

To: First Minister
Minister for Business, Innovation and Energy

UNCONVENTIONAL OIL AND GAS (UOG): UNCONVENTIONAL OIL AND GAS RESEARCH PUBLICATION

Purpose: To summarise the findings of the research into unconventional oil and gas (UOG)
REDACTED

Priority: Immediate

Background

1. The Scottish Government is taking a cautious and evidence-led approach to unconventional oil and gas (UOG), which will be supported by a full public consultation. On 08 Oct 2015, the Scottish Government published details of a comprehensive research programme and consultation timetable.

• Commission research	January/February 2016
• Publish final research reports	Summer 2016
• Publish report of regulatory workshop	Autumn 2016
• Public Consultation (4 month)	Winter 2016/17
• Consultation Analysis	Spring 2017

2. In view of the importance of discussing and understanding UOG in the context of wider energy and climate change matters, officials are making preparation for publishing the UOG consultation in late January 2017, in coordination with the consultation on the draft Energy Strategy, and Climate Change Plan.

Overview of research

3. The following research projects were commissioned in 2016 following Scottish Government procurement guidance:

- Economic impacts (KPMG)
- Climate Change Impacts – (UK Committee on Climate Change)
- Decommissioning, site restoration and aftercare – obligations and treatment of financial liabilities (AECOM)
- Understanding and monitoring induced seismic activity (the British Geological Survey)
- Transport - Understanding and mitigating community level impacts (Ricardo).

4. Health Protection Scotland was asked to undertake an independent Health Impact Assessment of UOG. The assessment has undergone extensive peer review, including by reviewers nominated by stakeholders representing community, environmental and industry interests.

5. The independent consultants engaged with the main stakeholder groups representing community, industry, environment and local government interests at the outset of the projects to inform the scope and structure of the research. Health Protection Scotland also held stakeholder workshops (NGOs, community groups, health professionals, industry) to inform their assessment.

6. The final research reports have now been submitted to the Scottish Government. Summaries of the research findings are provided at **Annex A**.

7. The statement that accompanied the announcement of the UOG moratorium on 28 January 2015 stated that the Scottish Government would: *...conduct further work into strengthening planning guidance; and look at further tightening of environmental regulation*. The announcement of the evidence-gathering programme on 08 October 2015 indicated that stakeholder workshops would be undertaken to support this work, and that a summary of the workshops would be published in autumn 2016 before the consultation.

8. On 13 October 2016, officials hosted a workshop with the main regulators. The purpose of the workshop, without prejudice to the eventual outcome of the Government's review and moratorium process, was to:

- consolidate the range of examinations and considerations of the regulatory framework to date;
- consider the current regulatory framework in light of issues raised by the independent research, and how to approach improvements should it become necessary;
- discuss how to inform the public consultation.

9. A summary of this workshop will be available for uploading to the SG website at the same time the research is published. Details of the workshop are provided in the accompanying submission from **REDACTED** (01 Nov 16).

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Recommendation

You are asked to note the content of this submission **REDACTED**

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Copy List:	For Action	For Comments	For Information		
			Portfolio Interest	Constit Interest	General Awareness
Deputy First Minister					X
Cabinet Secretary for Economy, Jobs and Fair Work			X		
Cabinet Secretary for Health and Sport			X		
Cabinet Secretary for Environment, Climate Change and Land Reform			X		
Cabinet Secretary for Communities, Social Security and Equalities			X		
Cabinet Secretary for Rural Economy and Connectivity			X		
Minister for Public Health and Sport			X		
Minister for Local Government and Housing			X		

Permanent Secretary
 DG Economy
 DG Communities
 Chief Scientific Advisor
 Chief Scientific Advisor for Rural Affairs, Food and the Environment
 Chris Stark
 Kenneth Hogg
 Bridget Campbell
 David Ritchie
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SUMMARY OF RESEARCH FINDINGS:**Economic impacts (KPMG)**

Research Aim: Understand the potential aggregate impact of unconventional oil and gas development under a range of scenarios on the Scottish economy

- It is estimated that total gas production would be a cumulative 947 bcf (billion cubic feet) in the central scenario up to 2062, equivalent to around 5.5 years of Scottish consumption at current levels. At its peak in 2035, annual **UOG production would be equivalent of around 2% of current UK Continental shelf offshore production** of hydrocarbons in the central scenario, rising to around 7% under a high scenario, and a negligible amount under the low scenario.
- In the central scenario the cumulative value of UOG to the economy over the period to 2062 is estimated at **£1.2 billion** (High £4.6 bn, Low £0.1 bn). This is approximately equivalent to £30 million per annum of GDP – equivalent to **0.1% of Scottish GDP**. To put this into context, offshore oil and gas production in Scotland was worth £9.9 billion in 2015, or 6.5% of Scottish GDP.
- In the central scenario, it is estimated the Scottish industry would support **1,400 jobs** in Scotland at its peak (High 3,100, Low 470). This includes indirect jobs in the supply chain and induced jobs.
- Potential UOG production in Scotland's Midland Valley is restricted by the relatively high level of urbanisation, water bodies, and designated areas. KPMG assumes a total of between 10 and 31 UOG pads with 10 to 30 wells per pad is the likely scale of development in prospective UOG areas.
- If oil and gas prices remain at current levels it is unlikely that UOG production would be economic in Scotland.

Research Aim: Consider the specific impacts of the development of unconventional oil and gas in Scotland and in particular identify the key sectors and groups likely to be affected by each scenario

- In quantifying the industry's potential economic impact, **the report does not include the potential benefits it could have for the Grangemouth plant** if products were used as a feedstock. Nor does it speculate on the impact that not proceeding with UOG production could have on the facility's long term future.
- Instead, the report notes **Grangemouth has been unable to operate at full capacity due to lack of feedstock**, and a number of petrochemical companies could see a positive impact on their supply chain if UOG is developed as they would avoid the costs of importing/transporting their primary input.
- The report highlights a number of other factors which should be considered when looking at the economic impact of UOG including the impact on local house prices, road use, agriculture, visual amenity, environmental costs and health costs.

Research Aim: Consider the potential nature and extent of any community benefit payments

- In the central scenario the cumulative value of community benefit payments over the period to 2062 is estimated at £217 million (High £663m, Low £63m). This is based on an assumed contribution of 4% of revenues to local communities.

Climate Change (UK Committee on Climate Change)

Research Aim: Examine the impacts on territorial carbon emissions of unconventional oil and gas activities in Scotland in line with the economic scenarios

- The potential impact on Scottish climate change targets would be highly uncertain.
- Exploiting UOG on a significant scale is only compatible with Scotland's climate change targets if
 - a) Emissions are limited through **tight regulation**
 - b) Scottish UOG production **displaces imports**, rather than increasing domestic consumption,
 - c) Emissions from production of UOG are **offset through reductions in emissions elsewhere** in the Scottish economy.
- Central estimates are for emissions from UOG to reach 2.6 Mt/year CO₂ equivalents in 2035 for unregulated production under the KPMG High Production scenario falling to 1.6 Mt under the CCC's 'minimum necessary regulation' scenario, falling to 1.1 Mt with fuller technical mitigation.
- To put these figures into context, they **would account for roughly 11%, 7% and 5% respectively of the Scottish Government's carbon target for 2035** and would require an increase in carbon mitigation elsewhere in the economy.
- If Scottish UOG production simply offsets other global production of gas, then there will not be increase in **global emissions**. Emissions which would have previously occurred overseas will now take place in Scotland.

Research Aim: Consider how the impacts might vary over time.

- The emissions relating to production grow over time, broadly in line with the growth in hydrocarbons produced, peaking slightly after 2035 under each scenario.

Decommissioning, site restoration and aftercare (AECOM)

Research Aim: better understand the steps that can be taken to ensure decommissioning, site restoration and aftercare can be undertaken in a way that ensures robust regulation and minimises impacts on communities and the environment.

- The risk of leakage from abandoned UOG wells is likely to be low, and international experience suggests that long-term well integrity can be achieved by implementing best

practice during well construction and abandonment operations under a strong regulatory regime.

- There is a risk that a small proportion of wells may fail. Leaks may occur from these wells if there is a source of oil or gas under pressure (generally not the case). Therefore it may be appropriate to monitor for leakage from decommissioned UOG wells for as long as SEPA consider necessary.
- Scotland has a mature framework for the regulation and control of UOG development which is at least the equal of those examined in other countries or other industries. With appropriate regulatory oversight and monitoring, the framework is sufficient to manage risks of well leakage consistent with the aim of providing suitable protection for communities and the environment.

Research Aim: to identify and explore different models of financial guarantee that provide robust security against liabilities, and improve understanding of associated costs.

- It is essential that UOG operators have sufficient funds available to cover liabilities associated with the abandonment and decommissioning of wells.
- Taking lessons from open cast coal mining there are financial mechanisms available which can minimise the risk of operators failing to honour their commitment to decommissioning.

Understanding and monitoring induced seismic activity (BGS)

Research Aim: better understand the levels of induced seismic activity that could be associated with unconventional oil and gas activities in Scotland.

- Hydraulic fracturing is generally accompanied by microseismicity, the magnitudes of these events are usually less than 2.0 making them too small to be felt by people.
- The process of hydraulic fracturing as presently implemented poses **a low risk of inducing felt, damaging or destructive earthquakes.**
- In western Canada, increases in annual earthquake rates over the last ten years correspond to increases in the number of hydraulically fractured wells, suggesting that **hydraulic fracturing has induced earthquakes.** However, the probability of earthquakes that can be felt appears to be small given the large number of hydraulic fractured wells (>12,000. In comparison, the KPMG analysis envisages 300 wells in Scotland under its central scenario, and 930 in the high scenario).

Research Aim: better understand the robust regulatory and non-regulatory actions that can be taken to mitigate any noticeable effects on communities.

- Recent increases in earthquake rates and significant earthquakes in many areas of the United States where fracking is undertaken have been linked to the **disposal of wastewater by injection into deep wells rather than hydraulic fracturing itself.** This practice is **not something that we would expect to be permitted** under the current Scottish regulatory regime.
- In the UK, following induced seismicity near Blackpool in 2011, the UK Government put steps in place to mitigate risks. This includes a traffic light threshold, with the limit of

0.5ML for cessation of operations. An event of this magnitude is unlikely to be felt, does not pose any seismic hazard, and would only be detected by sensitive monitoring equipment in the vicinity of the epicentre.

- A dense network of monitoring stations is essential for reliable detection and discrimination of induced seismic events, and to allay public concern.

Transport- Understanding and mitigating community level impacts (Ricardo)

Research Aim: Explore the scope and scale of increased traffic volumes in community localities around site(s) during the four stages of unconventional oil and gas development (exploration, appraisal, production and decommissioning & restoration).

- The additional traffic movements associated with UOG resources are unlikely to be significant or detectable at a regional (i.e. local authority) or national scale, in view of the much greater numbers of traffic movements resulting from other activities.
- Each well pad could require traffic movements to be sustained at around **190 per week for a period of approximately 2 years** during the development phase. For context, a warehouse / distribution centre may be expected to generate approximately 5,000 two-way HGV movements per week. A wind farm construction can require 800-1,000 two-way movements at its peak.
- The main factor affecting traffic flows is the requirement for transportation of water. If that can be avoided (e.g. by use of pipelines or re-using wastewater) the impacts can be significantly reduced.

Research Aim: Explore the range of potential impacts (and duration of impacts) of these traffic volumes, and robust regulatory and other options that could mitigate impacts for communities.

- Any increase in vehicle movements could result in an increase in noise, vehicle emissions, road damage or traffic accident risks, which may be identified as negligible, or may require mitigation.
- Provided the planning and Environment Impact Assessment system is properly implemented, any significant impacts would be avoided through the use of appropriate mitigation measures.
- However, even with mitigation and guidance in place, **local communities would experience an increase in traffic numbers, potentially for an extended period of a number of years.**

Public Health Impact Assessment (Health Protection Scotland)

Research Question: What are the potential risks to health associated with exploration for and exploitation of shale oil and gas and coal bed methane?

- The overall conclusion of this HIA is that the evidence considered was 'inadequate' as a basis to determine whether development of shale oil and gas or coal bed methane would pose a risk to public health. However, individual conclusions were drawn on particular types of UOG-related hazard and specific types of health outcome.

- There was 'sufficient' evidence to determine that a number of airborne and waterborne environmental hazards would be likely to occur as a result of UOG operations. Specific UOG processes of hydraulic fracturing and to a greater extent, the disposal of UOG waste water into deep injection wells, were found to be associated with increased seismicity of variable intensity, much of it minor. However, there was 'inadequate' evidence that seismicity linked to UOG activity was associated with any actual physical risk to health.
- There was 'sufficient' evidence that silica, a component of fluids used in fracking processes, occurred at levels that could pose a risk to UOG workers' health. There was also evidence that other UOG hazards occurred at levels that could pose a risk to the health of nearby residents (this evidence was classed as 'limited').
- There was 'inadequate' evidence to suggest that other UOG-associated chemical hazards or nuisances such as noise, light or odours, occurred at levels that could pose a risk to physical health.

Research Question: What are the wider health implications of deploying the technology necessary for the exploration and exploitation of shale oil and gas and coal bed methane?

- The evidence reviewed on the wider implications of UOG on health was primarily qualitative. This identified ambivalent views in the studied communities regarding the perceived positive and negative impacts of UOG development. It focused on self-reported concerns, anxieties and stress and possible economic benefits.

Research Question: What options could there be to mitigate any potential adverse impacts that are identified?

- HPS identified areas where the current regulatory framework for UOG development could be strengthened, including in respect of planning and environmental regulation.
- The evidence reviewed, while lacking in quantity, quality and consistency, would justify adopting a precautionary approach if UOG development is permitted in Scotland in the future. A precautionary approach should be proportionate to the scale of the hazards and potential health impacts, both adverse and beneficial.
- Within environmental public health, adopting a precautionary approach can take a number of forms, and it is not unusual for a precautionary approach to allow the development of a technology, where it is considered that realistic, practical opportunities can be identified to control potentially hazardous exposures.
- The report summarises the approaches taken to UOG by other countries/governments, ranging from bans to supporting industry, concluding that a precautionary approach in Scotland could be based on adopting a range of mitigation measures involving operational best practice, regulatory frameworks and community engagement.

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