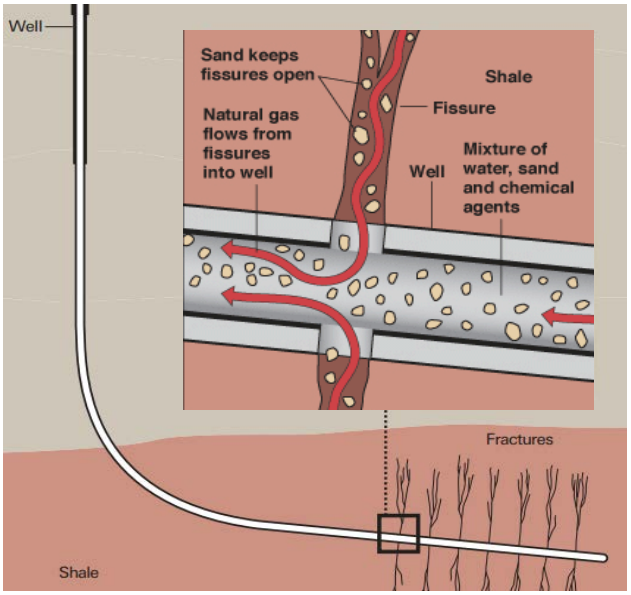
Why the UK government should abandon fracking

By Alp Katalan

This paper will provide evidence that fracking is counterproductive for the well-being of the UK and urges refocusing on renewable sources of energy and increasing energy efficiency as alternatives.

The fracking process



An illustration of hydraulic fracturing (Al Granberg)

Hydraulic fracturing – better known as fracking – is a method of extracting shale gas and oil from deposits of mineral rich shale rock. Once a well has been drilled and cased, holes are perforated along selected intervals granting access to the shale. Pumps are then used to inject fracking fluids under hydraulic pressure into the well. Fracking fluids consist of 90% water, 9.5% treated sand, and 0.5% chemicals. The high pressure induces fractures along the shale rock, allowing natural gas to freely flow up (Royal Academy of Engineering, 2012, p.9).

Avoiding climate change

In 2008 the UK Climate Change Act was passed, promising to cut net carbon emissions from GHGs to at least 80% lower than the 1990 baseline by 2050. This was done to avoid dangerous climate change – internationally recognised as a 2°C rise in global temperatures (Harrison, Parkinson and McFarlane, 2014, p.8). The IPCC (Intergovernmental Panel on Climate Change, 2013) and the IEA (International Energy Agency, 2012) agree that 70-80% of proven fossil fuel reserves must remain unexploited for a reasonable chance of not exceeding the 2°C threshold.

There are two main arguments in favour of extracting shale gas to reduce climate change:

1. Natural gas is the cleanest fossil fuel – burning it only emits about 40-50% as much carbon dioxide as coal (UCSUSA, 2015)
2. Natural gas will displace the dirtier fuels, ultimately acting as a 'transition fuel' towards a low-carbon economy (Katusa, 2012)

Although it is true that burning natural gas is cleaner than the other fossil fuels, the overall impact of extracting natural gas may offset the effects of lower carbon dioxide emissions. This is mainly due to "fugitive emissions" – unintentional methane leakage during the fracking processes. Methane is the most potent greenhouse gas; on a 20-year timescale the global warming potential of methane is 72 times greater than that of carbon dioxide (United Nations Environment Programme, 2012). New gas plants reduce climate impacts compared with new coal plants only if leakage rates remain below 3.2% (Harrison, Parkinson and McFarlane, 2014, p.9). In the US, leakage rates of 9%, 12% and even 17% have been detected (Tollefson, 2013), putting into question how effective the UK will be to not suffer the same.

Environmental and health impacts

Water

Water and ground contamination can occur not only from the act of fracking itself but also from subsequent failure of the well or during the refinement process. Contamination through fracking fluids, flowback water or methane can occur from:

- Well integrity failure – part of the well becomes damaged over time, opening up a contaminant pathway
- Migration down naturally occurring fractures or via extension of hydraulically induced fractures
- Percolation into water table, or surface runoff into water streams from leaks/spillage during transport

There is widespread evidence of fracking causing water contamination in the US. For example, a study in Pennsylvania (Jackson et al., 2013) examining gas concentrations close to shale gas wells found methane in 82% of drinking water samples, with average concentrations six times higher for homes within 1km of a well. Data shows that there is a failure rate of 6% among wells less than a year old, rising to over 50% in wells aged over 15 years (Brufatto, 2003). Even though there will be heavy regulation in the UK, given the large number of wells proposed – around 2500 to 3000 horizontal wells per year (Broderick et al., 2011, p.95) – failure of even a fraction could have significant impact.

Seismicity

The government has recognised that the earthquakes near Blackpool in 2011, were caused by Cuadrilla Resources' fracking practices (Department of Energy and Climate Change, 2014). The UK's complicated geology makes it prone to earthquakes as natural fractures in the ground are tampered with (Harrison, Parkinson and McFarlane, 2014, p.5). Furthermore, in the US, although earthquakes in Oklahoma were rare until 2009, 2014 saw 584 earthquakes with magnitude 3.0 or over – more than in the past 30 years combined. This was largely due to fracking companies storing wastewater underground (Jopson, 2015). Similar techniques in the UK could result in disastrous earthquakes.

Noise & Aesthetics

The UK operator Composite Energy estimates that fracking a single well requires 60 days of 24h drilling. Additionally, the onsite construction of well pads requires significant volumes of truck traffic. Estimates suggest up to 11,000 truck visits may be necessary to deliver all the supplies needed for the construction of ten well pads (Broderick et al., 2011, p.93). Apart from heavy traffic in densely populated areas, it would turn pristine rural areas into industrial highways, putting into risk picturesque roads dating to Roman times (Bakhsh, 2015). These effects will be amplified if fracking takes place in a natural park or in "areas of outstanding natural beauty", which according to the recently passed Infrastructure Act is completely feasible (Herringshaw, 2015).

Public opinion

There is large-scale grassroots opposition to fracking in areas where shale is currently being explored, including Lancashire, Sussex, Salford and areas around Scotland and Northern Ireland (FOE, 2014). The recent Infrastructure Act also allows fracking companies to frack under homes without consent of the homeowners, further aggravating discontent amongst residents (RT, 2014). Before introducing the clause, the government ran a public consultation seeking views on the proposal. The report revealed that 99% of the 40,647 respondents opposed the proposed legislation, yet it was still passed (Department of Energy and Climate Change, 2014). This is completely contrary to the government's pledge that "communities will be consulted at all stages of development" (Department of Energy & Climate Change, 2014).

Economic benefits

Claims that exploiting shale gas could dramatically reduce energy prices – like it did in the US – have been refuted by Cuadrilla's own PR representative, saying that fracking's effect on energy prices will be "basically insignificant" (Bawden, 2013). Firstly, this is due to operating costs of fracking in Europe being 30-50% higher than in the US, mainly because of less promising geology and associated problems of land availability (EIA 2015). Secondly, tougher environmental regulation and higher population density will slow down the rate of development of UK resources. This rate will likely be too slow to offset the need for imported gas, merely replacing some of the UK's declining conventional production (Isola and Turner, 2013). Continued reliance on imported gas would mean that shale gas would not indeed improve the UK's energy security like the government hopes (Department of Energy & Climate Change, 2014), but instead would tie the UK into an international gas market vulnerable to geopolitical and supply disruptions (Ekins, 2012). The lack of price reductions starkly contrasts with the 65% price decrease of solar panels in the past five years (Roston, 2015).

Conclusion

This paper has given evidence that fracking will in fact be completely counterproductive to the government's objectives of reaching legislated carbon emissions, energy security, and economic prosperity. The results of the UK's only fracked well in Lancashire, marred by induced earthquakes, well degradation, public opposition and water depletion, on top of disappointing job and energy production, are all testimony of how the UK is not geologically, socially or economically capable of benefitting from fracking.

Bibliography

Bakhsh, N. (2015). *Fracking in Europe - QuickTake*. [Online] BloombergView.com. Available at: http://www.bloombergview.com/quicktake/fracking-europe [Accessed 13 May 2015].

Bawden, T. (2013). *Cuadrilla PR man admits George Osborne's shale gas revolution won't cut energy bills*. [Online] The Independent. Available at: http://www.independent.co.uk/environment/green-living/cuadrilla-pr-man-admits-george-osbornes-shale-gas-revolution-wont-cut-energy-bills-8656246.html [Accessed 14 May 2015].

Blackmon, D. (2013). *Horizontal Drilling: A Technological Marvel Ignored*. [Online] Forbes. Available at: http://www.forbes.com/sites/davidblackmon/2013/01/28/horizontal-drilling-a-technological-marvel-ignored/ [Accessed 9 May 2015].

Briggs, S. (2011). *Fracking*. [Online] Kent Online. Available at: http://www.kentonline.co.uk/deal/news/fracking-a69303 [Accessed 13 May 2015].

Broderick, J., Anderson, K., Wood, R., Gilbert, P. and Sharmina, M. (2011). *Shale gas: an updated assessment of environmental and climate change impacts*. [Online] Manchester: Tyndall Centre for Climate Change Research. Available at: http://www.co-operative.coop/Corporate/Fracking/Shale%20gas%20update%20-%20full%20report.pdf [Accessed 9 May 2015].

Brufatto, C. (2003). From Mud to Cement – Building Gas Wells. *Oilfield Review, Schlumberger*, pp.62-76.

Committee on Climate Change, (2012). *The need for a carbon intensity target in the power sector*. [Online] London: Department of Energy & Climate Change. Available at: http://www.theccc.org.uk/wp-content/uploads/2013/02/EMR-letter-September-12.pdf [Accessed 12 May 2015].

Department of Energy & Climate Change, (2014). *Fracking UK shale: understanding earthquake risk*. [Online] GOV.co.uk. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/283837/Seismic_v3.pdf [Accessed 13 May 2015].

Department of Energy & Climate Change, (2014). *Government Response to the Consultation on Proposal for Underground Access for the Extraction of Gas, Oil or Geothermal Energy*. Underground Drilling Access. [Online] London. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/358521/Government_Response_FINAL.pdf [Accessed 13 May 2015].

Department of Energy & Climate Change, (2014). *Shale gas made simple*. About shale gas and hydraulic fracturing (fracking). [Online] London. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/374718/Shale_in_Plain_English_booklet_Web_Final.pdf [Accessed 14 May 2015].

European Commission, (2015). *Environmental Aspects on Unconventional Fossil Fuels (shale gas)*. [Online] Ec.europa.eu. Available at: http://ec.europa.eu/environment/integration/energy/unconventional_en.htm [Accessed 13 May 2015].

Friends of the Earth, (2013). *The UK, shale gas and unburnable carbon: Questions for the UK Government*. [Online] Available at: http://www.foe.co.uk/sites/default/files/downloads/unburnable_gas_2013.pdf [Accessed 14 May 2015].

Friends of the Earth, (2013). *Unconventional, unnecessary and unwanted*. Why fracking for shale gas is a gamble the UK does not need to take. [Online] Available at: http://www.foe.co.uk/sites/default/files/downloads/shale_gas.pdf [Accessed 14 May 2015].

Gold, R. (2014). *The Boom: How Fracking Ignited the American Energy Revolution and Changed the World*. New York: Simon & Schuster.

Harrison, G., Parkinson, S. and McFarlane, G. (2014). *Shale gas and fracking: examining the evidence*. [Online] London: Scientists for Global Responsibility and the Chartered Institute of Environmental Health. Available at: http://www.cieh.org/WorkArea/showcontent.aspx?id=53520 [Accessed 9 May 2015].

Herringshaw, L. (2015). *From national to fracktional: will fracking come to Britain's National Parks?*. [Online] Durham, UK: Durham Energy Institute. Available at: https://www.dur.ac.uk/resources/dei/briefs/FractionalParks_DEIbriefing_Final.pdf [Accessed 12 May 2015].

International Energy Agency, (2012). *World Energy Outlook 2012*. [Online] IEA, p.3. Available at: http://www.iea.org/publications/freepublications/publication/English.pdf [Accessed 11 May 2015].

International Panel on Climate Change, (2013). *Climate Change 2013: The Physical Science Basis*. Summary for Policymakers. [Online] New York, USA: Cambridge University Press,. Available at: http://www.climatechange2013.org/images/report/WG1AR5_SPM_FINAL.pdf [Accessed 11 May 2015].

Isola, J. and Turner, G. (2013). *UK shale gas no "get out of jail free card"*. [Online] Bloomberg New Energy Finance. Available at: http://about.bnef.com/press-releases/uk-shale-gas-no-get-out-of-jail-free-card/ [Accessed 14 May 2015].

Legislation.gov.uk, (2015). *Climate Change Act 2008*. [Online] Available at: http://www.legislation.gov.uk/ukpga/2008/27/contents [Accessed 11 May 2015].

Neslen, A. (2015). *Poland's shale gas revolution evaporates in face of environmental protests*. [Online] the Guardian. Available at: http://www.theguardian.com/environment/2015/jan/12/polands-shale-gas-revolution-evaporates-in-face-of-environmental-protests [Accessed 14 May 2015].

Roston, E. (2015). *By the Time You Read This, They've Slapped a Solar Panel on Your Roof*. [Online] Bloomberg.com. Available at: http://www.bloomberg.com/news/articles/2015-02-25/in-the-time-it-takes-to-read-this-story-another-solar-project-will-go-up [Accessed 14 May 2015].

Royal Academy of Engineering, (2012). *Shale gas extraction in the UK: a review of hydraulic fracturing*. [Online] London: The Royal Society. Available at: https://royalsociety.org/~/media/policy/projects/shale-gas-extraction/2012-06-28-shale-gas.pdf [Accessed 9 May 2015].

RT, (2014). *UK to allow fracking drilling under people's land without their consent*. [Online] Rt.com. Available at: http://rt.com/uk/190996-fracking-trespass-law-britain/ [Accessed 13 May 2015].

Sovacool, B. (2014). Cornucopia or curse? Reviewing the costs and benefits of shale gas hydraulic fracturing (fracking). *Renewable and Sustainable Energy Reviews*, [Online] 37, pp.249-264. Available at: http://www.frackfreewrexham.org.uk/wp-content/uploads/2015/02/Cornucopia-or-curse-Reviewing-the-costs-and-bene%EF%AC%81ts-of-shale.pdf

The Economist, (2012). *Shale of the century*. [Online] The Economist. Available at: http://www.economist.com/node/21556242 [Accessed 10 May 2015].

The Economist, (2015). *Renewable Energy: Not a toy*. [Online] The Economist. Available at: http://www.economist.com/news/international/21647975-plummeting-prices-are-boosting-renewables-even-subsidies-fall-not-toy [Accessed 14 May 2015].

The Telegraph, (2013). *France upholds ban on fracking*. [Online] Telegraph.co.uk. Available at: http://www.telegraph.co.uk/news/earth/energy/fracking/10374602/France-upholds-ban-on-fracking.html [Accessed 10 May 2015].

Tollefson, J. (2013). Methane leaks erode green credentials of natural gas. *Nature*, [online] 493(7430), p.12. Available at: http://www.nature.com/news/methane-leaks-erode-green-credentials-of-natural-gas-1.12123 [Accessed 12 May 2015].

U.S. Energy Information Administration, (2015). *U.S. remained world's largest producer of petroleum and natural gas hydrocarbons in 2014*. [Online] Eia.gov. Available at: http://www.eia.gov/todayinenergy/detail.cfm?id=20692 [Accessed 10 May 2015].

Union of Concerned Scientists, (2015). *Environmental Impacts of Natural Gas*. [Online] UCSUSA.org. Available at: http://www.ucsusa.org/clean_energy/our-energy-choices/coal-and-other-fossil-fuels/environmental-impacts-of-natural-gas.html#.VVE9Ivl_Oko [Accessed 11 May 2015].

United Nations Environment Programme, (2012). *Gas fracking: can we safely squeeze the rocks?*. [Online] UNEP. Available at: http://na.unep.net/geas/getUNEPPageWithArticleIDScript.php?article_id=93 [Accessed 13 May 2015].

United States Environmental Protection Agency, (2010). *Hydraulic Fracturing Research Study*. Science in Action. [Online] Available at: http://www.epa.gov/ogwdw000/uic/pdfs/hfresearchstudyfs.pdf pdf [Accessed 9 May 2015].

Vidal, J. (2014). *Cheaper oil could damage renewable energies, says Richard Branson*. [Online] the Guardian. Available at: http://www.theguardian.com/environment/2014/dec/16/cheaper-oil-could-damage-renewable-energies-says-richard-branson [Accessed 12 May 2015].

White, G. (2011). *Cuadrilla admits drilling caused Blackpool earthquakes*. [Online] Telegraph.co.uk. Available at: http://www.telegraph.co.uk/finance/newsbysector/energy/8864669/Cuadrilla-admits-drilling-caused-Blackpool-earthquakes.html [Accessed 13 May 2015].