Submission to the inquiry on ‘Environmental Risk of Fracking’ by the House of Commons Environmental Audit Comittee

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Policy paper

December 2014

Centre for Climate Change Economics and Policy

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This policy paper is intended to inform decision-makers in the public, private and third sectors. It has been reviewed by at least two internal referees before publication. The views expressed in this paper represent those of the author(s) and do not necessarily represent those of the host institutions or funders.

Environmental Audit Committee inquiry on 'Environmental risks of fracking'

Executive summary

1. This is a submission by the Grantham Research Institute on Climate Change and the Environment at the London School of Economics and Political Science and the Grantham Institute at Imperial College London. It focuses in particular on the implications of fracking for the UK's carbon emissions reduction obligations.
2. Our response builds on the evidence collected in the course of the study 'A UK 'dash' for *smart* gas' (Bassi et al., 2013) by the Grantham Research Institute on Climate Change and the Environment at LSE, the Grantham Institute at Imperial College London, and the Centre for Climate Change Economics and Policy at the University of Leeds.
3. The key messages in our response are the following:
   - shifting from coal to natural gas - either from conventional or unconventional domestic sources, or from imports - for electricity generation could help the UK power sector decarbonise in the near-term. Gas-fired power plants could also play an important back-up role as the share of renewable electricity in generation increases;
   - in the longer run, gas-power plants will have to be either replaced by low-carbon alternatives or fitted with carbon capture and storage (CCS) if the UK is to comply with its emission reduction targets;
   - a lower risk option would be a 'dash' for smart gas, where natural gas, including domestic shale gas, is used judiciously in those areas where it offers the greatest value in decarbonising the power sector, preventing undesirable infrastructure fossil fuels lock-in.

The implications of fracking for our carbon emissions reduction obligations

4. Natural gas, either domestic or imported, will continue to play an important role in the UK energy mix over the coming decades, for both heating and electricity generation. Shale gas could have a role to play, especially in terms of increased energy security. It is, however, unlikely to be a game changer in the UK in the same way as it has been in the United States.
5. There is great uncertainty about the actual size of UK shale gas reserves that can be commercially extracted. The available evidence (EIA, 2011; Cuadrilla, 2011; ECC, 2012; Andrews, 2013 and 2014; Monaghan, 2014; DECC, 2012a) suggests that these could, at best, make up for decreasing domestic resources, as conventional reservoirs are depleting. But shale gas is unlikely to expand domestic gas availability beyond current levels, let alone render the UK energy independent and free from the need to import natural gas.
6. Economic implications, especially concerning future gas prices, will also affect fracking developments. Domestic shale gas reserves are likely to be too modest to affect gas market prices. These may remain largely driven by wholesale prices

charged by foreign suppliers, which are highly uncertain. A decrease in gas prices could have positive consequences for the UK economy, but could also affect the profitability of fracking, resulting in lower production. The potential of shale gas is worth investigating, to get better certainty on its actual availability. However, exploration and production will have to be subject to strict environmental standards, including at the wellhead to prevent fugitive emissions.

7. The production of shale gas can lead to higher greenhouse gas emissions than conventional gas. This is because it involves a larger number of wells and more hydraulic fracturing operations, both of which require energy. And, importantly, shale gas operations lead to more venting of gas during well completion if they are not managed and regulated effectively (Hirst et al., 2013). There is evidence that shale gas development in the United States has led to significant fugitive methane emissions (e.g. EPA, 2012; Howarth et al., 2011; Clark, 2011; Pétron, 2012). Some analysts have concluded that these have been so great as to eliminate the lifecycle greenhouse gas emission benefits of shale gas compared with coal for power generation (e.g., Howarth et al, 2011), although this has been disputed (e.g. Clark et al, 2011).

8. UK and EU environmental regulation, however, can counteract the risk of high emissions. A recent analysis for the European Commission (AEA et al., 2012) found that lifecycle greenhouse gas emissions from shale gas in the EU may be only slightly higher (4-8 percent) than those from conventional gas. And if emissions from well completion are mitigated and utilised, the difference in emissions can be reduced to between 1 and 5 percent. In such a case, lifecycle emissions from European Union shale gas can also be 2 to 10 percent lower than emissions from electricity generated from conventional pipeline gas obtained from non-Member States, notably Russia and Algeria. Lifecycle emissions from power generation that is fuelled by shale gas are estimated to be also significantly lower (almost 41 to 49 per cent) than those of electricity generated from coal.

9. The main issue is therefore not whether fracking would be compatible with the UK carbon budgets (to the extent that its potential may be modest, and emissions comparable to conventional gas), but rather whether the overall UK policy concerning gas - including conventional, unconventional and imported resources - is consistent with them.

10. Meeting the economy-wide carbon budgets will require a gradual reshaping of the UK's energy infrastructure. The power sector, in particular, will need to play a central role in meeting the budgets, since it is a major source of carbon emissions (about a quarter of total 2011 emissions; DECC, 2012b) and it offers mitigation opportunities at the lowest potential cost (CCC, 2010). Furthermore, low-carbon electricity is assumed to provide the basis for the decarbonisation of other parts of the economy, such as surface transport, residential heating and perhaps parts of industry.

11. In the short run, the UK's emissions can be reduced by innovating in shale gas extraction and replacing coal-fired power stations with those fuelled by natural gas, especially if fugitive emissions are adequately controlled for and gas

development does not significantly reduce technological progress in low-carbon and renewable energy. The use of gas without carbon capture, however, should be agreed to be on a time-limited basis (Aghion et al, 2014).

12. In the medium- to long-term, a heavy reliance on gas-fired power stations with unabated emissions would hinder the decarbonisation of the UK's power sector. In such case, to be able to meet the overall fourth carbon budget, the additional emissions from the power sector would need to be offset by additional cuts in other sectors. Whether this would be economically sensible will depend on the future price of gas, which remains uncertain, as well as on the cost-effectiveness of alternative emission abatement measures in other sectors. Furthermore, some of the alternative mitigation measures may still be linked to the decarbonisation in the power sector (for example, in the case of switching to electric cars and heating), so higher carbon intensity for electricity generation could have further knock-on effects on their cost and feasibility.

13. To alleviate concerns of lock-in of gas-based infrastructures, the government would need to credibly signal to the private sector that gas (without carbon capture) will be not subject to a favourable regime in the medium run, for instance from 2030 (Helm, 2012). The private sector would then invest in gas capital assets (fields, power plants etc.) on the basis that they could make an economic return over the coming 15-year period, but potentially no longer (Aghion et al, 2014).

14. The life of gas-fired power plants could be extended only if their emissions can be captured with carbon capture and storage (CCS) technology. If CCS is effective and implemented, then a sustained use of gas for electricity generation could well be consistent with carbon budgets after 2030. Further, research in fully clean technologies would need to be strongly stepped up over the intervening period, along with other supportive policies (Aghion et al, 2014).

15. Investment in complementary technologies will therefore be essential. In particular, it will be crucial to find out as soon as possible whether gas-fired power stations fitted with CCS can become economically viable in the UK within the next decade or so. Strong UK Government support for research, development and deployment across a number of CCS pilot projects will be crucial to prove this technology is commercially viable, and to bring down costs (Imperial College London, 2011). The Member States of the European Union should also coordinate their CCS efforts and push ahead with pilot schemes, including technology that can be retrofitted (Bassi et al, forthcoming).

16. A mandatory decarbonisation target for the power sector in 2030 could also help to ensure that enough investment is made in low-carbon electricity generation, by reducing policy uncertainty. This can also encourage 'smart' investment in fracking and gas-fired power stations to a level which is consistent with the carbon budgets and preventing infrastructure lock-in.

Declaration of interests

The authors have undertaken research on energy, climate change and the environment for several public organisations, including the European Commission, the UK Department for Environment, Food and Rural Affairs (Defra), and the Joint Nature Conservation Committee (JNCC). Sam Fankhauser is also a member of the UK Committee on Climate Change (CCC).

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