Climate Change Impacts of Unconventional Gas Extraction in Scotland

A Response from The Broad Alliance

1. The ‘transition’ argument
Broad Alliance views investment in a UOGE fossil fuel industry as an unsustainable shift away from investment in renewable energy. A transition from fossil fuel use to renewables would be made much more difficult by having a new fossil fuel industry established.

SGIESPR (2012) is frequently cited by UCG advocates for evidence of its green credentials, but more careful reading of it includes the following points:

6.67
While the use of gas may bring a benefit through replacing coal use, there is a longer term risk that investment in gas, particularly gas power generation, will replace investment in lower-carbon renewable technologies.¹

6.73
the decarbonisation benefits of unconventional hydrocarbons from Scotland are not clear or guaranteed;
Scottish emissions during appraisal and production of unconventional gas may increase;

6.100
The impact on the Scottish Government policy for reducing GHG emissions needs strategic consideration as unconventional hydrocarbon extraction will maintain and continue Scottish fossil fuel-derived GHG emissions above an

¹ SGIESPR (2014) 6.67ff, p.45
alternative scenario of reliance on renewable energy (noting our remit here is not to consider the feasibility of renewable sources in meeting complex energy demands).²

1b Joan MacNaughton on Emissions to 2035
Joan MacNaughton, Chair of World Energy Trilemma, World Energy Council, comments on UOOG:

A European strategy for gas would lead to an increase in GG emissions by 2035.(4)

1c Stamford & Azapagic
Whilst citing evidence for the possibility of a ‘transition’ argument in theory, Stamford & Azapagic’s Life Cycle Environmental Impacts of UK Shale Gas (2014) acknowledges the realistic outcome arising from economic factors:

“availability of cheap shale gas is also likely to depress investment in low-carbon technologies such as nuclear and renewables.”³

“in light of these predictions, the ‘transitions’ argument seems to us a dubious and unwise strategy for meeting Scotland's strict greenhouse gas emissions targets.”⁴

Since the writing of this section, the UK Government’s CCC report (July 2016) has added extra material for consideration – see section 3.4 below on the ‘bridging/transition’ argument.

2. Technical issues
In Broad Alliance’s view, meeting emission targets, via reduced fugitive emissions and a necessary 95% carbon capture target, would be an unlikely scenario, both on economic and technical grounds.

⁴ ibid.
**2a Joan MacNaughton on methane and carbon capture issues**

MacNaughton’s view is that

> Methane leaks have been a significant issue in the USA
> Carbon capture in gas powered power stations would need to be 95%, but even then would not be ideal. 

**2b Economics of Carbon Capture & Storage**

Although Scotland has world-leading CCS R&D projects, the need to develop cost-effective CCS technology for continued reliance on natural gas is necessary now for UGE to be viable industry. It cannot wait for future improvements if the UGE strategy is to be implemented now as a transition fuel. The economics and technical specifications for MacNaughton’s 95% target seem unlikely to be met.

Boot-Hanford (2014) predict that plans for CCS, in the immediate term, are “both internationally and in the UK, are unlikely to deliver the level of CCS deployment that many suggest will be required.” (see appendix 2)

**2c Howarth et al. (2011)**

Howarth et al. (2011) argue for a projected outcome where UGE greenhouse gas emissions do not happen at sufficient levels in practice to mitigate Climate Change impact. Their high estimate figure for methane emissions through ‘fugitive emissions’ has been disregarded by Azapagic et al. as a statistical outlier compared to more favourable estimates.

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5 Joan MacNaughton, CB, HonFEI, Chair, Energy World Trilemma, World Energy Council, former Director General of Energy for the UK, Keynote speech, Glasgow University ‘Festival of Sustainability’ seminar, 13 June 2016


7 Life cycle environmental impacts of UK shale gas, Laurence Stamford, Adisa Azapagic, Applied Energy Volume 134, 1 December 2014, Pages 506-518, online publication
However this must be viewed in the context of Howarth’s report’s independence from industry bias, in favour of a more committed concern to focus on the risk of climate change impacts. Its significance should be noted as a counter-balance in evaluation of the array of research sources. The rigour of its scientific integrity can be demonstrated by its use of primary sources (see appendix 1). We do not feel it should be disregarded. The report includes the following points:

“Methane is a powerful greenhouse gas, with a global warming potential that is far greater than that of carbon dioxide, particularly over the time horizon of the first few decades following emission. These methane emissions are at least 30% more than and perhaps more than twice as great as those from conventional gas. Compared to coal, the footprint of shale gas is at least 20% greater and perhaps more than twice as great on the 20-year horizon and is comparable when compared over 100 years.”

3.6% to 7.9% of the methane from shale-gas production escapes to the atmosphere in venting and leaks over the life-time of a well.”

3. Update – Committee on Climate Change (CCC) Report, July 2016

3.1 CCC Report – Executive Summary
The recent (July 2016) release of the Committee on Climate Change report to the Westminster Government not only confirms, but validates Broad Alliance concerns


regarding climate change emissions as we have argued above. Our response, given the short notice, is highlighted as follows, with key concerns in bold type.

In the Executive summary it states

“The implications for greenhouse gas emissions of shale gas exploitation are subject to considerable uncertainties, both regarding the size of any future industry and the emissions footprint of production.” It also states, “Our assessment is that exploiting shale gas by fracking on a significant scale is not compatible with UK climate targets unless three test are met,” one of which is,

“Production should not be allowed in areas where it would entail significant CO2 emissions resulting from the change in land use”.

The Broad Alliance submits that current live PEDL license areas in Scotland being predominantly agricultural land with relatively small CO2 emissions would, using the criteria stated, preclude them being used for any form of Unconventional Gas Extraction.

As far as Global Emissions are concerned the summary states

“Increased UK production of fossil fuels could affect global emissions”.

Given that Scotland has, at this moment, minimal onshore fossil fuel extraction, the Broad Alliance is of the opinion that any further onshore fossil fuel extraction would affect global emissions. As we have argued above, we have little confidence that the ‘transition’ would in fact lead to an overall lower carbon footprint.

In fact the summary continues,

“Domestic production of shale gas will lead to some additional UK emissions… The size of these extra emissions depends on the size of the future industry, about which there is considerable uncertainty”.
“Accommodating additional emissions from shale gas production of 11MT/year may be possible, although it would require significant and potentially difficult offsetting effort elsewhere”.

The Broad Alliance would like to put this in a Scottish context; given the much stricter emission targets set by the Scottish Government, ‘accommodating’ additional emissions a fraction of the amount quoted is virtually impossible.

3.2 CCC Report ch.2 – Carbon footprint of resulting industrial use
In chapter 2 the report states

“Our assessment is therefore that UK shale gas production will do little to reduce energy bills, with prices set by international markets. This finding is consistent with those of other studies. Production that bypasses wholesale markets could, however, reduce costs for some industrial users.”

The Broad Alliance is of the opinion that the use of shale gas by industrial users could lead to further emission increases due to industrial processes. This would obviously have to be taken in to account in any calculations regarding Scotland's strict emission targets.

3.3 CCC Report ch.3 on ‘bridging fuel’
In chapter 3 the report states, “Carbon budget scenarios do not imply a role for UK shale gas as a bridging fuel, given the relative timing of coal closures and potential UK shale gas production”.

This categorical statement confirms our argument in section 1 that the Transition Fuel argument is an unworkable compromise. The Broad Alliance recognise that the renewables sector is stepping up to fill the void left by the demise of Scottish coal production, as technological advances in renewables continue apace. In our opinion this negates the need for shale gas extraction in Scotland, either as a bridging fuel or indeed as a fuel “of the future”.

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3.4 CCC report ch.3 on CCS

Regarding CCS, the report states

“shale gas is one source of fossil natural gas. Although natural gas has a lower carbon content than other fossil fuels, it is not low carbon unless used with CCS. UK unabated consumption of oil and gas, (i.e. without CCS), will need to fall over the coming decades in order to meet the carbon budgets and the 2050 target”.

“The recent cancellation of the UK CCS Commercialisation Programme does not mean that CCS cannot play a role to 2050, but this cancellation has raised doubts about that role and may imply a substantial delay in its deployment at scale”.

The Broad Alliance concurs with the findings of this part of the report; CCS is not an option at the moment, therefore there is no chance of planned shale gas extraction meeting the strict Scottish Government carbon reduction targets.

3.5 CCC Report c.3 on Environmental Assessment (EA) and Land Use

Regarding emissions of shale gas extraction during production, the report states

“However, in England the EA only regulates to the boundary of the shale well site. It is essential that the requirement for methane mitigation extends beyond the well pad to all associated infrastructure prior to the gas being injected into the grid or put to use”.

In a Scottish context, the Broad Alliance are of the opinion that the monitoring area for any fugitive methane would have to be in an area surrounding the well site, pre-determined in conjunction with the appropriate regulatory body, and include all associated infrastructure up to and including the end user. The costs of this extra duty of care would have a considerable impact on commercial viability, but its omission in a business model would have serious emissions implications.
Regarding land use change emissions, the report states

“The results presented here include estimates of land-use change emissions that result from development of wells on grassland. Were the development of wells instead to occur in areas that have much greater potential for carbon release (e.g. areas of deep peat soils), then land-use change emissions would be much greater and could dominate the results. Given the scale of such potential emissions, production on such land should not be allowed”.

3.6 Scotland’s Third National Planning Framework on Land Use (NPF)
The Broad Alliance would draw attention to these excerpts from Scotland's Third National Planning Framework on Land Use:10

Our principal physical asset is our land. Our most productive soils extend along the east coast and across the Central Belt into Ayrshire. Peatlands are an important habitat for wildlife and a very significant carbon store, containing 1,600 million tonnes of the 3,000 million tonnes in all Scottish soils.11

The report continues:

“We have long sought to protect Scotland’s environment, recognising that it is a dynamic resource rather than a fixed asset. To better reflect this, more proactive and innovative environmental stewardship is required. The pressing challenge of climate change means that our action on the environment must continue to evolve, strengthening our longer-term resilience. A planned approach to development helps to strike the right balance between safeguarding assets which are irreplaceable, and facilitating change in a sustainable way. We must work with, not against, our environment to maintain and further strengthen its contribution to society.”12

The Scottish Government’s Land Use Strategy sets out key principles for the use and management of Scotland’s land. It emphasises that land use should deliver multiple benefits, and encourages us to make best use of assets to support

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11 Ibid.
12 Ibid.
primary activities including food production, flood management and carbon storage. To achieve this, we must recognise that the environment is a functioning ecosystem and take into account the opportunity costs arising from poor decisions on land use. In passing, it is noted that additional impacts on ecosystems, agriculture and flood risk are also significant. However, for the purposes of this report, the NPF makes clear that the issue of carbon storage through disruption and change of land use is a significant issue.

These statements, in our opinion, vindicate our stance opposing all forms of Unconventional Oil and Gas Extraction. It is inconceivable that it would be allowed under any circumstances given the tone of these statements.

3.7 CCC report on Carbon Budgets

Regarding the impact on Carbon budgets, the Committee on Climate Change Report continues:

Even tightly regulated oil and gas production leads to some emissions. Domestic onshore production in place of imports would mean that production emissions occur in the UK rather than overseas. This would therefore increase UK greenhouse gas emissions, even if it leads to no greater consumption of oil and gas in the UK and even if the overall greenhouse gas footprint of UK production is lower than that of imported gas. Onshoring of production means onshoring of emissions relating to production. The implications for greenhouse gas emissions of shale gas exploitation are subject to considerable uncertainties, both regarding the size of any future industry and the emissions footprint of production.

13 Ibid.
The Broad Alliance note that the report states that there are ‘considerable uncertainties;’ that being the case, shale gas exploitation should not be permitted by the Scottish Government.

The report continues;

**Meeting the 2050 target**

The Climate Change Act specifies a target to reduce emissions in 2050 by at least 80% on 1990 levels. It is not clear that there will be much scope for international trading to meet this target, so it is sensible to plan to reduce emissions by 80% across all domestic sectors, plus a UK share of international aviation and international shipping (Box 5.3).

It is too early to estimate possible ranges for emissions that might be associated with onshore petroleum extraction in 2050. The Committee would make such estimates if the evidence base improves sufficiently.

It is also premature to attempt to identify with any confidence specific areas in which effort could be increased to offset new sources of emissions on that timetable. The 2050 target is very challenging to meet and requires major effort to reduce and limit emissions, so flexibility should not be taken as a given.

Should emissions in sectors excluding shale gas exploitation be allowed to go well beyond our Central scenario in one or more areas (e.g. uncontrolled expansion of aviation, little or no CCS, failure to decarbonise heat), then the 2050 target would be at risk and it is very unlikely that there would be scope for additional emissions from shale gas exploitation consistent with meeting carbon budgets or the 2050 target.

Should the emissions impact in 2050 be similar to that in 2030 it is likely to be considerably more difficult and expensive to find ways to offset this, due to the stretching nature of the 2050 target.

In a case in which CCS is not deployed at all by 2050, this challenge would be much greater. Even without additional emissions from onshore petroleum extraction, our analysis shows that the absence of CCS is likely to require near-full decarbonisation of surface transport and heat in buildings by 2050. It is
difficult to see how significant further emissions reductions could be found to offset the impact of additional fossil fuel production.

The Broad Alliance concurs with the Committee’s statement and would re-emphasise that as the report states, ‘it is difficult to see how significant further emissions reductions could be found to offset the impact of additional fossil fuel production.’

Again, we remain unconvinced that once a UOGE industry is established there would be a likely scenario of genuine transition away from investment in it into sufficient renewables investment. ‘Additional fossil fuel production’ therefore seems the most likely outcome with offsetting alternative reductions equally unlikely.

In conclusion the CCC report states:

3. Conclusions and recommendations
The prospects for a domestic onshore petroleum industry are currently highly uncertain. It depends on the underlying economics of production, which in turn depend on the productivity of UK geology. This can only be resolved via exploratory drilling. But even if such exploration produces favourable results, other uncertainties remain, including whether public acceptability challenges can be overcome and the viability of UK onshore production in the context of developments in international fossil fuel markets.
Should an onshore petroleum industry be established in the UK and grow quickly, this would have the potential for significant impact on UK emissions. In order to ensure that these are manageable within carbon budgets, it is necessary that increased UK production does not feed through into increased unabated consumption of fossil energy; that emissions associated with production are strictly limited; and that the production emissions that do occur are offset by actions to reduce emissions elsewhere in the economy in order to stay within overall carbon budgets.
Our assessment is therefore that onshore petroleum extraction on a significant scale is not compatible with UK climate targets unless three tests are met:

- **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.
  - 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 is essential in order to limit the impact of ‘super-emitters’;
  - Production should not be allowed in areas where it would entail significant CO2 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.

There also remains a question over whether increased fossil fuel production in the UK would lead to higher overall emissions globally (Box 5.4). This is something that we have not been able to explore in this report, but are planning to look at later this year.

There are other issues linked to ongoing gas consumption and carbon budgets, but not specific to shale gas production. These include methane emissions from
the storage and transportation of gas and the future use of the gas grid. We will consider these issues separately in future reports, including our annual Progress Reports to Parliament.

This report provides our first advice under the Infrastructure Act. We are required to provide further advice at five-yearly intervals. However, given the pace at which things could develop, we will monitor this area and, if necessary, provide further advice outside this predetermined cycle.

The Broad Alliance notes the use of the phrases; “currently highly uncertain” and “other uncertainties remain”. It is ever clearer that Climate Change is the greatest challenge to be faced on a global scale, and our hope is that Scotland, even as a small nation, could continue with its ambitious targets. We could truly be a flagship nation on the world stage, using our abundant natural resources for renewables, showing that it can be possible. We believe that as long as even the tiniest “uncertainty” remains, then Unconventional Gas and Oil Extraction have no place in Scotland.

3.8: Letter to the Scottish Government regarding emission reduction from the Committee on Climate Change. (Lord Deben / Paul Wheelhouse 24/3/14)

Reducing emissions in Scotland – 2014 progress report

The attached report is the response to your request for an assessment of Scotland’s progress towards meeting emission reduction targets.

It is our third report on Scotland’s progress towards meeting emission reduction targets, and reports on progress towards achieving the second annual target. We provide our assessment of progress against the target for 2011, the latest year for which official data is available. We also consider traded sector data for 2012, as well as macroeconomic and temperature data, to give an indication of what is likely to have happened to emissions in Scotland in 2012 (the 2012 inventory for Scotland will be available later this year).

We then discuss underlying progress towards reducing emissions through the development and implementation of policies and measures.
Scottish emissions were slightly higher than the legislated target in 2011, by around 0.8 MtCO2e. This can be attributed to the recent revision of the Scottish greenhouse gas inventory, which added 1.2 MtCO2e to estimated emissions in 2011. However, it should not distract from the assessment of underlying progress reducing emissions.

While the inventory revision represents an improvement in the methodology for estimating emissions, it will continue to make achievement of currently legislated targets more difficult. There are two basic options for addressing this. The first is to adjust targets, for example by recasting these in terms of year-on-year emissions reductions or by revising the targets to allow for the inventory revision. The second would be to adapt to the inventory change by finding additional opportunities to reduce emissions that go beyond current and proposed policies.

Scotland has made good progress in a number of key emitting sectors, namely renewable electricity, energy efficiency and fuel efficiency of new vehicles, despite the first two legislated targets being missed. However, challenges remain to achieve the stretching annual emissions targets and sectoral targets set out by the Scottish Government and further action is required in terms of policy development and implementation.

4. Conclusion

The Broad Alliance would respectfully suggest that the Scottish Government should develop a policy to stop all planned Unconventional Gas and Oil Extraction. Implementation of such a policy would undoubtedly help to meet the challenges of the ‘stretching targets’.

We believe that Climate Change Impacts of the industry are totally unacceptable. Given the evidence we have highlighted above, including that of Government advisors, we are confident that the Scottish Government will, under no circumstances, permit the development of this industry.
The Broad Alliance reserves the right to submit further evidence as and when it becomes available.

**Addendum**

The Broad Alliance would draw attention to the conclusions of this European Union communication which came out after this submission was made, especially,

“*Europe’s transition to the low-carbon economy needs to accelerate.*”

Current plans for Unconventional Oil and Gas Extraction in Scotland are at odds with the EU recommendations, given the tone of this communication, the Broad Alliance further restate their case that UOGE is incompatible with the Scottish Governments strict Climate Change reduction measures, the sense of urgency relayed by this communication further strengthens our opposition to all forms of UOGE.

http://ec.europa.eu/transparency/regdoc/rep/1/2016/EN/1-2016-500-EN-F1-1.PDF

**References**

*References cited by Howarth et al. (2011)*

Scientific Society Presidents, 1155 16th Avenue NW, Washington, DC 20036.
Available


2 Carbon Capture & Storage Update (2014)

“In the relatively small literature on CCS as an investment proposition, there appears to be something of a consensus emerging that the policy support mechanisms under consideration, both internationally and in the UK, are unlikely to deliver the level of CCS deployment that many suggest will be required. Hamilton and colleagues suggest that given ‘nth of a kind’ cost estimates available and the projected value of avoided carbon emissions under the then proposed US carbon cap and trade bills, Super Critical Pulverised Coal (SCPC) plant with CCS would not present a breakeven proposition until after 2030.
Osmundsen and Emhjellen argue in their 2010 paper that CCS does not offer a profitable proposition and delivers CO₂ abatement at ‘very high cost’. Others contend that the EU ETS on its own won't lead to large scale CCS deployment, a view that has some support from within the industry. Flannery contends that ‘CCS today lacks both an economically viable policy framework and a business model’.


http://pubs.rsc.org/en/content/articlehtml/2014/ee/c3ee42350f accessed 29 June 2016