

NEW ENERGY, NEW JOBS

Aisha Vance, Director of Energy and Security, Parliament Street, and **Dr. James P. Verdon**, MA(Cantab), M.Sci, Ph.D, BGS Senior Research Fellow in Geophysics, School of Earth Sciences, University of Bristol argue that implementing a US-style energy policy will benefit us as much as it has our cousins across the pond.

In 2009 the US was in the deepest recession since the 1920s,³⁵ unemployment was over 10% and former companies that were the foundation of American industry had begun to collapse. The US lost over 7.5 million jobs and entire states went into huge debt in its wake.³⁵ Around the same time the shale-gas boom was about to begin, a technique called Hydraulic Fracturing or 'Fracking' was about to become the white-knight of America's economy.

In hard-hit states like Pennsylvania and the other states along the east coast, Fracking has benefited their local economy, and has created 1.7 million new direct and indirect jobs in the United States.³⁶ Some reports say it is likely to rise over 3 million, when it is projected the US will overtake Saudi Arabia in oil output.³⁷

The shale gas boom has added \$62 billion to federal and state treasuries, with that total expected to rise to \$111 billion by 2020. By 2035, U.S. oil and natural gas operations could provide more than \$5 trillion in cumulative capital expenditures to the economy, while generating

³⁵Zuckerman M, 'The Great Jobs Recession goes on' *US News* 11 Feb 2011

³⁶Efstathiou J, 'Fracking will support 1.7 million jobs, study shows' *Bloomberg*, 23 Oct 2012.

³⁷ American Petroleum Institute (API) *The State of American Energy*, 2013

NEW ENERGY, NEW JOBS

more than \$2.5 trillion in cumulative additional government revenues.³⁸

Although the game-changing technology has been used since the early 1940s in the US and Canada, it wasn't until the recession hit, and oil prices sky-rocketed that oil companies began to invest heavily into the technology. The revolution of the shale gas boom led to the satisfaction of a large portion of US demand through domestic production rather than reliance on OPEC oil. Moreover, fracking has allowed the US to become vastly energy independent and less reliant on oil and gas from the Middle East, Russia and Venezuela.

In the UK, only two companies, iGas Energy and Cuadrilla, have made attempts to drill. You'd be excused if you thought there were many more companies drilling all over the countryside, when in fact there are only four sites that have drilled in the UK. The process for gaining permits for hydraulic fracturing can be long and drawn out, with investors often having to patiently wait for years while community engagement takes place, which is often infiltrated with relentless scare-mongering PR tactics from environmental groups like Greenpeace.

The Department of Energy and Climate Change estimates that by 2025 the UK will have to import more than 70% of its energy consumption, assuming we do not utilise shale gas. Moreover, the exploration of gas will mean new high-paying jobs for men and women up and down the countryside. The Institute of Directors estimated that UK shale gas production would be a huge benefit to the economy, including a benefit to public finances, attracting investment of £3.7 billion and support of up to 74,000 jobs directly, indirectly and through broader economic stimulus.³⁹

³⁸ Ibid

³⁹DECC, *Developing Onshore Shale Gas and Oil* Dec 2013

A BRIEF HISTORY OF HYDRAULIC FRACTURING (FRACKING)

The oil and gas industry has long known that the presence of fractures in the reservoir rock mass will allow hydrocarbon to flow more easily into the well, improving production rates. While fractures occur naturally, from the earliest days of the industry, operators have sought methods to create man-made fractures in the rocks they were targeting.

In 1865, Colonel Edward A.L. Roberts, a veteran of the US Civil War, received a patent for a “nitroglycerin torpedo” that could be inserted into an oil well and detonated to create fractures in the rock. Colonel Roberts was able to improve production rates by as much as 1000% in some cases. The technique of “well-shooting” – using explosives to generate fractures in reservoir rocks – reached its zenith with the Project Gasbuggy tests in New Mexico in 1967. As part of Operation Plowshare, the push to find peaceful alternative uses for nuclear weapons, the US Department of Energy detonated a 29 kiloton nuclear device at a depth of 4,240 feet below ground in a tight, low permeability gas reservoir. The explosion successfully fractured the reservoir, and production tests showed a substantial increase in gas production. However, this gas was found to be contaminated by radioactive tritium, and the project was soon shelved.⁴⁰

Instead, the use of explosives to fracture reservoir rocks was being superseded by a newer, more efficient technology: by 1947, Stanolind Oil had identified that fractures could be created by pumping fluids at high pressure into a formation. Stanolind performed the first such hydraulic fracture stimulation at a gas field in Kansas, using 1,000 gallons of gelled gasoline as the fracturing fluid. By 1949, over 300 wells

⁴⁰ US Dept. of Energy Legacy Management, *Gasbuggy, New Mexico, Site Fact Sheet*

NEW ENERGY, NEW JOBS

had been “stimulated” in this manner,⁴¹ and the technique of hydraulic fracturing soon became a common tool in the conventional oil and gas industry. The American Petroleum Institute estimates that over one million oil and gas wells have been hydraulically stimulated.⁴²

HORIZONTAL DRILLING

There is more to shale gas extraction than hydraulic fracturing. An equally crucial technology, without which shale gas would not be commercially viable, is the ability of drillers to turn wellbores to run horizontally along the shale layers. This horizontal drilling allows a much larger volume of rock to be accessed from one small well pad. Horizontal drilling was first developed in the 1930s, but became widely commercially used only in the 1980s. The Wytch Farm oil field underneath Poole Harbour was a pioneer in the use of extended reach lateral wells.^{43 44}

THE BARNETT SHALE

In the wake of the 1970s energy crisis a Texan oilman George Mitchell began looking to extract gas from the Barnett Shale, a shale formation underlying some of his existing conventional fields in northeast Texas. The fact that shale rocks contained abundant hydrocarbon resources was well known. However, conventional wisdom dictated that the low permeability of shale would prevent commercial extraction.

⁴¹ Montgomery C.T. and Smith M.B. ‘Hydraulic fracturing: History of an enduring technology’ *Journal of Petroleum Technology*, Dec 2010, pp26-32

⁴² API, *Hydraulic Fracturing Q & A’s*

⁴³ Mantle K, ‘The art of controlling wellbore trajectory’ *Schlumberger Oilfield Review* 25, 2010, pp.54-55

⁴⁴ Energy Information Administration, ‘Drilling sideways – A review of horizontal well technology and its domestic application’ 1993

SMART GOVERNMENT: A PARLIAMENT STREET GUIDE

In almost 20 years of experimentation to unlock these rocks, a crucial breakthrough pioneered by Mitchell Energy was a change in the composition of the fracturing fluid. In conventional reservoirs, large amounts of chemicals were typically added to the fluid to create a viscous gel, along with breakers to break down the gel once it had penetrated the formation. Instead, Mitchell Energy began using a large volume of water, but a relatively small amount of additives. Typically, the principal component was a friction reducer, so the new style frac fluid has become known as “slick-water”, as opposed to the “gel fracs” used previously.⁴⁵ Mitchell Energy found that the lower amount of additives required for a slick-water frac reduced costs while substantially improving production.^{46 47}

In the late 1990s, using slick-water fracs in combination with horizontal wells, Mitchell Energy began to produce commercial volumes of gas from the Barnett Shale. Soon, competitors were following the same approach, looking for acreage in the Barnett Shale, as well as targeting other shale formations across North America. The shale gas revolution had begun.

THE HYDRAULIC FRACTURING PROCESS

Energy companies in the UK also investigated using the same approach; but the process is very technical and therefore easy to misunderstand.

The aim of hydraulic fracturing is to create fractures that connect the well bore to the hydrocarbon-bearing rock mass. Typically, the weight of overlying rock

⁴⁵ Halliburton Fact Sheet H05667: Fracturing fluid systems.

⁴⁶ Davids Hinton D. ‘The seventeen-year overnight wonder’ *Journal of American History* 99, 2012, pp. 229-235

⁴⁷ Wang Z. and Krupnick A. ‘A retrospective review of shale gas development in the United States’: *Resources for the Future Discussion Paper* 2013.

NEW ENERGY, NEW JOBS

means that stresses acting on a rock mass are compressive. To break the rock, tensile stresses must be created. This can be done by increasing the pore pressure of fluids in the rock such that they exceed the compressive stresses. Once the tensile stress exceeds the tensile strength of the rock, then fractures can be generated.

The hydraulic fractures will develop on planes that are perpendicular to the minimum stress orientation. In most sedimentary basins, the orientation of the minimum compressive stress is horizontal. Therefore the hydraulic stimulation will create vertically orientated fractures that propagate in a direction parallel to the maximum horizontal stress. Most sedimentary formations are layered horizontally. This stratification tends to act as a barrier to fracture propagation. As such, the fractures tend to propagate horizontally along the maximum stress direction, as opposed to vertically.

CONVENTIONAL HORIZONTAL DRILLING

The first stage of the hydraulic fracturing process is to drill a well down to the target shale layer, turning the wellbore horizontally to run along the target zone. The well is then cased and cemented with multiple layers of steel piping. The well must then be perforated in the production zone to allow fluids to pass from the reservoir rocks into the well. A “perforation gun” is lowered into the well, which carries a number of shaped explosive charges. These are detonated to perforate a series of holes in the casing through which fluids can flow. All of the above activity is no different to operations in a conventional well.

HYDRAULIC STIMULATION

Once the well has been drilled, it can be hydraulically stimulated. This is usually done in a series of stages along the horizontal part of the well,

SMART GOVERNMENT: A PARLIAMENT STREET GUIDE

starting at the toe of the well and moving back towards the heel. Packers are inserted into the well to isolate the section to be stimulated. The hydraulic fracturing fluid is pumped down at a sufficient pressure to exceed the tensile strength of the rock as described above, creating hydraulic fractures.

At the end of the stimulation, pore pressures will be reduced, leaving the compressive stresses to act on the rocks. If the fractures are left unfilled, the compressive stress will force the hydraulic fractures closed. To prevent this, proppant, which consists either of sieved sand or ceramic beads, is used. Towards the end of a stimulation stage, proppant is added to the fluid, which sweeps it into the hydraulic fractures. The proppant fills the fractures, preventing them from closing once the pressure is reduced.

Each stimulation stage typically takes a few hours. Once a stage is complete, the packers are moved to isolate the next stage, and the process is repeated. A multi-stage lateral well may be stimulated in as many as twenty stages, taking several days to be completed.

Once all of the stages have been completed, the well is depressurized, allowing the fracturing fluid to return up the well, leaving the proppant in the newly created fractures. Within a week of stimulation, between 25- 75% of the injected fluid will have returned to the surface. This “flowback fluid” must be stored on site, and taken to a waste disposal facility to be treated.

As the fluid leaves the fracture system, gas will begin to flow from the shale rock through the fractures and into the well. The wellhead is connected into a gas pipeline system, and the well will then be on production. A successful shale well may then continue to produce gas for over 20 years.

NEW ENERGY, NEW JOBS

With tremendous opportunity to drill for shale gas and create thousands of well-paid jobs and secure independent energy for the UK; it is time for a shale gas revolution.

To get there, this government will need to focus on five key areas in order to attract investors and ensure that it is affordable and simple to explore and drill for shale gas.

FIVE RECOMMENDATIONS

1. US style property rights agreement

Part of the reason that there is seemingly less opposition to shale gas exploration by land owners in the US is due to the fact that landowners receive a chunk of the profit when energy companies drill underneath their homes. In contrast, some companies offer a one-off drilling payment of £20,000 to landowners for drilling that takes place 200 meters underground.⁴⁸ In the state of Pennsylvania alone, the royalties from fracking passed onto landowners is upwards of \$1.2bn.⁴⁹

If in the UK we allowed landowners to benefit financially as much as they do in the US, there would be very little opposition from landowners and NIMBYs would virtually disappear.

2. Cut red tape for companies who want to drill

Last year, when the Government encouraged investment in the shale gas extraction industry, they announced that they would be cutting taxes on company profits from 62% to 30%. They also issued 176 licenses to explore and drill for gas and said they would be cutting the

⁴⁸DECC *Underground Access Factsheet*

⁴⁹ Drost M, 'Landowners poised to reap \$1.2bn from Pennsylvania shale gas

SMART GOVERNMENT: A PARLIAMENT STREET GUIDE

time taken to grant exploration permits from thirteen weeks to two weeks.

In 2014, then-Energy Minister Michael Fallon went to Azerbaijan to speak with their government and gas industry and discuss the progress of the new Southern Corridor gas pipeline that will deliver gas from Azerbaijan direct to Europe.

While diversifying Europe's gas imports away from predominantly Russia, and towards other countries is understandable, it is difficult to fathom why relying on yet another importer of gas is a better alternative to producing gas in the UK. If our gas industry was given the green light, it would allow the UK to become an exporter to other European countries, thus creating not only jobs and security but another economy.

Fallon said he thinks it is important in the context of current events in Ukraine that there is a mix of providers in European energy. However, it is not altogether clear that a country like Azerbaijan, which is surrounded by geopolitical threats, is more secure in the long-term than building up our own energy resources.

3. Stop investing millions in green technologies and instead invest in training and education for well-paid energy jobs.

Instead of enjoying the fruits of a shale gas boom, taxpayers are paying wind farms £30 million to stand idle in bad weather.⁵⁰ Meanwhile, the British Geological Survey and the Department of Energy and Climate estimate that there are vast reserves of shale gas all over the country and suggest that just 10% of UK shale gas (130 TCF) would supply

⁵⁰ Webb T, 'Wind farms paid £10,000 a day to sit idle in blustery conditions' *The Times* 4 Mar 2013

NEW ENERGY, NEW JOBS

Britain's gas needs for about 50 years⁵¹, yet there is very little commercial drilling going on in the UK. If we cut red tape and make it easier and profitable for companies to explore and drill, we are going to need skilled workers to fill the technical jobs that shale gas extraction requires. In the US, the Fracking industry supports 1.7 million directly and indirectly.

An IHS study that predicted drilling for shale gas alone would create more than 600,000 jobs by the end of the decade in the United States.⁵² If we are to undergo a shale gas revolution in the UK we will need to be prepared to fill skilled job opportunities in the energy sector.

4. Get out of the energy market – let free markets decide energy pricing

Ed Miliband was a large part of the reason why energy prices in the UK have slightly increased and not decreased, when he announced that, if Labour were in Government, they would freeze energy prices. This is all well and good, but the UK's energy companies must buy their energy at market price every two years.⁵³ If the price of energy has increased dramatically they would not be able to change their cost. Thus, Government getting involved with trying to set the cost of energy hurts those who are the most vulnerable when it comes to energy costs – the poorest in society.

5. Counter-act the green lobby and get the facts out about shale gas

⁵¹ Henning G and Johnson C, 'UK has vast shale reserves, geologists say' *Reuters*, 17 Apr 2012

⁵² Efstathiou J, 'Fracking will support 1.7 million jobs, study shows' *Bloomberg*, 23 Oct 2012.

⁵³ 'Energy Bills: UK gas prices hit record low' *Sky News* 31 Oct 2014

SMART GOVERNMENT: A PARLIAMENT STREET GUIDE

The environmental lobby in the EU is one of the most well-funded in Brussels, with the EU giving the green lobby £90 million per year.⁵⁴ In essence, environmentalist bureaucrats are giving huge grants to lobby themselves, all on the backs of the taxpayer. Earlier this year, NATO's Secretary General, Anders Fogh Rasmussen, said: "I have met allies who can report that Russia, as part of their sophisticated information and disinformation operations, engaged actively with so-called non-governmental organizations — environmental organizations working against shale gas — to maintain European dependence on imported Russian gas."

The anti-fracking movement is strong and will only get stronger as Russia's hold on the European energy market becomes essential. The Government needs to push back on factually incorrect information so that citizens can make informed decisions based on fact, not on scare-mongering rhetoric.

⁵⁴Mendick R, 'European Union funding £90m green lobbying con' *The Telegraph*, 21 Dec 2013