

## Fracking presentation for Crediton

The UK faces an energy crunch. Electricity supply will soon be running with only 2% spare capacity (25% is considered a safe margin). **Slide – graph of exports/imports.** North Sea oil and gas continue their inexorable decline, and we depend increasingly on energy supplies from countries either unstable or unfriendly. Renewables are expensive, intermittent and often unsightly. Dithering over nuclear and the post-Fukushima backlash mean that replacements are delayed. World demand for energy increases as conventional oil supplies flatline.. And of course, cheap energy is a fundamental requirement for economic growth. Without it, we collapse.

Small wonder then that when a new potential source of home-grown energy comes along, the government should leap at it. **Slide – Fracking schematic** The process of fracking – hydraulic fracturing of rocks deep underground using water, sand and chemicals to break open the rocks and release pockets of methane gas – could be a game-changer for the cash- and energy-strapped UK. **Slide – UK shale deposits.** 60% of England has been identified as possibly having some gas under it, and the Bowland Shale in Lancashire is so deep and wide that one newspaper declared the county the 'new Middle East'! Devon, by the way, is on the edge of a shale area, so is likely to be much further back in the goldrush.

So how much gas is there? **Slide – Bowland Shale** The British Geological Survey did a detailed report in 2013 on the Bowland -Hodder Shale which identified around 1300 trillion cubic feet as the median potential resource. This is enormous, given that the UK consumes around 2.8 tcf a year, and up to 2012 the North Sea's total yield has been 86 tcf. But there's a catch. The shale is very thick, which is good, but it is thought that the organic matter content is lean, somewhere between 1 and 3%. (A sweet spot would be about 8%) In other words, plenty of it, but highly dispersed, mostly below about 3km from the surface. And technically recoverable reserves are a small fraction of what is down there. They could be anything from zero to 175 tcf, with some estimates being as low as 4.7tcf.

**Slide Type Gas well decline US.** Shale gas wells typically decline quite rapidly. In the US they have had decline rates of around 85% in three years. And there is an inescapable consequence to the decline, which is that in order to maintain steady production, you have to drill an increasing number of wells. **Slide UK production.** If we take a highly optimistic view of the UK potential, 100 wells a year over 10 years drilled by 17 mobile platforms could provide us with about half of our requirements. Each well takes a couple of months to drill, never mind the planning process. We would be looking at 2 start-ups a week, every week for ten years. It hardly seems realistic.

If, however, we take a more pessimistic view of the potential, **Slide Alternative UK production** and assume a similar decline rate to that observed in the US, then we would need 300 new wells a year, every year, with 51 drilling rigs operating full-time. One start-up almost every day. This looks like fantasy land.

**Slide US map.** But shale gas has been a game-changer in the US, hasn't it? Aren't they experiencing an energy revolution? Barack Obama said they had 100 years-worth of gas.

Well, this is what has actually happened. **Slide US production rise.** They have drilled 65,000 wells and extracted gas worth more than \$100 billion. Shale gas has gone from practically nothing to around 40% of US supply. Gas prices have fallen dramatically as the market has been swamped, from \$12 per thousand cf in 2005 to \$2 now.

Gas prices fell because of the surprising fact that the US has no gas-exporting facilities. It is a gas island. Pity for them, as prices in Japan are about seven times higher. So the US has switched from coal to gas, boasting about reducing their carbon emissions, but exporting the coal to be burnt somewhere else – namely the UK and Europe....

And while the low price of gas may be great for consumers, it has made it increasingly difficult for drilling companies to turn a profit. The early prospectors made a fortune, mostly by buying up then selling off stakes in the various plays to those who piled in later, including big oil. Now, many are posting losses. Shell has written off \$2 billion out of its investment of \$24 billion in a single year. Its CEO described shale as his biggest regret ever. Exxon Mobil went into shale gas in 2010 and has recently experienced a 57% drop in quarterly earnings and a 23% fall in profits. BP is withdrawing from shale altogether. **Most shale gas wells in the US are currently unprofitable.** They need between \$4 and \$8 to be in profit. So why are they still at it?

Simply because most costs are upfront, and leases are time-limited. It costs \$10 to \$20 million dollars to drill a well, and they are currently getting \$6 to \$15 million in return. How can anyone think that fracked gas is cheap? Many companies have now switched to drilling for tight oil, which has not seen a similar slump in prices. In North Dakota, where the Bakken shale is mostly tight oil, they are burning off a billion dollars' worth of gas each year, because it would cost more to ship it around the country than it is worth. This is the equivalent to the carbon emissions of one million cars....

If the drilling companies are not continuing to drill for shale gas, what does that mean for supply? There is a time-lag of about three years because of delays in hooking-up wells, so it is likely that supplies will start to drop off in a couple of years. The US government itself estimates that to maintain steady supply up to 2030 410,722 new wells will be needed, something utterly unprecedented. They would need to triple their rate of drilling, when at the moment they are reducing it.

Which will increase the price of gas and threaten recovery from recession. And the US is rapidly building gas exporting facilities, which will be ready at the end of 2015. This will link them to world markets, and ensure that gas prices in the US increase.

**Slide Bell curve.** If this is starting to look like a Ponzi scheme, it may be that it is one. It is clearly driven by the intoxicating combination of short-term financial self-interest and patriotic wishful thinking. A hundred years of gas? Hardly. The US bonanza may well be over by 2020.

Returning to the UK, it is surprising that the message has not got through. Shale gas is only cheap in the US because of their isolation. The UK is connected to continental Europe via Norway and Belgium, so vast quantities of gas would be needed to reduce prices even slightly. This is not in prospect. **Slide – Banks test site.**

And let's be clear, fracking in the UK is still in its exploratory stage. No one will know exactly how much is recoverable or how easily until they drill the holes. In any event full-scale production of fracked gas is about ten years away, according to Centrica.

Let's look at some practical details. In the Fylde in Lancashire, an area of Grade 1 and 2 agricultural land, and adjoining important wildlife areas on the Ribble, **Slide Well.** it is likely that around 80 pads, at 3.6 hectares per pad, will be located with approximately 840 individual wells. The pad area is higher than Cuadrilla's statement of 0.7 h. to take into account the related infrastructure. It is

perhaps not entirely coincidental that environmental impact statements are not required for developments under 1 h.!

IN NY State 7,000 to 11,000 truck movements were observed per pad, much of this carrying the truly enormous quantities of water needed, (about 4 million gallons per well) so approximately 1,000 per well, and significantly if distances between pads were in the order of 1.5km, then severe cumulative impacts arose. Lorry traffic jams. This is about the distance that the wells will be separated by in the Fylde.

So let's unpack the numbers a little more: a site with 10 wells needs 10,000 truck movements. If this is done over a 3 month period, that's 3,300 a month, approximately 110 a day, so 55 trucks a day turning up every single day for three months including weekends. About one every nine minutes during an 8 hour day.

Some wells will be complete duds. The guess is that the UK will sink about 1000 to 3000 wells. The US has drilled 65,000 wells.

In the UK the Government, which increasingly sounds like a mouthpiece for the industry rather than an independent and responsible arbiter, has offered money for affected communities, business rate retention at 100% for councils, the prospect of cheaper energy bills and the carrot of up to 74,000 new jobs. Oddly, this last claim is denied by representatives of the industry. They reckon between 6,000 and 25,000 specialist jobs. The first two claims, money for communities and councils, have been described as bribes. And the cheaper bills claim is a downright lie. (We actually have some of the cheapest energy in Europe, but the highest bills, because our housing stock is so inefficient.)

The government has also stated that the regulation of the industry will be the tightest in the world. (Given that the only other country to have fracked on any scale is the US, and shale gas was specifically excluded from environmental legislation there, this is not a big promise). The UK government has considerable regulatory experience in this field, but notably in offshore oil and gas, which is not quite the same. It has also been strongly resisting EU proposals for stricter regulation of shale gas.

The Royal Society and Royal Academy of Engineering jointly published a review in 2012 which emphasised the need for robust monitoring and regulation. It noted that the UK's well examination scheme would need to be made fit for purpose for onshore activities. It stressed that Environmental Risk Assessments should be mandatory across the lifetime of the well, and that operational best practices must be implemented and enforced through strong regulation.

So far, the track record with Cuadrilla has not been promising. There were earthquakes at their first drilling site, Preese Hall, which fractured the drill casing. Another well, Anna's Road, also in the Fylde, has been abandoned recently. The reason given was the impact on overwintering birds in the adjoining Special Protection Area, but it seems that the concrete casing was inferior and a piece of equipment got stuck down the well.

“Well integrity is the highest priority.” says the Royals report. What's so important about the concrete casing? This is what protects the aquifers. If fracking is going to be a success in the UK, they have to demonstrate operational best practice, and we must have a regulator with real teeth.

In my opinion, most of the environmental concerns, about the pollution of groundwater, about earthquakes and some of the above-ground disturbances can be managed. The UK is not like the US – our population density is 14 times greater, and we have much stronger environmental controls. Even the uncontrolled escapes of methane, that have been cited by some as making fracked gas as environmentally bad as coal, have been shown to come from a few rogue plants. Strict regulation, if the government actually means strict, would tackle this. It may even be that some of these concerns are used to divert attention away from some bigger issues that have not been properly addressed

Namely where to dispose of large quantities of contaminated waste water, mud and drill cuttings. The real question is whether we are desperate enough to think that fracking provides any sort of solution.

In the longer term it certainly does not. **Slide Carbon budget.** The total carbon budget of the planet has been calculated as being around 1 trillion tonnes, that's what we can put into the atmosphere before we go above 2degC and risk triggering uncontrollable climate change. We are already over half-way there. **Click** But that only gives us a 50% chance of safety, a coin-flip. To stand a 75% chance, **Click** we need emissions to be below 750 Gt.

At the present rate we will reach 750Gt **Click** by about 2025 and the 1 trillion limit **Click** by 2040. After that everything has to be zero carbon or better.

### **Slide emissions capability.**

This has some interesting implications for the fossil fuel industry, which has already identified enough reserves that, if exploited, could push emissions five times over the limit. That's without the Arctic or fracking, just what we already know is available. So if up to 80% of those reserves cannot be burned, they are stranded assets. Effectively worthless. A write-off of \$20 trillion. If we add fracked gas, it would double the emissions from gas in this diagram. What is the point in looking for more?

But of course the fossil fuel industry isn't behaving as if it is about to go bust. Critics may describe fracking as its 'retirement party', but the industry carries on with the assumption that we won't limit our use, and that growing worldwide demand means they must find oil and gas wherever they can. Let us not forget that we all support them in this, because the primary stockholding in all our pension funds is hydrocarbons.

Maybe they are banking on technologies such as Carbon Capture and Storage, which is still not being demonstrated properly at scale, and could probably only capture about 10% of current emissions at best, while adding between 25% and 40% to energy costs from fossil fuels.

Or of course, they hope the whole climate thing will turn out to be a hoax. Which would be handy.

**Slide green.** It seems to me that fracked gas in the UK will prolong our dependency on fossil fuels and may divert investment away from the more important task of developing and rolling out renewables, and cracking the problem of storage as part of a really sustainable long-term energy strategy. No government truly serious about meeting its carbon reduction targets would contemplate fracking for gas.

The fracking industry will need to meet stringent environmental standards, that may yet prove to be beyond their capability, and the UK public will need to tolerate the intrusion of heavy vehicle traffic into rural areas on a significant scale.

Fracked gas is a short-term policy, prompted by panic on the part of politicians who are clutching at straws rather than discussing a proper energy strategy. We no longer have any good solutions on offer, only a range of poor options. Fracking may be among the poorest. **Click – Duck!**

It may rise and fall quickly, as the US is likely to do, but I think that in 10 years' time it will largely be seen as an irrelevance.

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