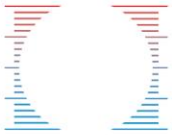

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Submission to inquiry on 'Environmental risks of fracking' by the House of Commons Environmental Audit Committee

Samuela Bassi, Sam Fankhauser, Neil Hirst, Bob Ward and Dimitri Zenghelis

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The Centre for Climate Change Economics and Policy (CCCEP) was established in 2008 to advance public and private action on climate change through rigorous, innovative research. The Centre is hosted jointly by the University of Leeds and the London School of Economics and Political Science. It is funded by the UK Economic and Social Research Council and Munich Re. More information about the Centre for Climate Change Economics and Policy can be found at: http://www.cccep.ac.uk

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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 ESRC Centre for Climate Change Economics and Policy and Grantham Research Institute on Climate Change and the Environment at 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 targets for reducing greenhouse gas emissions.
2. This submission builds on the evidence collected in the course of the study 'A UK 'dash' for *smart* gas' (Bassi et al., 2013) by the ESRC Centre for Climate Change Economics and Policy, Grantham Research Institute on Climate Change and the Environment , and Grantham Institute.
3. The main points of this submission:
    - 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 to 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 term, gas-fired 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 the undesirable lock in of infrastructure for fossil fuels.

The implications of fracking for the UK's targets of reductions of greenhouse gas emissions

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 have the same dramatic effect in the UK as has occurred in the United States.
5. There is great uncertainty about the actual size of UK shale gas reserves that would be commercially viable to extracted. The available evidence (EIA, 2011; Cuadrilla, 2011; ECC, 2012; Andrews, 2013 and 2014; Monaghan, 2014; DECC, 2012) suggests that these reserves could, at best, make up for the decreasing size of conventional domestic resources as 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, particularly the future price of natural gas, will also affect the extent of fracking. Domestic shale gas reserves are likely to be too modest to

affect gas market prices in the UK, which may remain largely driven by uncertain wholesale prices charged by foreign suppliers. 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 gain a better understanding of its actual availability in the UK. However, exploration and production will have to be subject to strict environmental standards, including at the wellhead to prevent fugitive emissions of methane, which is a powerful greenhouse gas.

7. The production of shale gas can lead to higher greenhouse gas emissions than those released during the production of natural gas from conventional sources. This is because shale gas production 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 emissions of methane (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 European Union (EU) environmental regulation, however, can counteract the risk of high fugitive emissions. A recent analysis for the European Commission (AEA et al., 2012) found that lifecycle greenhouse gas emissions from shale gas production in the EU may be only slightly higher (4-8 percent) than those generated by the extraction of conventional gas. And if emissions from well completion are mitigated and utilised, the difference in emissions can be reduced to between 1 and 5 per cent. In such a case, lifecycle emissions from EU shale gas production can also be 2 to 10 per cent 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 (41 to 49 per cent) than those generated by the burning of coal for electricity.

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 greenhouse gas emissions (about a quarter of total 2013 emissions; DECC, 2014) 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 term, 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 and gas development does not significantly reduce technological progress in low-carbon and renewable energy. According to provisional figures published by the Department of Energy and Climate Change (2014), coal was responsible for 21.1 per cent of the UK's annual emissions of greenhouse gases in 2013. The use of natural gas without CCS technology should, however, 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 measures for emissions abatement in other sectors. Furthermore, some of the alternative mitigation measures may still be linked to decarbonisation of the power sector (for example, switching to electric cars and electric heating), so a higher level of carbon intensity for electricity generation could have further knock-on effects on their cost and feasibility.

13. To alleviate concerns about the lock in of gas-based infrastructures, the Government would need to credibly signal to the private sector that gas (without CCS) will be not subject to a favourable regulatory environment in the medium term (i.e. 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 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 CCS technology. If CCS is effective and implemented, then a sustained use of natural 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 EU should also coordinate their CCS efforts and push ahead with pilot schemes, including the development of CCS technology that can be retrofitted to power stations (Bassi et al., forthcoming).

16. A mandatory decarbonisation target for the power sector in 2030, as required by the UK Energy Act 2013, 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, and the Joint Nature Conservation Committee. Sam Fankhauser is also a member of the UK Committee on Climate Change.

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