Department of Energy & Climate Change

ONSHORE PETROLEUM: THE COMPATIBILITY OF UK ONSHORE PETROLEUM WITH MEETING THE UK'S CARBON BUDGETS

Government Response to the Committee on Climate Change Report

July 2016

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Presented to Parliament pursuant to Section 49 of the Infrastructure Act 2015

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Introduction

Duties under the Infrastructure Act

i. The Infrastructure Act 2015 requires the Government to seek advice from the Committee on Climate Change (CCC) on the impact of combustion of, and fugitive emissions from, petroleum obtained through onshore activity. This relates to the Secretary of State's ability to meet the UK's carbon budgets and the 2050 emissions reduction target. The first report was provided to the Secretary of State earlier this year, in accordance with the timeframe set out in the Act, and is laid before Parliament alongside this response.

ii. Under the Act, the Secretary of State is required to lay the CCC report before Parliament with either:

   a. regulations to provide for the right to use deep-level land to cease to have effect; or

   b. a report explaining the reasoning for not laying regulations

iii. The Government believes that regulations are not required. This Government response provides the reasoning for this decision as well as a response to the points raised in report. The Government is thankful to the Committee for their advice and will seek it again in 2021 as required in the Act.

Summary of Response

iv. The Government is committed to taking action on climate change by reducing greenhouse gas emissions and making the transition to a clean, low-carbon economy. As well as in ensuring the UK plays its part in the global effort to combat change, clean growth presents a huge economic opportunity.

v. The successful transition to that low-carbon economy requires clean, safe and secure supplies of natural gas in the coming years. Gas is not just used for electricity generation, but for heating, cooking and as a feedstock for the chemical industry. Greater home-grown production will reduce reliance on imports, particularly with the projected decline of production from the UK Continental Shelf.

vi. In electricity generation, the Government believes that natural gas, including shale gas, can be a bridge, while the UK phases out old coal generation and develops energy efficiency, renewables and nuclear.

vii. At a local and a national level, there are also potential economic benefits in a new industry. In 2014, EY estimated that 64,000 jobs in the gas, oil, construction, engineering and chemical sectors could be supported at the peak of a successful shale industry[1]. This new industry would benefit from 50 years' worth of experience and skills developing oil and gas onshore and offshore in the UK.

viii. The British Geological Survey estimates the shale gas resource in the Bowland-Hodder basin under Northern England could be 23.2 to 64.6 trillion cubic metres (tcm), with a central value of 37.6tcm [2], compared to current UK annual gas consumption of around 0.07tcm. The Government does not yet know how much can be extracted technically or economically.

ix. The Government therefore believes that there is a clear need to explore and test our shale resource to better understand the potential shale gas reserve. As such, the Government agrees with the CCC's conclusion that uncertainty exists, and that exploration is required to determine the potential of both the size of a UK shale industry and its associated emissions footprint. The CCC report states that emissions associated with exploration are "generally small". The Government agrees with the view in the report that "appropriate emission mitigation techniques should be employed where practical" during the exploration phase.

x. Moreover, the Government welcomes the CCC's primary conclusion that shale gas development at scale – i.e. at production stage - is compatible with carbon budgets if certain conditions, set out as three "tests", are met, and, under those conditions, the CCC believes shale gas could make a useful contribution to UK energy supplies.

xi. These three proposed tests for production stage development are:

- **Test 1: Well development, production and decommissioning emissions must be strictly limited.** Emissions must be tightly regulated and closely monitored in order to ensure rapid action to address leaks.

[1] Getting Ready for Shale Gas, EY, 2014, http://www.ey.com/Publication/vwLUAssets/Getting_ready_for_UK_shale_gas/$FILE/EY-Getting-ready-for-UK-shale-gas-April-2014.pdf

[2] Bowland Shale Gas Study, British Geological Survey, 2013, https://www.gov.uk/government/publications/bowland-shale-gas-study

  - A range of technologies and techniques to limit methane emissions should be required, including 'reduced emissions completions' (also known as 'green completions') and liquid unloading mitigation technologies (e.g. plunger lift systems) should these be needed;
  - A monitoring regime that catches potentially significant methane leaks early is essential in order to limit the impact of 'super-emitters';
  - Production should not be allowed in areas where it would entail significant CO_2 emissions resulting from the change in land use (e.g. areas with deep peat soils);
  - The regulatory regime must require proper decommissioning of wells at the end of their lives. It must also ensure that the liability for emissions at this stage rests with the producer.

- **Test 2: Consumption – gas consumption must remain in line with carbon budgets requirements.** UK unabated fossil energy consumption must be reduced over time within levels we have previously advised to be consistent with the carbon budgets. This means that UK shale gas production must displace imported gas rather than increasing domestic consumption.
- **Test 3: Accommodating shale gas production emissions within carbon budgets.** Additional production emissions from shale gas wells will need to be offset through reductions elsewhere in the UK economy, such that overall effort to reduce emissions is sufficient to meet carbon budgets.

xii. The Government believes that the strong regulatory environment for shale gas development, plus the determined efforts of the UK to meet its carbon budgets, means that the three "tests" put forward by the CCC will be met. The necessary actions already underway are described in detail on the following pages.

xiii. Given this view, the Government does not intend to lay regulations under Section 49(3) of the Infrastructure Act 2015, which would provide for the right to use deep-level land to cease to have effect. The Act requires a further report to be provided by the CCC in April 2021. The Government may also request updated advice in the meantime, should it deem it helpful.

1. Developing Shale Gas in the UK

1. Exploring and developing the UK's shale gas resources could potentially bring substantial benefits and help us meet our objectives for secure energy supplies, economic growth and lower carbon emissions. The Government is committed to exploring the UK's shale gas potential whilst maintaining the very highest safety and environmental standards.

2. Having access to clean, safe and secure supplies of natural gas for years to come is a key requirement for the UK's successful transition to a low-carbon economy. Gas provides around one third of our current energy supply - as described in Chapter 2.

3. Since 2004, the UK has been a net importer of gas due to the rapid decline of production from the UK Continental Shelf. In 2014 around 45% of UK gas supply was made up of net imports[3], with projections that this will continue to increase in future. Any oil and gas that the UK does not produce will have to be imported at significant extra cost.

4. Exploring for, and developing shale will also help create jobs and grow local economies. Investment in shale could reach £33 billion and support 64,000 jobs directly and in the supply sectors, including construction & engineering. Development could also deliver investment in key domestic infrastructure and reduce imports, improving the balance of trade.

5. The full scale of the UK's shale resources nor how much can be extracted technically or economically is not yet known. As such, there is a clear need to test our shale potential. Exploration is required to determine this potential and reduce the uncertainty described in the CCC report.

The Regulatory System for Shale Gas and Hydraulic Fracturing

6. The UK has been successfully regulating gas and oil drilling for over 50 years and has tough regulations in place to ensure on-site safety, prevent water

[3] DUKES, Chapter 4, 2015, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/447631/DUKES_2015_Chapter_4.pdf

contamination, mitigate seismic activity and minimise air pollution. Any shale development must be safe and environmentally sound.

7. A simplified version of the regulatory regime is described below.

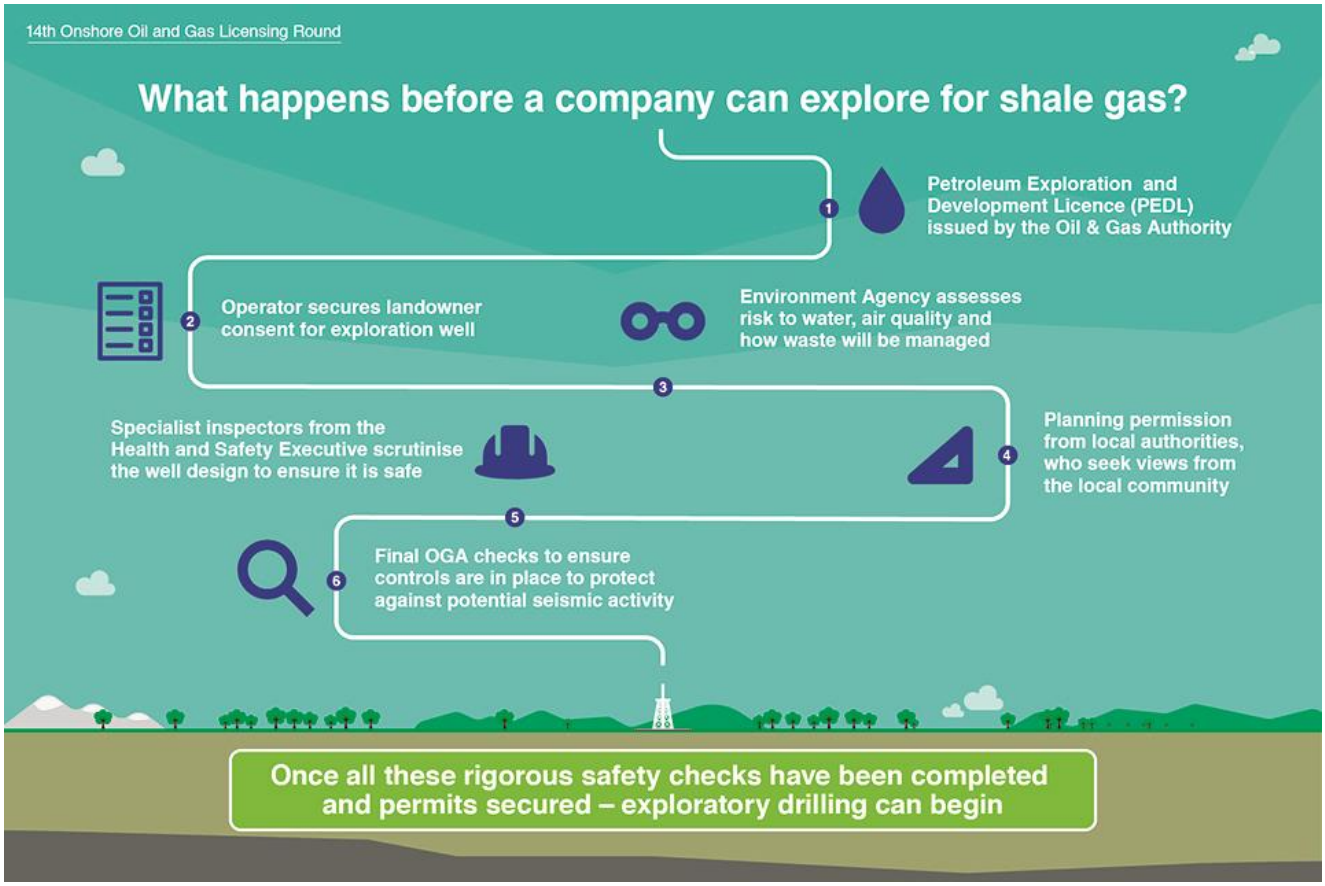
8. An onshore oil and gas operator is required to have a number of permits, consents and licences before commencing any operations. The first is to acquire a Petroleum Exploration and Development Licence (PEDL) through a licensing round. A PEDL grants exclusivity to licensees within a defined area for onshore hydrocarbon exploration and extraction.

9. Further requirements then include agreement with the landowner, planning permission, and obtaining an environmental permit. All these stages involve scrutiny by the relevant regulatory organisations. All projects must be approved by the relevant environmental agency and are scrutinised by the Health and Safety Executive (HSE). They are also subject to scrutiny through the planning system. Further consent from DECC/the Oil and Gas Authority (OGA) is required before drilling, hydraulic fracturing or production activities can commence.

10. Further consents are required for any developments using hydraulic fracturing (as opposed to conventional means of extracting oil and gas). Operators need to submit a Hydraulic Fracturing Plan to the OGA, and comply with requirements to mitigate any seismic risks. Section 4A of the Petroleum Act 1998 (inserted by section 50 of the Infrastructure Act 2015)[4] also sets out a range of requirements that operators need to comply with before the Secretary of State will issue a hydraulic fracturing consent. These include taking into account the environmental impacts of development, groundwater monitoring, community benefits and prohibiting hydraulic fracturing in protected areas.

[4] Section 50, Infrastructure Act 2015, http://www.legislation.gov.uk/ukpga/2015/7/section/50/enacted

Figure 1: Overview regulatory checks for exploratory drilling



Meeting Test 1

11. The CCC report states that "*well development, production and decommissioning emissions must be strictly limited*" for shale gas development at scale to be compatible with carbon budgets.

12. The Government agrees with this conclusion. This should be the case for all natural gas extraction, not just developments using hydraulic fracturing. As described below, the regulatory regime requires that operators make every effort to minimise associated emissions from well development, production and decommissioning. In particular, management of fugitive emissions from shale well sites is covered by the Environment Agency (EA) permit. As part of the permit application, the operator will need to describe how they will manage fugitive emissions, for example in an emissions management plan.

13. Additionally, as the CCC note, a number of emissions mitigation techniques are cost effective, as they avoid leakage of methane that could otherwise be sold.

14. The CCC has four sub-recommendations to Test 1. The first recommended that "*A range of technologies and techniques to limit methane emissions should be required, including 'reduced emissions completions' (also known as 'green completions') and liquid unloading mitigation technologies (e.g. plunger lift systems) should these be needed*".

15. The Environment Agency has already stated that they consider green completions, meaning techniques applied to 'well completions' to significantly reduce the emissions of gases to the air, to be a 'best available technique' for shale gas production. Other individual mitigation techniques will be considered on a case by case basis, retaining the flexibility to take into account individual well situations plus future technological advancements as the industry moves towards production. The CCC report recognises that their view of the current UK position does not include further techniques and technologies that are likely to be required by the EA.

16. The second sub-recommendation is that "*A monitoring regime that catches potentially significant methane leaks early is essential in order to limit the impact of 'super-emitters*".

17. Monitoring of any methane emissions from shale well sites is also covered by the Environment Agency permit. During operations the operator will be required to undertake environmental monitoring, including emissions monitoring, to demonstrate compliance with their permits. In some cases, depending on the risks

presented by a site or community concerns, the EA may undertake extra monitoring themselves.

18. As a further safeguard for developments using hydraulic fracturing, section 4A of the Petroleum Act 1998 (inserted by section 50 of the Infrastructure Act 2015) makes it clear that hydraulic fracturing activities cannot take place unless appropriate arrangements have been made for monitoring emissions of methane into the air.

19. The Health & Safety Executive (HSE) also has an important role to play in ensuring that there are no significant leaks as a result of a loss of well integrity. The HSE's robust regulatory requirements for well design construction, operation and decommissioning help mitigate the risk that 'super emitters' would occur. If they did, the Borehole Sites and Operations Regulations 1995[5] include provisions for the detection and monitoring of hydrocarbons. If an unintended release of hydrocarbon was detected, this must be reported to HSE, who would ensure that the operator took appropriate action.

20. The strong safeguards described in the previous paragraphs are in place to ensure that the chances of any "super-emitter" leaks, as described by the CCC are minimised. DECC will continue to work with the EA and HSE as the shale industry grows to ensure this remains the case.

21. The third sub-recommendation is that "*production should not be allowed in areas where it would entail significant CO_2 emissions resulting from the change in land use (e.g. areas with deep peat soils)*". Such possible impacts from land use change are clearly not specific to onshore oil and gas, and could arise from any development, such as new housing or industry.

22. As for other types of development, planning permission is required by oil and gas operators for shale extraction proposals. Any impacts of the development in respect of CO_2 emissions, as set out in the National Planning Policy Framework, resulting from a change in land use would be capable of being taken into account in the decision on the proposals where relevant.

23. The final sub-recommendation is that "*the regulatory regime must require proper decommissioning of wells at the end of their lives. It must also ensure that the liability for emissions at this stage rests with the producer."*

[5] The Borehole Sites and Operations Regulations 1995, http://www.legislation.gov.uk/uksi/1995/2038/contents/made

24. When operations finish, the licensee is responsible for safe decommissioning of the well(s) and for restoring the well-site to its previous state or a suitable condition for re-use. As the lead regulator for well integrity, HSE ensures that the well operator has complied with regulatory requirements to decommission the well so that there can be no unplanned release of fluids from the well or any reservoir attached to it, so far as is reasonably practicable.

25. There are further additional safeguards regarding decommissioning. The relevant planning authority may require suitable restoration of the site as a condition of the planning permission. In England, the Environment Agency also requires that a site condition report is submitted by the operator as part of its Environmental Permitting regime that demonstrates that the site is in a satisfactory state when they surrender their environmental permit.

26. **In conclusion, the Government is confident that the existing regulatory regime means the CCC's "Test 1" recommendation will be met for production stage shale development. The regulatory system ensures that wells are safely and appropriately designed, operated and decommissioned during development, production and decommissioning. There are strong requirements in the regulatory system to ensure any associated emissions are limited. DECC will continue to monitor the appropriateness of these regulations as the industry grows.**

2. Use of Gas in the UK

27. Gas – the cleanest fossil fuel – provides around one third of our current energy supply[6].

28. In 2014, around 35% of gas in the UK was used in households for heating and cooking purposes. A similar amount was used in the industrial sector, for power, heating and also as a feedstock for the chemicals industry and in manufacturing processes. Close to 30% was used in electricity generation[7].

29. A key rationale for exploring our domestic shale gas potential is that the more energy sources we are able to access, the greater our energy security. There is clearly a strong driver for us to explore the potential of the domestically available gas, with the associated economic benefits for the UK, if we are able to do so in a safe and sustainable way.

30. This is reinforced by the decline of domestic production from the UK Continental Shelf, plus the projections that this will continue.

31. The Government wants the UK to successfully transition in the longer term to a low-carbon economy. Access to safe and secure supplies of natural gas in the coming years is central to that transition.

Emissions from Shale Gas

32. The 2013 report "Potential Greenhouse Gas Emissions Associated with Shale Gas Extraction and Use" by Prof David Mackay and Dr Tim Stone concluded that the carbon footprint of shale gas extraction and use is likely to be in the range 200–253 g CO_2e/kWh of chemical energy, which makes shale gas's overall carbon footprint comparable to gas extracted from conventional sources (199–207g CO_2e/kWh), and lower than the carbon footprint of imported Liquefied Natural Gas (233-270g CO_2e/kWh)[8].

[6] DUKES 2015 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/450302/DUKES_2015.pdf
[7] UK Energy in Brief 2015, DECC, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/516837/UK_Energy_in_Brief_2015.pdf
[8] Potential greenhouse gas emissions associated with shale gas extraction and use, 2013, https://www.gov.uk/government/publications/potential-greenhouse-gas-emissions-associated-with-shale-gas-production-and-use

33. Gas is the cleanest fossil fuel and produces half the carbon emissions of coal when used for power generation[9]. When shale gas is used for electricity generation, Mackay-Stone found its carbon footprint is likely to be in the range 423–535g CO_2e/kWh(e), which is significantly lower than the carbon footprint of coal, 837–1130g CO_2e/kWh(e).

34. This CCC report backs up these conclusions, whilst recognising that the size of any UK industry, and therefore cumulative GHG emissions footprint, is dependent on exploration to indicate the productivity of UK shale. For UK shale gas extraction (not including combustion), it estimates that emissions are likely to be in the range 14-71g CO_2e/kWh (0.014-0.071 $MtCO_2$e/TWh), and a similar range for LNG – which also has significant uncertainty[10].

Meeting Test 2

35. The CCC report states that "gas consumption must remain in line with carbon budgets requirements".

36. The Government agrees with this conclusion. The Government believes that shale gas development is compatible with our goal to cut greenhouse gas emissions and does not detract from our support for renewables. The Government remains committed to the development of renewable energy technologies and the development of new nuclear, and to improving energy efficiency.

37. It is not believed that development of shale at scale will significantly alter UK domestic gas consumption. As described above, the UK is increasingly dependent on gas imports and as such, gas from a strong domestic shale sector would be likely to replace these imports. For a secure energy supply, there is a need to maximise domestic production of gas, increase generation from renewables and new nuclear, as well as manage energy demand.

38. A third of UK energy demand is met by gas, and as less coal is used in the next 10-15 years for electricity generation, gas will help fill the gap alongside renewables, nuclear and demand reduction, helping the UK reduce carbon emissions.

[9] International Panel on Climate Change, Mitigation of Climate Change, 2014, https://www.ipcc.ch/report/ar5/wg3/

[10] The CCC report does not include methane combustion (or use as described in the MacKay Stone) emissions. However, removing the 190g CO_2e/kWh methane combustion estimate from the Mackay-Stone figures gives a range of 10-63g CO_2e/kWh for gas extraction, comparable to 14-71g CO_2e/kWh in the CCC report.

39. In the electricity sector, this is further reinforced by the Government's strong support for renewables, plus the Government's commitment to phase out coal. In the UK, with low carbon generation supported by the contract for difference mechanism, investment in low carbon plant would not be expected to be significantly affected by changes in gas origin.

40. **In conclusion, the current view is that lifecycle emissions from UK shale gas are comparable to conventional sources of natural gas, and that it is not believed that UK shale development will impact overall UK gas consumption. As such, the Government is confident the CCC's "Test 2" recommendation will be met for production stage shale development.**

3. Accommodating Shale Gas Production in Carbon Budgets

41. The Government is committed to taking action on climate change by reducing greenhouse gas emissions and making the transition to a clean, low-carbon economy. As well as in ensuring the UK plays its part in the global effort to combat change, clean growth presents a significant economic opportunity.

42. The Climate Change Act 2008[11] provides the framework for UK domestic action, binding this and future Governments to a target to reduce greenhouse gas emissions by at least 80% below the 1990 baseline by 2050. It also established a series of carbon budgets on the path to 2050. These budgets set a limit on the amount of greenhouse gases that the UK can emit over a five year period.

Meeting Test 3

43. The final test the CCC identifies is that additional UK emissions from domestic production of shale gas must be accommodated within carbon budgets.

44. The Government agrees with this view. Shale gas extraction has the potential to create additional emissions that count towards UK carbon budgets in comparison to imported gas. This is because emissions from the extraction of gas, rather than use, are accounted for in the country of production. These additional emissions can be minimised by the strong regulatory regime.

45. The Government's commitment to meeting carbon budgets means that any additional emissions from shale gas production would be accommodated within carbon budgets and offset by lower emissions in other sectors.

46. **Given this, the Government is confident that the CCC's "Test 3" can be met for production stage shale development.**

[11] Climate Change Act 2008, http://www.legislation.gov.uk/ukpga/2008/27/contents

4. Conclusions and Next Steps

47. The Government thanks the CCC and those organisations and individuals consulted by the CCC as it developed its report. It is critical that the Government's policy takes account of independent analysis.

48. The Government believes that the three tests set by the CCC will be met for the production stage of shale development and as such is not bringing forward legislation that would provide for the right to use deep-level land to cease to have effect. This meets the Government's obligations under section 49 of the Infrastructure Act 2015.

49. The Government is committed to meeting its carbon budgets and will continue to consider the impact of shale development on UK emissions as uncertainty reduces through the exploratory phase of development.

50. Under the Infrastructure Act 2015, the Secretary of State must from time to time request the Committee on Climate Change to provide advice (in accordance with section 38 of the CCA 2008) on the impact which combustion of, and fugitive emissions from, petroleum got through onshore activity.

51. Each reporting period for advice is five years as set out by the Act. Given this, the CCC are required to provide a further report on the compatibility of UK onshore petroleum with carbon budgets in April 2021. The Department may also request updated advice in the meantime, should it deem it helpful or necessary.

52. More broadly, proposals for meeting forthcoming carbon budgets will be set out in the Government's new emissions reduction plan. The working assumption is that this will be published towards the end of 2016.

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