Edge Debate/Debate 49 – Shale gas: a game changer?

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OPENING REMARKS

CHRIS HUHNE MP - CHAIR

Shale gas has shaken up the market considerably in the US, dramatically reducing the gas price (the Henry Hub Index has fallen by around 50% in the last 5 years) to roughly half of UK gas price. It has had little effect outside of USA, limited so far by arbitrage, but this is about to change.

Exploitation of shale gas has transformed the USA's strategic planning in the gas industry – with recently built LNG import terminals lying unused and with one new export terminal constructed.

Outside of the US, shale gas has had much less effect on the market with gas prices still going up as many countries review nuclear energy policies in the wake of Fukushima and because of the considerable uptake of gas-fired generation in the Far East.

Where the global price of gas will settle in the long run depends on whether demand grows faster than new supply capacity can be opened up, but the 'conventional wisdom' is that the gas price outside of North America is unlikely to fall as a result of shale gas technology. Shale gas however, may mitigate price increases.

In USA mineral rights are generally tied to the land deed whereas, in most of the rest of the world, sub-surface concessions are separate. This leads to 'NIMBYism' making it likely that future development of most shale gas resources will be slower outside North America. Furthermore, the footprint required for shale gas extraction has not been a barrier to development in North America where large reserves lie in unpopulated areas but this is often not the case in Europe where gas reserves are much closer to populations.

Environmental risks are still a major aspect of the pro-gas / anti-gas debate. A recent documentary on shale gas in Philadelphia called "Gasland" cited fracking led to methane contamination of aquifers, (depicting drinking water supplies on fire). The states of New York and New Jersey, which both border Philadelphia, duly enacted bans on shale gas extraction.

Another environmental concern is the atmospheric methane released by fracking. Methane is 23 x more potent a GHG than CO_2. While science suggests it can be captured, it's been a real problem with other carbon fuel extraction, including natural gas, so much doubt remains.

UK has inefficient energy infrastructure and we did not use North Sea oil wisely. We have a costly backlog of infrastructure investment if we are to remain a gas-fuelled economy.

So far the UK has yet to cook a single roast dinner using shale gas.

PRESENTATIONS

BILL BORDASS

Is shale gas a blessing or a bane?

It could prove a blessing as an interim energy resource, reducing dependence on gas imports to improve fuel security, whilst enabling wider energy issues, like demand reduction, the roll out of renewable energy supplies, CCS and the like to be implemented. It might enable aspects of a wider energy strategy – including aspects such as nuclear – to be revisited and improved.

The risk is that it has the opposite effect, by extending the availability and economic life of carbon fuels and diminishing the drive for energy demand reduction and carbon proberty.

Precedents are not encouraging. The UK developed the short-term inefficient system(s) we have today largely because of the abundance of its fossil fuel resources. More advanced, lower carbon economies (such as some in continental Europe) have tended to be those with little indigenous fossil fuel resources.

Even the global opportunity to switch from coal to gas fired electricity generation with the purported benefits of lower CO_2 emissions is not all that it seems. While emissions measured at the power station support gas fuelling, the overall system from abstraction to point of use when leakage and incidents are reckoned, indicates the overall global warming effect of gas-based generation to be far closer to coal than supposed.

Indeed, large scale methane release in the short term resulting from shale gas extraction has the potential to contribute towards accelerating planetary meteorological system towards a no-return tipping point quicker than might otherwise occur

MARK WHITBY

Exploiting unconventional (shale and tight) gas could be a very advantageous game-changer offering the potential for gas prices to be decoupled from oil prices, resulting in less dependence on oil cartel nations and the potential for coal-to-gas fuel switching in power generation. It also offers the potential for gas to "bridge" technology development towards a low carbon future.

Exploiting shale gas has seen American gas prices fall six-fold (comparing pre-recession spot prices to the current day's) and is linked to burgeoning economic recovery in the United States – because energy cost is a key determinant of investment – particularly in manufacturing. It has attracted inward investment to USA industry from nations like Japan (where gas prices are 5 fold higher).

Decoupling gas and oil pricing enables gas-to-gas price competition as in USA leading to stable long-term energy supply contracts. Thus America is advantaged over most of the world where volatile oil price indexation continues to be the norm.

Shale gas reserves discovered in the USA have increased year on year with ongoing exploration. It can be assumed that the known reserves in other countries, where less exploration has been done, are understated.

Shale gas has halted the nuclear renaissance in America and has bought time for other low carbon technologies to be brought on line.

JOHN MILES

Professor of Transitional Energy and Arup Group Board Director

(Presentation Notes)

The global picture is more complex when demographics are factored.

The Western world / OECD represent the "golden billion" who enjoy highest quality of life, with per capita carbon emissions typically 4.5 - 6 tonnes/annum.

Demographic projections show global population growing to 9bn in the next 40 years – the life-time of a power station. The rest of the world aspires to a quality of life similar to that currently enjoyed in OECD nations. The prospect is that the 8bn people looking for an improvement in lifestyle will produce at least half the per capita emissions again of the OECD population if fossil fuels continue to be used.

Estimates of recoverable gas have gone up and up with shale gas coming into the picture. We have the beginnings of a global trade in gas. If this is followed through there is the opportunity for gas to be de-coupled from oil.

The quantities of shale gas and tight gas are about the same as conventional gas and will at least double global capacity. We can expect the rest of the world's gas reserves to go up when people start looking for it. At current consumption levels we have 50-60 years of gas reserve for the whole world. But howsoever viewed, gas is only a small fraction of coal reserves.

Thus it seems likely that, unless other energy sources are developed, much of the future demand of the emerging 8bn will have to be met by coal – and the much vaunted potential for coal-to-gas fuel shift will not happen globally. Vast amounts of gas and coal will be needed to feed the exploding energy demand.

In UK, the population growth is such that by 2031 it will be the most populous nation in Europe at 71million. UK shale gas reserves are reckoned at 20 trillion cu ft (20tcf) compared with about 9tcf of North Sea gas. (Cuardrilla claims Lancashire's shale gas reserves may be as high as 200tcf). Thus shale gas could soon be a very significant source of energy in the UK.

(Shale gas also boosts the indigenous gas reserves of the industrial countries very considerably).

But oil reserves are not affected and its price will not stop rising. Since compressed gas is a possible alternative vehicle fuel, shale gas may provide a way forward and an attractive alternative to battery powering. However its methane losses suggest it will have worse consequences for global warming than diesel or petroleum.

In UK gas fired power stations will meet 2020 but not its 2050 targets. The availability of shale gas suggests a UK power generation scenario where:

- coal is phased out from 2017 with the advent of the EU Large Combustion Directive
- Further prevarication over nuclear policy will see no new capacity delivered
- This will again lead to a dash for gas
- 2020 climate targets will be met, largely as result of the UK coal-to-gas switch

A key effect will be that UK becomes locked-in to its new gas power stations for 40 years and unable to meet its 2050 targets. But an energy switch would involve leaving them as stranded assets.

POST PRESENTATION DISCUSSION

Is the combination of shale gas power generation and carbon capture and storage a possible solution? .

- CCS is still to be proven as a complete solution although the individual parts of it have been validated. For example the pilot plant at Ferrybridge does CO_2 capture successfully but has not yet piped any of it into long-term storage. The main issue is whether storage can be made to work and this remains an unknown. In Germany carbon storage underground is a contentious political issue and many parts of the world do not have depleted subterranean gas fields to use for storage.
- Concern about CO_2 leakage from storage is creating a new type of NIMBYism – albeit a reaction common to all new energy forms!
- CCS adds 20-25% to the costs of energy generation.

What will be the effect on the water footprint of fracking?

- The UK is still some way from establishing the availability of shale gas fields before overlaying water resources.
- In China the major shale gas fields are in a huge inland desert without access to the necessary water to pump underground to release the gas. In addition 40% of the population in India and China rely on the only available supply, the melt-water from Himalayan glaciers.
- Water availability will be a limiting factor and a constraint on how quickly deposits can be exploited and brought to market in many areas.

Does fracking create ground water pollution problems?

- Problems with water pollution have been reported in the USA. There shale gas extraction is exempt from clean water obligations and operators can be 'as careless as they like', leading to the consequence that shale gas exploitation has been banned in some States. There are no such exemptions in Europe so the USA experience may be of less concern here.

What is the significance of the seismic problems associated with 'fracking' as occurred in the Blackpool trials?

- The problem was traced to fracking but it is considered that new procedures will minimise seismic effects and the risks are no worse than with coal.

Is there a measure relating global temperature rise with different energy scenarios?

- Not specifically – but there is much related data.

Will shale gas bring the cost of carbon down?

- Yes. (Which is not what's needed!) Currently carbon stands at about $20-30/t due to the recession. Low carbon viability lies between $200-300/t.

If shale gas prices come down will the Treasury cut low carbon funding?

- A solution would be to oblige energy companies to invest more in renewables when feedstock prices come down.
- Such market mechanisms can produce unexpected consequences! We rely too much on them – a guiding hand is needed/preferred.

What will be the impact of shale gas have on the Climate Change Act?

- Shale gas would help enable the UK to meet its CCA obligations for 2020. However the Act would then likely have to be repealed if gas-fired installations are retained because 2050 targets could not then be achieved. Even if shale gas helped fund more renewable generation the UK could end up in a worse place because of the relatively short life of most renewable technologies.
- While the UK might be trusted to drive its energy policy down the CCS route with shale gas in order to meet its 2050 commitments, globally there are fewer long-term emissions reduction targets and gas is not likely to displace coal as overall energy demand grows.
- So far this has been a supply-side conversation with no discussion of energy efficiency. Shale gas does not bode well for emissions trajectory development - research shows that low energy prices lead to rocketing demand (e.g. Shanghai currently has half the energy prices of London and double the per capita emissions). The UK provides historical evidence for this relationship - where large energy reserves produced higher energy use than nations with fewer resources – even though all paid the same price for energy.
- We are not being radical enough in saving energy by reducing demand. There needs to be a positive price to saving carbon. All supply-side technologies in energy policy have problematic issues to overcome. The only policy measure that universally helps in all cases is demand reduction.

Is it not now time to introduce energy quotas and personal carbon allowances / rationing?

- Yes. But it is also time to restructure tariffs to penalise profligate use of energy.
- Personal carbon allowances and tariff restructuring may seem logical but at the moment they would create real problems of inequity. According to the Institute of Fiscal Studies there are six-fold differences in energy consumption across the homes of the lowest 20% income group. It would become a lottery for home occupiers. Government is intervening with the private rental sector requiring properties with EPCs rated at F or G to be uprated under the Green Deal. Consequential improvements will also become a condition of consent for property upgrades.
- A carbon allowance system, given the existing complexity of our taxation system, could be constructed to address social inequalities and be socially acceptable? Creating a complex but workable (and equitable) carbon allowances scheme seems a more certain means of achieving the 2050 targets than pinning all hopes on carbon capture and storage, which may never be deployable.
- While personal carbon allowances might be implemented in the UK, they would be far more difficult to roll out worldwide. The allowance would need to be 2tCO_2/person/annum for global equity, less than half the UK current per capita figure of 4.5 tonnes. Small marginal behaviour changes are possible in UK (as with recycling) but the lifestyle impacts of more drastic cuts would be hard to implement without role models to show us how.

It seems that Europe is leading the drive for low carbon but the rest of the world is not engaged.

- This is a widespread fallacy - many other nationals think their countries are leading the drive. There is major cooperation between nations as evidenced by the agreement at the Durban COP.
- Globally, economics drives all patterns of energy consumption and no matter what course of action is taken in Europe the rest of the world will continue to burn the cheapest fuel that they can find.
- Carbon mitigation is essentially incompatible with the operation of free markets, as noted by the Stern review. It is the role of governments to drive policy to overcome economic externalities.

Why do we use energy consumption as a proxy for carbon emissions?

- There is abundant solar energy available if we set out to harness it. Although not all solar energy is harvestable and it serves many other essential purposes, the world's energy needs could be met by only 1% of incident solar irradiance.

CLOSING COMMENTS

1. **Shale gas could be an opportunity – with gas prices maintained at current levels windfalls from the lower price of shale gas could be used for investment in carbon reduction measures.**
2. **Society's addiction to cheap-energy fuelled economic growth is at the heart of the problem. Decoupling economic growth from carbon intensive energy use needs to be further explored.**
3. **In the face of the new abundance of high quality fossil fuels offered by shale gas, tackling climate change is now more optional for governments and societies than when the 'peak oil' watershed and concerns about energy security governed thinking. This represents a greater challenge to tackling climate change than any previously faced**
4. **What does the Panel consider this discussion adds up to? What one thing would each recommend?**
    a. Keep energy prices constant and use the surplus revenue to fund a low carbon future.
    b. A cultural shift is needed to create behaviour-led rather than technology-led change. We should do everything to keep carbon in the ground!
    c. The immediate obligation lies with the professionals. It's very difficult to affect a sea change in public behaviour when professionals cannot reach agreement.

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