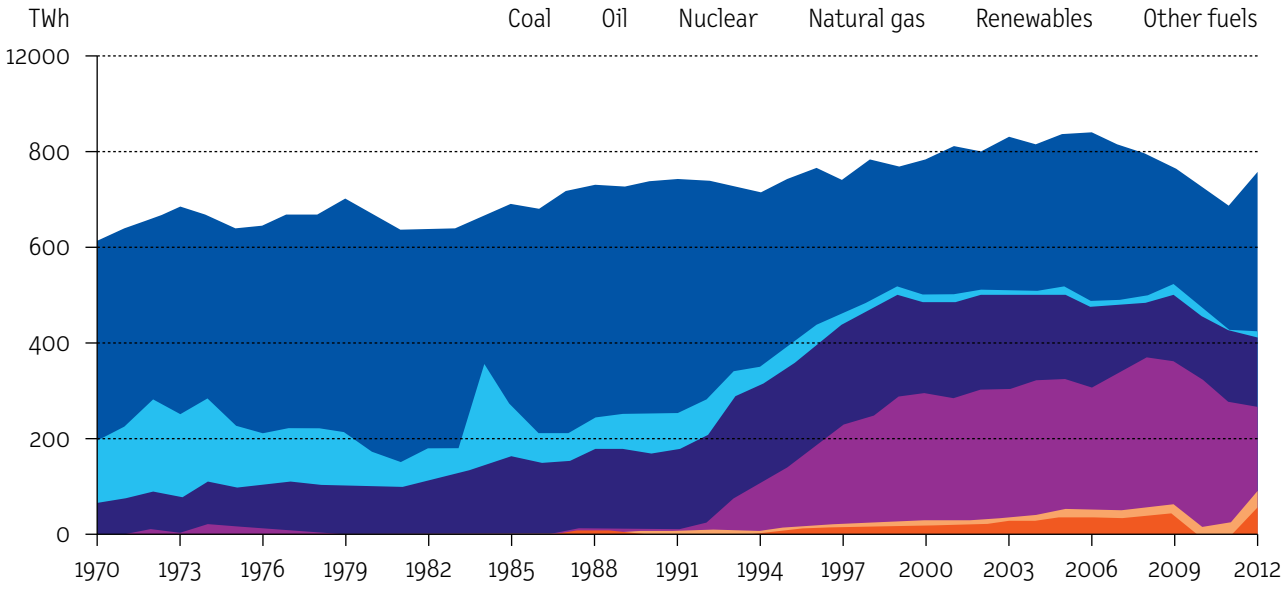
In 2014 approximately one quarter of renewable energy was from burning imported wood pellets to generate power. Sustainability of this 'biomass' electricity is under question. (7)

Coal has historically dominated the UK energy mix for heating and power but is being displaced by natural gas (8). Recently it has been used mostly to generate electricity. Electricity generation from coal is relatively inexpensive and reliable. It is less responsive to short-term demand fluctuations and is used to meet more predictable seasonal variations. Coal combustion produces more greenhouse gas emissions than the other sources of power generation and emits sulphur dioxide, nitrogen oxides and particulates (9).

Deep-mining of coal in UK ceased in December 2015 (10) so generation of electricity from coal in recent years (2012) has depended upon imported coal from Russia (40%), USA (24%), Colombia (27%) as well as other lesser exporters. (11)

Coal has been used to generate power at scale since 1882. On May 10th 2016, for the first time since 1882, coal was not present in the UK electricity generation grid (12).

Trends in gas demand



A BRIEF HISTORY OF UK NATURAL GAS

Natural Gas was discovered in the North Sea in the 1960's and has been in production since 1968 when Phillips-operated Hewett field was developed (13).

UK then undertook a campaign through nationalised energy companies to convert all industrial and domestic properties to natural gas previously served by 'town gas' and coal. The campaign lasted from 1968 to 1976 (14). Production of natural gas in the North Sea reached a peak in 2000 and has since been in decline. Current production is approximately 1/3 of peak production and forecast to decline by approximately 8% per year (15).

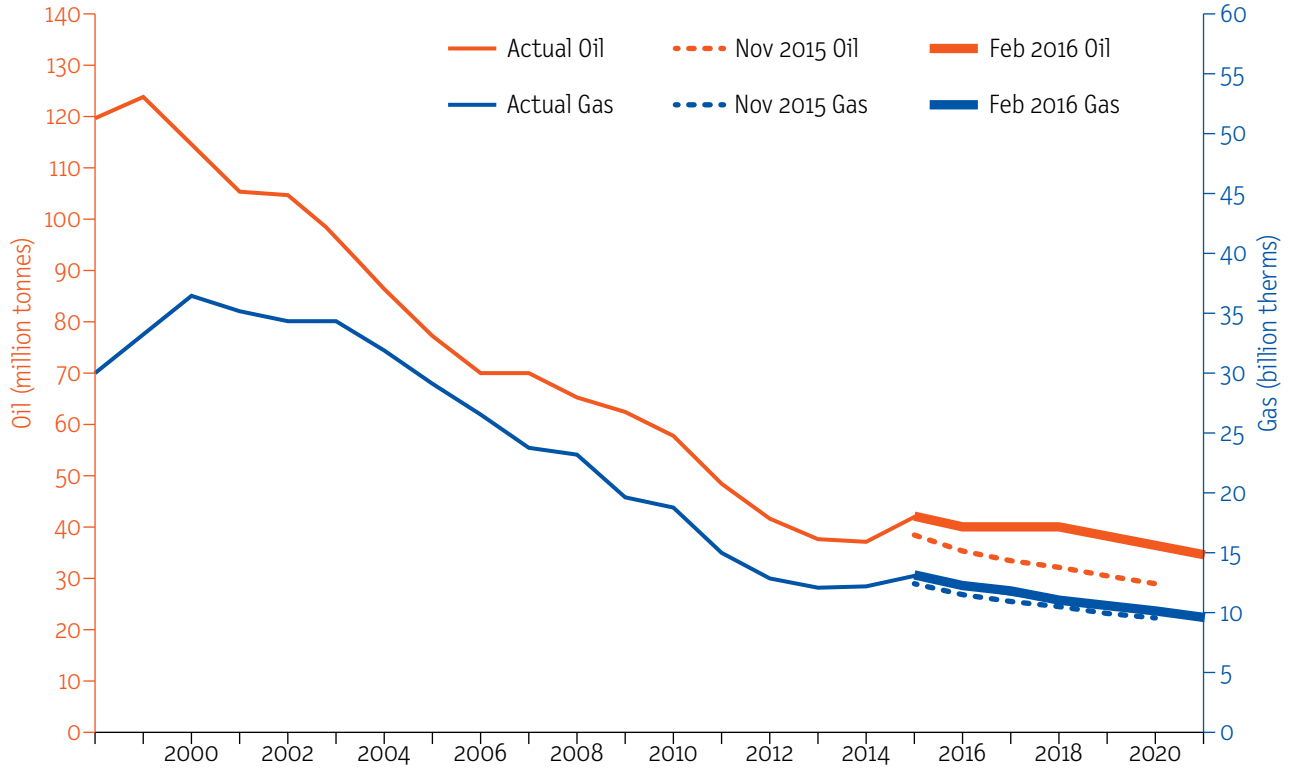
UK demand for natural gas has dropped steadily in recent years (15), particularly following the global recession beginning in 2008 but does not match the drop in domestic production.

Greater production drop than the corresponding reduction in demand inevitably leads to an increase in imported gas if supply is to be maintained. Today, after decades of being self-sufficient or a net exporter, UK imports a similar volume of gas as domestic production but with domestic production declining, imports are likely to dominate in the future. National Grid forecasts imports may be as high as 90% by 2035 (16). UK was self-sufficient in gas production as recently as 2000. Importing natural gas is predicted to cost UK £9 billion per year with no revenue or jobs generated (17)

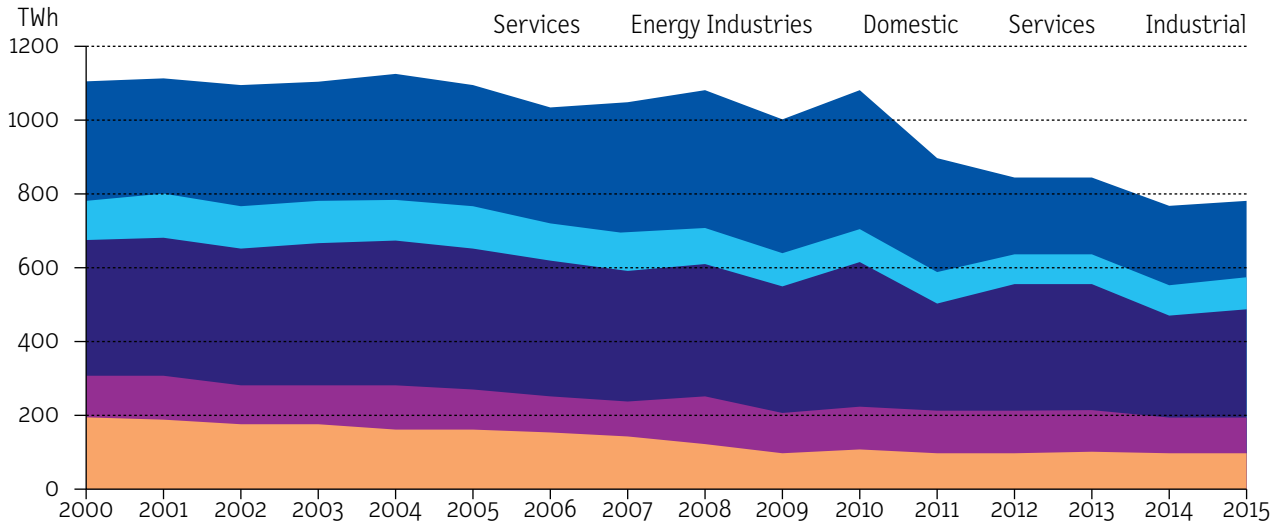
Most of UK gas imports are by pipeline from Norwegian North Sea gas fields or by LNG from Qatar. Since 2007 imported gas from Netherlands has become significant.

UK also imports some gas via the Zeebrugge (Belgium) interconnector. It is not straightforward to trace the origins of this natural gas due to the complex connections but this system is connected to Siberian gas fields of Russia. Russian agency Tass claims imports of Russian gas to UK are increasing significantly (18).

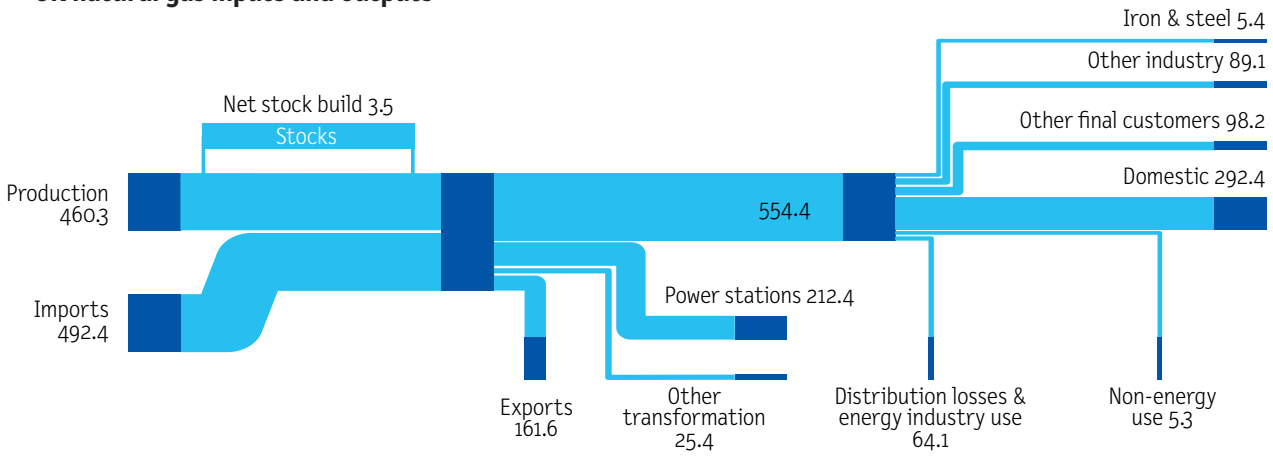
Actual/Projected UKCS Oil and Gas Production



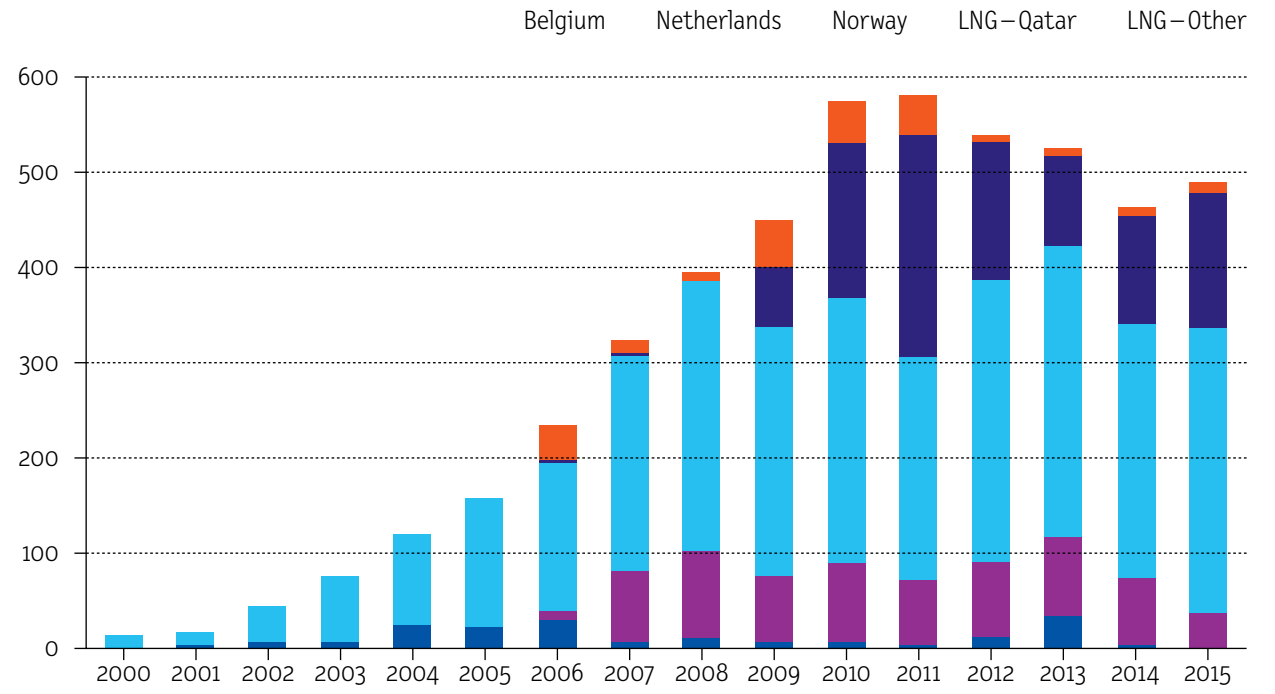
Changing energy mix through the years



UK natural gas inputs and outputs



Source of UK natural gas imports



GAS COST AND COST OF ENERGY

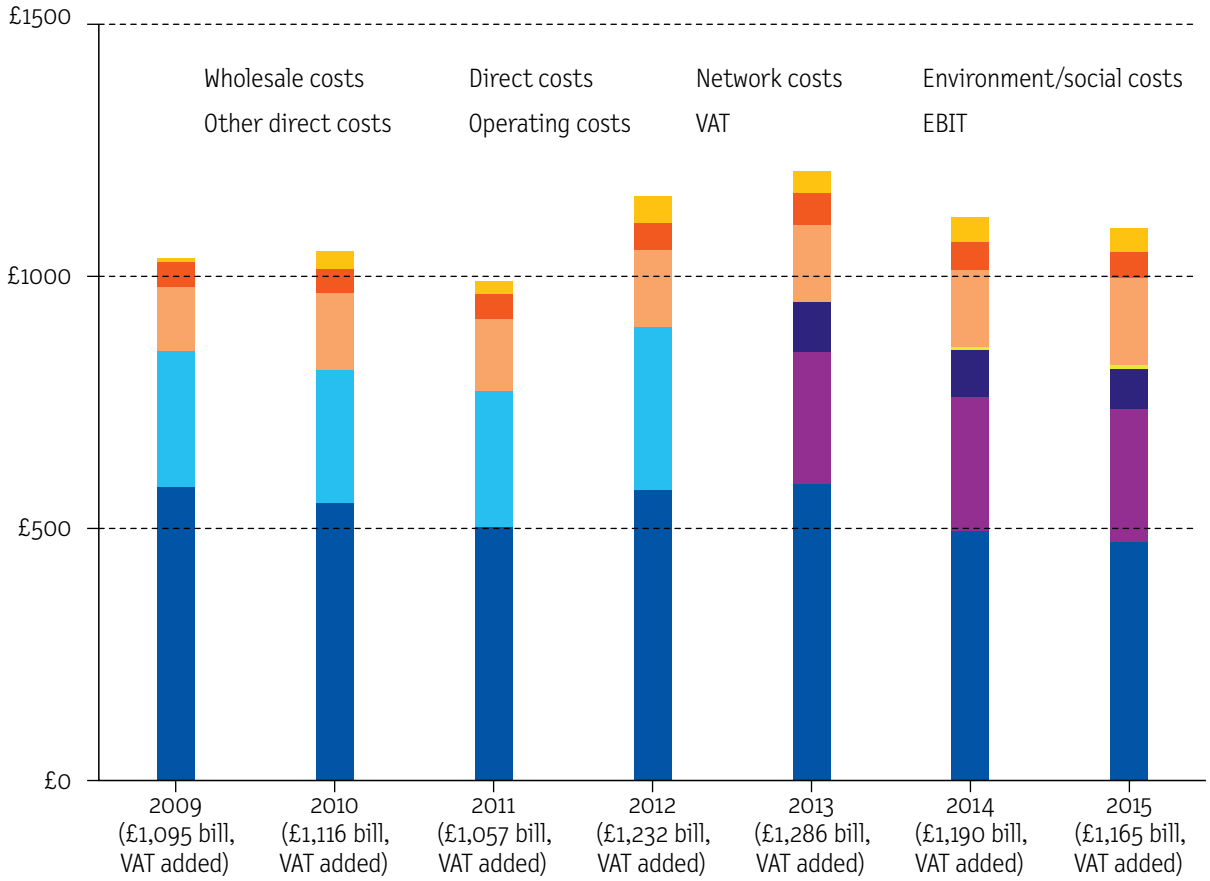
Natural gas has become more of a global or semi-global/Regional commodity since LNG became a viable solution for meeting national energy demands. The plentiful supply of natural gas around the world means that this has depressed the price of natural gas globally. However, regions can behave independently. US Shale Gas has caused US gas prices to dip (19) while costs in the UK, relatively low, are rising (20)

Cost of household energy (gas and electricity) is complex due to such things as change in demand, change in network costs, introduction of "environmental/social costs" but overall, average gas and electricity bills have remained quite stable around £1100 per year. UK ranks about average for electricity bills in Europe and above average for cost of gas supply (21)

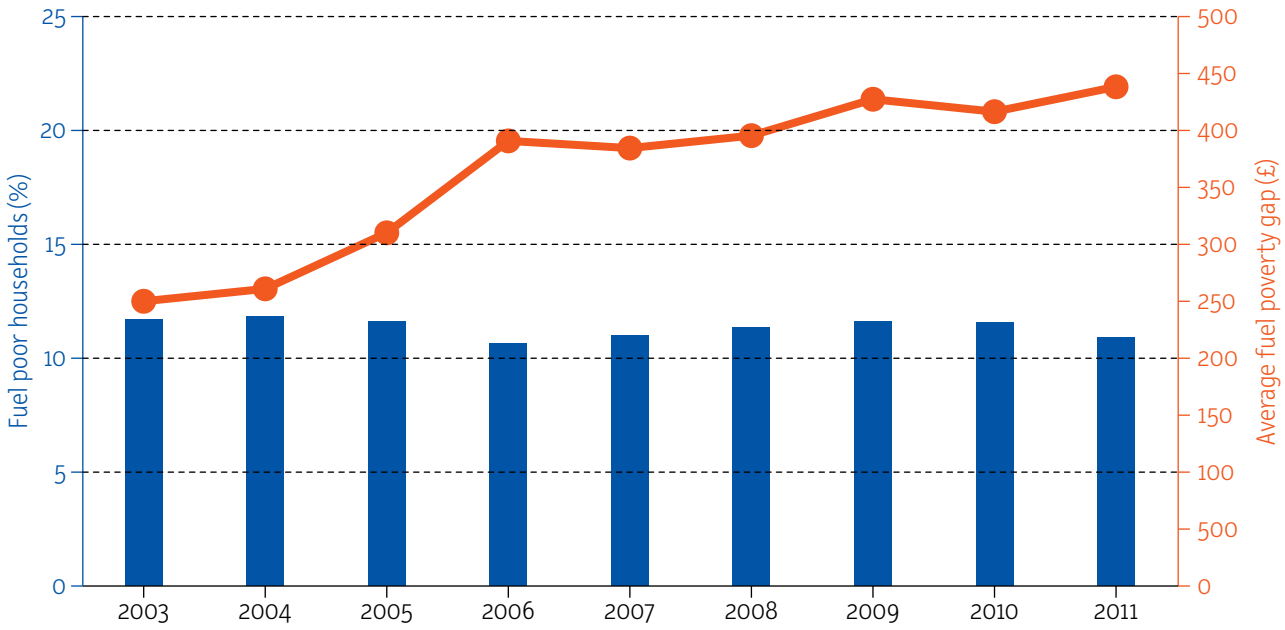
UK is highly dependent upon one storage facility to respond to high demand for natural gas such as a UK cold spell. Rough Storage Facility is a depleted north sea gas field situated off the Lincolnshire coast and constitutes 70% of UK gas storage. Gas is injected in summer months when demand and prices are lower and made available in Winter. However, the facilities, designed and built to last for the production lifetime, are showing signs of aging and the operator has announced it will not be available for injection this Summer. This is likely to put pressure on prices and supply security in Winter 2017/18 (22).

While average household energy bills have remained relatively stable there are significant variations and fuel poverty is an important social consideration in energy policy.

Large suppliers: Domestic dual fuel bill breakdown over time (GB)



Large suppliers: Domestic dual fuel bill breakdown over time (GB)



How and when fuel poverty is calculated is not consistent across the UK but methods are broadly comparable. In England, where fuel poverty is calculated as where households "have required fuel costs that are above average and were they to spend that amount, they would be left with a residual income below the official poverty line", approximately 10% of households were in fuel poverty in 2015 and this figure was stable and predicted to remain so (23 page 6). UK government reports indicate that households of single-parents, unemployed, younger families and those in rented accommodation are worst affected.

Depth of fuel poverty increases markedly for those living in poorest-rated properties for energy efficiency. Depth of fuel poverty has increased in England even though level of fuel poverty (proportion of people in fuel poverty) has been stable (8)

In Scotland, then Scottish Executive, in 2002, in its Scottish Fuel Poverty Policy statement set a target of eradicating fuel poverty "as far as is reasonably practicable", by November 2016. (24 page 1). During the period 2003 to 2012, fuel poverty rose from 16% to 27% reaching a high of 34% in 2009. Rural areas tend to be worse affected such as Eilan Siar and Orkney where fuel poverty was 62% and 58% respectively in 2012. A chief reason given for this in government reports is lack of access to inexpensive mains natural gas and a dependency on higher cost heating fuels.

Fuel poverty in Scotland is defined as households spending more than 10% of disposable income on fuel.

Table 2: Fuel poverty by UK nation, 2012

	SCOTLAND	ENGLAND	WALES (ESTIMATED)	NORTHERN IRELAND (ESTIMATED)
Number of Households	650,000	3,050,000	390,000	290,000
% of population	27%	14%	29%	42%

NATURAL GAS, ENERGY AND THE ENVIRONMENT

Part of the energy cost which has altered is the introduction of environmental costs which have been added to energy bills rather than being delivered through central taxation. If we may assume that the less well-off are more commonly in poor housing and on pre-payment tariffs which are among the most expensive per unit of energy; then the most vulnerable to fuel poverty are picking up a larger share of payment for environmental costs of energy.

Renewable energy, dominated by wind, remains heavily subsidised. National Audit Office anticipates subsidies to be about £8 billion by 2020 placing a cost on the average bill of £110 or 10% of recent average household bills (25).

In 2012 Scotland's carbon footprint had reduced from just above 80 million tonnes C02 in 1998 to just below 80 million tonnes in 2012 with a high above 90 million tonnes before the global recession in 2008 (26).

There is widespread if not complete consensus that we must remove or at least significantly reduce carbon from our energy supply. However, very few argue that we can take natural gas out of the system in the near-term, given the role it plays in heating, cooking and lighting along with other electrical appliances in homes, business, hospitals and schools.

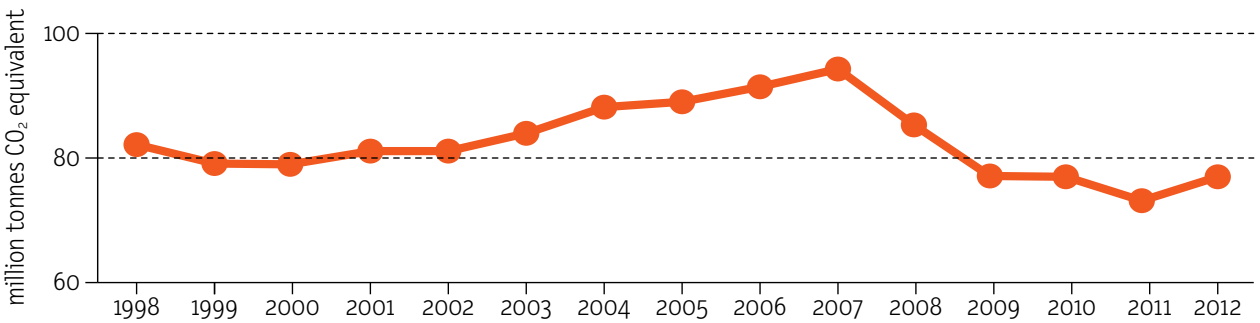
Moreover, gas (or more specifically, non-gas liquids produced with gas, such as ethane) is a key petrochemical feedstock in a range of industrial processes that are used to produce many of the goods and services that Scottish and UK households consume every day. This is particularly relevant in Scotland, where ethane derived from gas is used as a feedstock in the petrochemical industry at Grangemouth, activity that is widely accepted as making a significant direct and indirect contribution to Scotland's GDP and employment (INEOS's own figures estimate a GDP contribution of 3-4% (27).

To set the climate change concern in context, the total UK contribution to global greenhouse gas emissions from energy use is about 1.5% (28). A similar volume is generated from agricultural activity, specifically sheep and cattle farming. Cattle and sheep population in UK generate equivalent carbon dioxide of approximately 2 trillion cubic feet each year (29, 30). UK demand for natural gas is 2.5 trillion cubic feet per year (31).

Thus, given that power generation is about 13% of our energy use, if electricity were entirely provided by renewables it could only reduce global GHG emissions by 13% of 1.5% or 0.2% (approximately 0.02% for Scotland).

There is an important distinction between the role of gas, and our current gas production and supply capability, relative to other activities that contribute to climate change. In considering some of the potential 'game changers' such as CCS and hydrogen, our capabilities and infrastructure may play an important role. It is commonly understood that CCS could provide a means by which to continue the use of fossil fuels (gas and coal) with reduced carbon emissions. Hydrogen, on the other hand is identified as a 'clean' replacement fuel for both transport and heat. However, gas may still have a role to play in either or both the production of hydrogen (with CCS to remove carbon), while existing gas network infrastructure and the related skills/expertise may play an important role in the distribution of hydrogen and/or the transport of (potentially both domestically produced and imported) carbon to off-shore storage sites.

Scotland's carbon footprint



CONCLUSION

In conclusion, the choice would seem to be not one of whether to include gas in our energy mix for the foreseeable future, but where will the gas come from? The production/extraction of gas in Scotland/UK adds to our own territorial emissions, whether it is used at home or abroad. However, the use of gas has the same impact on our climate emissions whether it is extracted at home or abroad. On the other hand, a shift from domestic production/extraction to importing the gas we need will have significant negative impact on jobs and revenue, as well as the skills and infrastructure base that may prove crucial in making some of the major shifts in how we produce and use energy in a future low carbon economy.

NOTES

1. Figures come from as recent a reliable document as was available. They are presented where a more recent figure might be different but where the difference would not cause a different conclusion to be drawn. An exception to this is 2016 and 2017 are seeing a significant drop in coal use in the generation of electricity but figures are not yet available.
2. Typically, figures are for UK as they are more readily available over time and form part of ongoing UK research rather than new research which would take more time
3. An assumption of 10% of all figures can be applied between UK and Scotland. This may not be accurate but will be sufficiently close that the inaccuracy would not create an alternative conclusion.
4. Many references are government sources. None are peer-reviewed scientific papers. References are provided in order that reader can understand source rather than to indicate a level of assurance.

LIST OF REFERENCES

1. https://www.gov.uk/government/statistics/energy-consumption-in-the-uk
2. https://www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes
3. https://www.cambridgeenergy.org.uk/wp-content/uploads/2013/11/UK-Housing-Fact-File-2013-small.pdf
4. https://www.gov.uk/government/publications/the-future-of-heating-a-strategic-framework-for-low-carbon-heat
5. http://www.gridwatch.templar.co.uk/
6. https://www.solar.sheffield.ac.uk/pvlive/
7. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/594046/Summary_-_Assessment_of_high_carbon_biomass_fuel_sourcing_scenarios.pdf
8. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/345141/uk_housing_fact_file_2013.pdf
9. http://www.ucsusa.org/clean-energy/coal-and-other-fossil-fuels/coal-air-pollution#.WLE8cMGml2U
10. http://uk.dbcargo.com/rail-uk-en/News_Media/news/10838350/headboard_from_last_train.html
11. http://www.ukcoal.com/world-coal-statistics.html
12. Tiratsoo, E.N. (1972). Natural Gas. Beaconsfield: Scientific Press Ltd. p. 209
13. http://www.nationalgasmuseum.org.uk/gas-industry-chronology/
14. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/503852/OGA_production_projections_-_February_2016.pdf
15. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/540923/Chapter_4_web.pdf
16. http://researchbriefings.files.parliament.uk/documents/POST-PN-0513/POST-PN-0513.pdf
17. https://www.ogauthority.co.uk/data-centre/data-downloads-and-publications/production-projections/.
18. http://tass.com/economy/912285
19. http://www.eia.gov/naturalgas/weekly/
20. https://www.quandl.com/collections/markets/natural-gas
21. https://www.ofgem.gov.uk/publications-and-updates/infographic-bills-prices-and-profits
22. https://www.utilitywise.com/2017/02/06/rough-gas-storage-unclear/
23. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/468011/Fuel_Poverty_Report_2015.pdf
24. http://www.parliament.scot/ResearchBriefingsAndFactsheets/S4/SB_15-13_Fuel_Poverty_in_Scotland.pdf
25. https://www.nao.org.uk/press-release/controlling-the-consumer-funded-costs-of-energy-policies-the-levy-control-framework/
26. http://www.gov.scot/About/Performance/scotPerforms/indicator/carbon
27. http://www.ineos.com/sites/grangemouth/news/ineos-completes-construction-of-its-new-grangemouth-headquarters/
28. https://www.ncbi.nlm.nih.gov/pubmed/8567486
29. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/508230/structure-dec2015-uk-17mar16.pdf
30. https://www.ncbi.nlm.nih.gov/pubmed/8567486
31. https://www.gov.uk/government/publications/shale-gas-and-oil-policy-statement-by-decc-and-dclg/shale-gas-and-oil-policy-statement-by-decc-and-dclg

ABOUT THE AUTHORS

Karen Turner is Director of the Centre for Energy Policy (CEP), International Public Policy Institute (IPPI), University of Strathclyde.

Mark Lappin is a Visiting Professor with the Centre for Energy Policy. He is also Government and Universities Director with the Oil and Gas Technology Centre and a non-executive Director on the Board of Cluff Natural Resources. He has over 30 years exploration and production experience across the oil and gas business cycle, and is a specialist in onshore Europe natural gas exploration and development.

CONTACT DETAILS

Karen Turner
Director, Centre for Energy Policy
University of Strathclyde
t: 0141 548 3198
e: karen.turner@strath.ac.uk

International Public Policy Institute (IPPI)
McCance Building, Room 4.26
University of Strathclyde
16 Richmond Street
Glasgow G1 1XQ

t: +44 (0) 141 548 3865
e: ippi-info@strath.ac.uk
The International Public Policy Institute

IPPI focuses on global policy challenges in energy, future cities, health, economic development, government and public sector policy, education and social policy. IPPI draws on expertise from across the Humanities and Social Sciences, Strathclyde Business School, Science and Engineering and takes an inter-disciplinary approach to public policy challenges.

University of Strathclyde Glasgow

The place of useful learning

www.strath.ac.uk/research/internationalpublicpolicyinstitute
ippi-info@strath.ac.uk
University of Strathclyde Glasgow G1 1XQ

www.gmbscotland.org

@GMBScotOrg /GMBScotland