Whitehall's 'Fracking' Science Failure

How the Government misled Parliament and the public on fracking and climate change

Paul Mobbs' report for Talk Fracking is available their web site:
`http://www.talkfracking.org/`

Paul Mobbs' *Whitehall's Fracking Science Failure*, produced for Talk Fracking in 2017, seeks to explain how the debate over the emissions from 'fracking', and their impacts on climate change, has changed over the last few years – and why the Government has failed to acknowledge this change.

Precisely why that debate has changed is critical to how the Whitehall Government has justified, and promoted, onshore oil and gas extraction in Britain. At a more general level the report is a study in how Government itself has become hi-jacked by corporate interests, to the detriment of democratic accountability.

What is 'science'? It is a process for how we find, measure and then evaluate the real-world in order to identify 'how it works'.

The problem is, particularly for contentious debates in the media and politics, that we seldom hear the 'confidence' we might have in those results, or their 'uncertainties'. Rarely is the method of how those results were produced ever discussed.

When we hear the fracking industry and academics argue over leaks, we might presume the issue is whether or not one or other set of figures are correct. In fact, the issue here is the method used to make those measurements, and whether it produces a 'realistic' result or not.

The Government's case – detailed in the Mackay-Stone report – has been widely criticized in the past.

Research published over the last 18 months questions the accuracy of Mackay and Stone's data. As a result of this new information Whitehall's climate case has arguably collapsed.

"Fracking" & Whitehall policy

Whitehall has promoted fracking as a means to meet climate change obligations. As Energy Secretary Ed Davey claimed in 2013, shale gas is a "bridge" to a low carbon economy.

That claim rests on the results of one report, written by the Department of Energy and Climate Change's (DECC) Chief Scientist, David Mackay, and the economist, Timothy Stone.

The Mackay-Stone report, published in September 2013, states that,

> *We have gathered available information on the carbon footprint of shale gas to inform our estimate of the potential impacts of shale gas exploration, extraction and use in the UK on UK climate change objectives… With the right safeguards in place, the net effect on UK GHG emissions from shale gas production in the UK will be relatively small.*

The point at issue today is whether that process of evaluation was valid, even when the report was first published in 2013.

'Bottom-up' versus 'Top-down'

How we measure and evaluate the pollution emitted by industrial processes is a compromise between what is technically possible and realistically practicable. These historic difficulties mean that regulators have relied on a 'bottom-up' or 'inventory' method to assess the leaks.

Small parts of the equipment are tested, either in a laboratory or specially constructed test rigs. The leaks are measured or estimated. Finally the figures are combined in an 'inventory' of the system being monitored to produce a total.

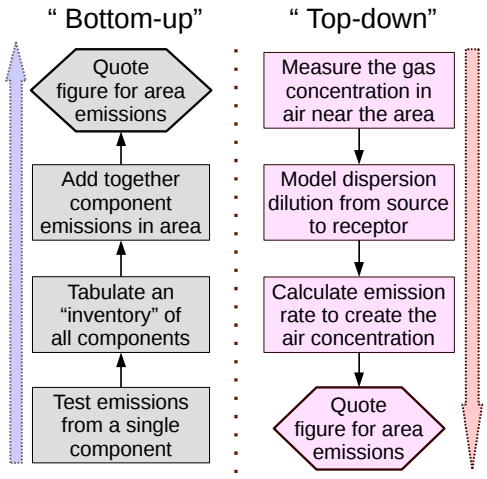
When the climate impacts of oil and gas production were first assessed in the 1990s the assumption was that the effects of leakage were "insignificant".

What has happened since is that the monitoring technology has improved.

Today it is possible to equip aircraft or ground vehicles as mobile gas laboratories. These are flown or driven around oil and gas fields to sniff the air.

From that sampling it is possible to produce a 'top-down' estimate of how much gas is leaking in order to create the measured concentrations in the air.

In an ideal world the top-down and bottom-up measurements would, within a reasonable boundary of uncertainty, match. The difficulty is that they do not.



What studies carried out over the last decade or so have found is that real-world, 'top-down' monitoring exceed the estimated 'bottom-up' measurement of emissions by at least 2 to 4 times.

It's this mismatch over measuring that is at the heart of the fracking and climate debate.

Howarth and methane

The research paper which highlighted the significance of this debate over measurement methods was produced by Howarth, Santoro and Ingraffea in June 2011.

The 'Howarth' paper gained prominence because it claimed to show that shale gas was not only worse than conventional gas. Under certain circumstances it could be worse than coal-fired power generation.

Firstly, because it was using 'top-down' assessments of leakage from natural gas systems. As noted above, these have consistently produced much higher levels of leakage .

Secondly, because it used a 20- rather than 100-year baseline for the impact of methane on climate change.

The 20-year issue is important as methane has gained prominence as a greenhouse gas. Again, new sampling techniques have been finding far higher concentrations in the environment than were expected.

As we approach climatic tipping points, the impact of fast-warming methane is becoming more significant to how we respond to climate change.

The Mackay-Stone review

In Britain, DECC commissioned Mackay and Stone to evaluate the climate impacts of shale gas. Very roughly, Mackay and Stone:

- Took a figure for how much gas leaks from a gas well, and the climate impact of those leaks;
- They added the impacts of the gas being burnt;
- Then they divided the impacts by the amount of gas produced from each well, to produce a figure for impacts per unit of energy produced;
- Then they compared that to other available figures for conventional gas, coal-fired power and imported liquefied natural gas (LNG).

That is a fair assessment procedure in order to test the impacts of shale gas against other sources of natural gas for power generation. The problem with Mackay and Stone's report is not the process, it is the data which they used in their calculations:

- Their figures for gas leakage were from 'bottom-up' studies – which on the have traditionally under-estimated emissions by 2 to 4 times;
- They excluded the figures in the Howarth study from their final calculations because they claimed they were a statistical 'outlier' which would skew their results; and
- The figures used for gas production were at least twice what is seen in US gas wells – and had no independent source (they probably came from Cuadrilla, who had links to DECC at that time).

Using a figure for leakage which was perhaps a half of what it should have been, and a figure for gas production which was twice what it should have been, the level of impacts which their analysis found is arguably a quarter of what it should be.

Mackay and Stone, while rejecting Howarth's figures, also disregarded other studies. Instead they promoted an as yet unpublished study, by Allen et al., which claimed that leakage rates could be minimized using 'reduced emissions completions' (REC).

The Allen study

The 2013 study by Allen et al. was part-funded by the campaign group, the Environmental Defense Fund. It is a 'bottom-up' analysis of leakage from oil and gas operations. However, the study ran into problems from the start:

The publishing journal, PNAS, had to issue a correction because the authors had failed to declare their conflicting industry affiliations.

The study does not disclose which, and what type of sites were being tested, so it was difficult to relate the results to the industry as a whole.

Most seriously though, the sites were not randomly selected for testing. Their industry partners selected which sites they were to test, and so there's no evidence the sample of sites measured were 'representative' of the industry.

The real problems for the Allen study emerged in 2015.

Research by Howard et al. highlighted that one of the sensors to measure methane concentrations – which had been used in the Allen study – routinely malfunctioned, under-reporting methane concentrations.

Then the US Argonne National Laboratory noted that the sensor might be under-reporting methane levels by 3 to 5 times.

Finally, in 2016, the Environmental Defense Fund, who had part-funded the Allen study, rejected its results.

Misleading Parliament

From the date of its publication the Mackay-Stone report has been flawed. DECC defended the report by referencing the Allen study. Now that the Allen study has been shown to be flawed, the Mackay-Stone report has been definitively invalidated too.

However, that has not stopped ministers and Parliamentarians quoting the Mackay-Stone report to support the Government's policies on oil and gas extraction.

DECC was disbanded in 2016.

In January 2017 the new department – the Department of Business, Energy and Industrial Strategy (BEIS) – issued revised guidance on shale gas. Once again it echoed the results of the Mackay-Stone report.

The science behind Whitehall's fracking policy is worthless

The Mackay-Stone report was arguably flawed on the day of its publication. Today it is wholly discredited.

No minister can quote its conclusions with any certainty without demonstrably misleading MPs and the public as to the current state of the science.

In fact, like the Mackay-Stone report, large parts of the two other reports which the Government rely upon to justify fracking – the Royal Society report from 2012, and the Public Health England report from 2014 – can be similarly invalidated if we look at the weight of evidence now available.

The Mackay-Stone report must be withdrawn, and a moratorium implemented on all 'fracking' operations until we can state their impacts with certainty.

At the same time Whitehall and government ministers must admit to the mistakes in their previous claims, and commit to an open and transparent review of the evidence now available.

Written by Paul Mobbs,
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