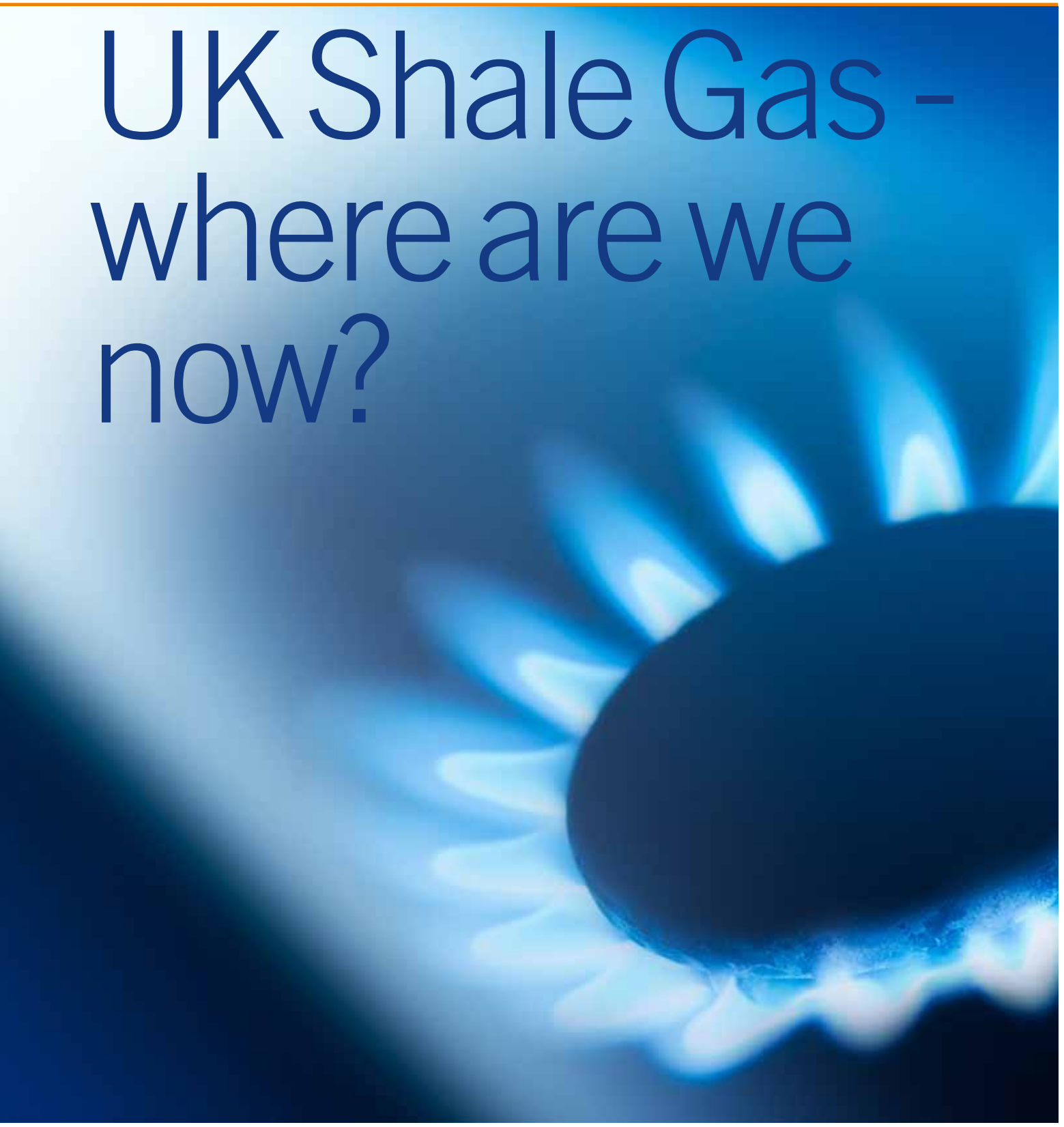
PÖYRY

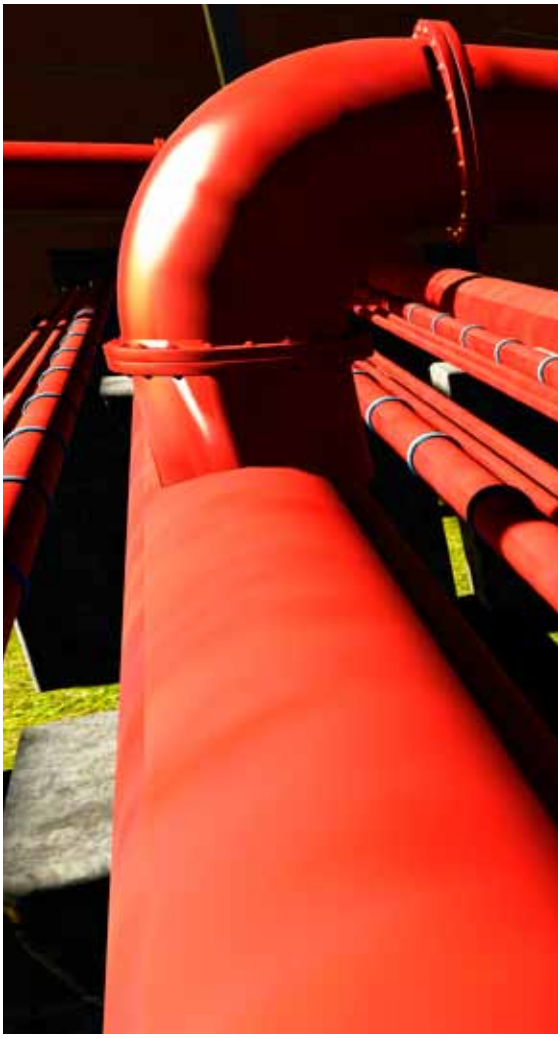
PÖYRY POINT OF VIEW:
SHAPING THE NEXT FUTURE

UK Shale Gas – where are we now?



Is the UK going all-out for shale?

Exploratory drilling activity on the part of shale gas developers remains low despite widespread coverage in the media and announcements that the UK is to "go all out for shale". Although regulation must remain thorough and robust, there is a risk that the complex approvals process will hinder production. Industry, government and regulatory authorities should ensure that the institutional capacity is in place to make the approvals process efficient so that the potential benefits of shale gas can be realised.



UK SHALE GAS – WHY ARE WE WAITING?

Energy has become a major political issue in the UK over the past twelve months. A number of issues, not least the rising price to consumers for electricity, have forced energy to the top of the political agenda.

Amidst this background, the Government has continued to stress the beneficial role that shale gas could play in the UK's energy mix. It has established the Office of Unconventional Gas and Oil (OUGO) and announced tax incentives for shale gas developers. The British Geological Survey has estimated the Bowland shale resources to be in the region of 1,300 trillion cubic feet (tcf) of gas-in-place, far higher than previous estimates.

Despite these developments there has been little drilling activity on the part of shale gas developers. In this Pöyry Point of View we ask why this is the case, revisit our previous analysis published in 2012, and analyse the benefits still realisable from shale in light of any delays in production.

- Are the benefits of shale gas still there despite the delays?
- What needs to change to enable the next steps in shale gas development?

PÖYRY'S 2012 LANCASHIRE SHALE GAS STUDY

In 2012, we assessed the potential impact of Cuadrilla production from the Bowland shale based on its preliminary estimates of gas-in-place in its Bowland shale licence area. We assessed the impact on UK wholesale gas prices and, more broadly, on security of supply and the balance of payments.

Source: The Department of Energy & Climate Change

BOX 1 – HOW WILL LANCASHIRE SHALE IMPACT THE UK ENERGY MARKET?

Our 2012 study found that shale gas production in Lancashire, to the extent projected by Cuadrilla was likely to result in:

1. Lower wholesale energy costs that could total £17billion between 2014 and 2035;
2. No impact on the ability of the UK to meet renewable targets and reduce its power generation carbon intensity; and
3. A 21% reduction in gas import dependence, with a transfer of an average of £3.3billion per annum of the UK's trade balance from debit to credit.

Why has there been little progress since 2012?

The 2012 study was based on a production profile commencing in 2014/15. In light of recent developments it is apparent that this is not achievable. It is clear that the length of time required to, in the first instance clarify, and thereafter secure the necessary regulatory permits and consents has been far longer than originally envisaged by shale gas developers and the Government alike. Commercial production is not now anticipated to commence until 2019/20, although production may still reach a significant quantity by the end of the 2020s.

SHALE GAS REGULATION IN THE UK

The UK has a relatively long track record of hydrocarbon exploration and production, with good regulation and social acceptance

`Pöyry has carried out an informal canvassing process – speaking to shale gas developers and regulators – and the overwhelming consensus is that the UK regulation and permitting process for shale gas is thorough and robust. Environmental and safety standards are high. Furthermore, the EU recently reinforced this position by deciding not to introduce new directives to enforce shale gas regulations on the basis that the market is already well regulated.

Whilst the UK regulatory framework for shale gas exploration is thorough and robust, it is also complex and requires interactions with a number of bodies including Department for Energy and Climate Change (DECC), the Environment Agency (EA), the Health and Safety Executive (HSE), and local Planning Authorities. Ultimately, the consent to drill and to hydraulically fracture is given by DECC.

In December 2013 DECC published a roadmap to guide shale gas developers in the exploration and appraisal phase (see Box 3). The process outlined by DECC only considers the permitting required to drill and hydraulically fracture one exploratory well. We have estimated that the entire process from licence award to commercial production

BOX 2 – ONSHORE OIL AND GAS IN THE UK

The onshore oil and gas industry in the UK can be traced back to 1850 and has developed ever since.

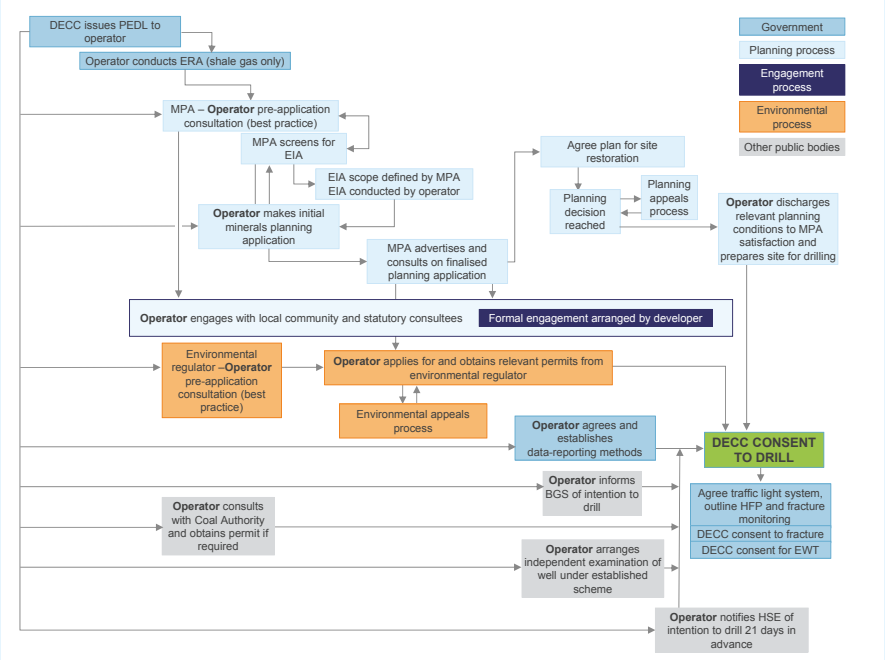
In 1973 the Wytch Farm onshore oilfield was discovered and is now Europe's largest onshore oil field operating successfully in an environmentally sensitive area. It produces in excess of 16,000 barrels of oil equivalent each day.

The onshore industry is regulated by the Department of Energy and Climate Change (DECC) with environmental approvals being given by the Environment Agency (EA) and the Scottish Environmental Protection Agency.

To date around 2,000 onshore wells have been drilled. There are currently around 120 operating sites with 300 operating wells producing in excess of 20,000 barrels of oil a day equivalent.

Source: UK Onshore Operators Group (UKOOG)

BOX 3 – UK SHALE GAS PERMITTING PROCESS



Source: The Department of Energy & Climate Change

may take around 6-8 years, not including any judicial reviews or legal challenges. Since exploration is only part of this process, there is real potential and a pressing need for streamlining if the industry is to develop in the UK.

The EA is responsible for developing the environmental permitting processes for shale gas. One difficult area is the interpretation and application of the European Mining Waste Directive to shale gas operations. Resolving complex technical and legal issues is proving a 'sticking point' for the completion of permitting.

On another front, the EA is developing standard rules permits. Currently bespoke permits are required for every well. Once standard rules have been out for public consultation and are agreed, then the standard rules permit can be applied without further consultation, thus speeding up the process. The first standard rules permit should be out for consultation in early 2014 but hydraulic fracturing will not be included within standard rules at this time. This means there will be limited benefit for shale developments.

Achieving local planning approval and gaining environmental permits has proved time consuming. This has meant that very limited exploratory drilling has taken place. As a result of this, the shale gas developers are still not able to determine whether the shale rock in place will yield commercial quantities of shale gas. This makes it difficult for developers, potential investors and market analysts to model production profiles with a high degree of confidence.

Can the UK realise significant shale production?

STEPPING UP REGULATION AND PERMITTING ACTIVITY IN THE PRODUCTION PHASE

Assuming that the results of any exploratory drilling are successful, developers will move from the exploration phase to the production phase. Due to the nature of shale gas and the process by which it is extracted, the number of wells that are drilled in the production phase increases substantially and will number in the hundreds. Although these wells will be spread over a much smaller number of well pads, there will be a clear step change in the activity of the shale gas developers. This will require a similar step change in the regulatory approvals and monitoring processes.

There is a risk that if the regulatory and permitting process is not made more efficient then it may not be possible to achieve shale gas production at any scale. An integrated one-stop-shop approach to permitting could offer real improvements to both the exploratory and production phases.

WHAT NEEDS TO HAPPEN TO ACHIEVE SIGNIFICANT PRODUCTION?

Achieving significant production from the Bowland shale is dependent on a number of factors:

- an efficient regulatory framework, including planning, permitting and monitoring;
- successful results of the exploratory drilling;
- achieving the social licence to operate;
- development of the onshore supply chain; and
- favourable economics relating to costs of production and the prevailing wholesale gas price.

A number of these factors are outside the direct control of UK policy makers and regulatory authorities, especially the capability of the shale rock to yield commercial quantities of shale gas. Development of the onshore supply chain may be influenced by policy but is best left to the market to deliver in response to demand from the shale gas developers. The cost of production may be influenced by the tax regime; but the wholesale gas price is determined by international gas markets and is outside the sphere of influence of Government. The social licence to operate relating to public acceptance of hydraulic fracturing can be directly influenced by the Government but it also requires concentrated efforts by the shale gas developers and organisations such as the UK Onshore Operators Group (UKOOG). There needs to be a concerted effort to engage with communities and convince them of the safety of operations and the economic and community benefits.

Perhaps the greatest opportunity rests with the potential to streamline and simplify the permitting, approval and consent process, which is untested for the likely number of shale gas wells that will need to be drilled in the production phases. The challenge is to streamline and simplify, and improve administrative capacity, without changing the effectiveness of the regulatory framework.

We believe that the current permitting framework for shale gas in the UK may

BOX 4 - SHALE GAS EXPLORATION

Based on preliminary exploratory work, in September 2011 Cuadrilla Resources announced that it estimated some 200tcf of gas-in-place in its licensed area in the Bowland shale alone. The subsequent British Geological Survey estimate for the whole of the Bowland shale is some 1,300tcf

This estimated resource base is very substantial by any account, especially when considering that the Bowland shale estimates refer to only one of many potential shale gas prospects across the UK. However, there are still significant uncertainties as to the exact size of these resources, which will remain until more exploratory wells are drilled.

Such uncertainties are perfectly normal at the current stage of development. Exploration operations represent a potentially lengthy and capital-intensive process which is aimed at reducing uncertainties pertaining to the size, quality, production costs and other relevant attributes of shale (or even conventional) hydrocarbons resources in place.

If the exploration process provides evidence of sufficient levels of gas which could be recovered at a reasonable cost and sold profitably, then operators can move towards positive final investment decisions.

For any given operator, this process consists of phases of decision-making and capital deployment. An operator will face an overall “stay or go” decision. Following a “stay” decision, capital deployment decisions are likely to be on a pad-by-pad or group-of-pads basis, depending on not only the estimated recoverability but also the estimated rate of permitting approval.

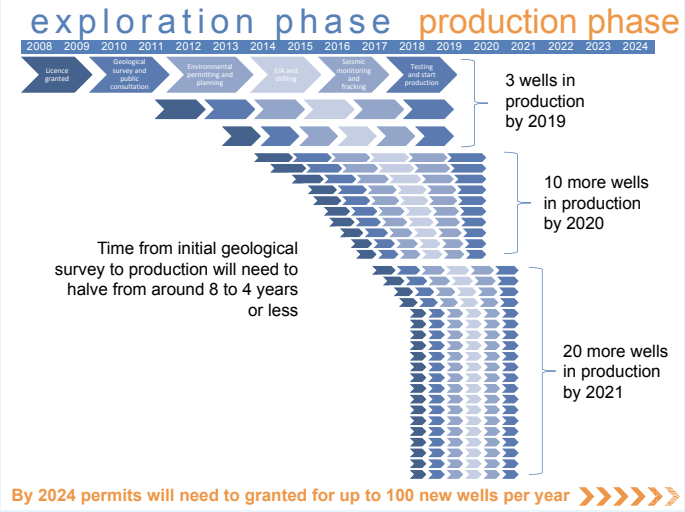
The rate of capital deployment is what paves the way for the production phase and the economic benefits associated with it.

not scale up to cope with the number of applications required to achieve commercial production levels to take place from the early 2020s onwards. During this time there will be a transition from the limited drilling (and permitting) requirements of the preliminary exploratory and early production phases to a higher number of drilling operations.

In the absence of certainty that the planning and approvals process can deal with a significant increase in applications in the production phase, investment in the industry may be adversely affected. If there is little certainty that shale gas can be brought to market then investment during the exploration phase may not be forthcoming. This will affect the ability of developers to ascertain the full production potential. Indeed, there is a real possibility that some project developers will shy away from investing in shale gas exploration in the UK if they do not believe they can move to the production phase and capture economic benefits over and above their investment in exploration operations.

BOX 5 – APPLICATIONS UNDER THE PRODUCTION PHASE

The operational, legal and permitting stages of the shale development process will need to be streamlined and significantly speeded up going from the exploration to the production phase. An example of the number of wells going through the permitting process could look something like this.



Until around 2019, Pöyry envisages a small number of applications for new shale gas wells each year. This will change rapidly during the production phase, such that 100 new wells may need permitting every year by 2024. These could be spread over about 10 new pads and require about 10 rigs to be in operation.

During this production phase, an integrated one-stop-shop permitting approach with a simultaneous move away from permitting on the individual well to the broader pad level could become inescapable if shale gas is to be produced at scale.

How financially attractive is shale to the UK?

TAX REVENUES FROM LANCASHIRE SHALE

Assuming that the issues relating to the permitting and approvals process can be overcome, there are a number of benefits that can result from UK shale gas production. Whilst our 2012 study found the impact on energy prices to be relatively modest we did see significant benefits in terms of balance of trade payments and security of supply. We have now revised the analysis to calculate the tax revenue and re-calculate the balance of trade impact of Lancashire shale gas production. Other benefits which we have not yet quantified include community benefits paid by shale developers and the benefits associated with additional employment which would result in higher GDP, higher employment related tax revenues and lower social security payments.

The UK Government will receive revenue in the form of corporation tax and other borne and collected tax relating to shale gas production, which would represent a welcome addition in the face of declining contributions from North Sea hydrocarbons production.

Whilst there is uncertainty regarding the cost of producing shale gas in the UK, if we assume that Cuadrilla could develop its resources at a breakeven of $8.5/mmbtu, then the Government could reasonably hope to receive a total of some £2.7billion by 2035 (in real 2013 money) from Cuadrilla's Bowland shale gas production alone. Roughly £500 million could be paid each year towards the end of our reference period, as shale production increases and overall gas profitability improves (see Figure 1).

This estimated tax revenue excludes any additional revenue which could come from other taxes paid by Cuadrilla in this framework and excludes other benefits that may arise through increased employment and the resulting beneficial impact on social security payments.

BALANCE OF PAYMENTS (BALANCE OF TRADE)

Production of indigenous gas whether from conventional or unconventional sources provides benefits to 'physical' security of supply and reduces the requirement to import gas from other sources.

The UK's import dependency, as a result of shale gas production from Cuadrilla's licence area alone, could reduce from 89% to 78% in 2035.

In addition to this, Cuadrilla's Bowland shale production would allow the UK economy to benefit from improvements in its Balance of Trade (a component of the Balance of Payments). These benefits are over and above physical security of supply benefits and would be a direct corollary of new shale gas production being used to substitute imports of natural gas from foreign sources.

According to our analysis, the UK Balance of Payments could be improved by a cumulative £39billion by 2035 (in real 2013 money), with more than £5billion saved in that year alone.

These benefits could naturally be magnified if Cuadrilla's shale gas production proves larger than assumed here, and if other shale producers are also successful in Lancashire and in other parts of the country, thereby increasing the UK's overall national shale gas output. This is a realistic upside, given the number of license holders looking to develop shale gas in the UK. Furthermore, 2014 is expected to see the award of a potentially significant number of new *Petroleum Exploration and Development Licenses* in other prospective shale areas.

Figure 2 presents the anticipated improvement in the Balance of Payments as a result of the assumed production of shale gas from Cuadrilla's Bowland prospect alone.

FIGURE 1 – ESTIMATED CUADRILLA CORPORATION TAX CONTRIBUTIONS

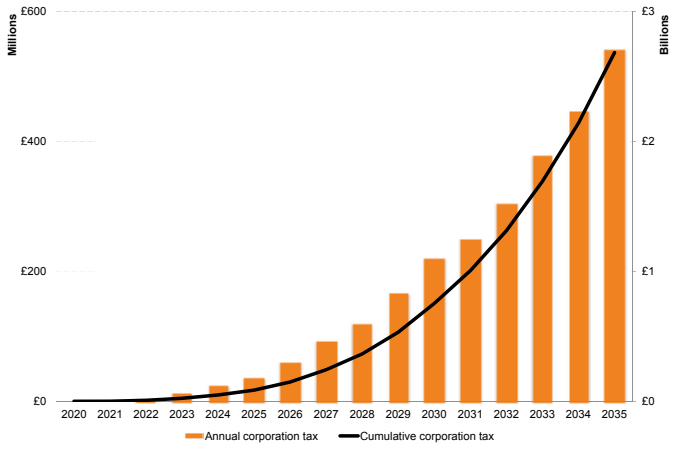
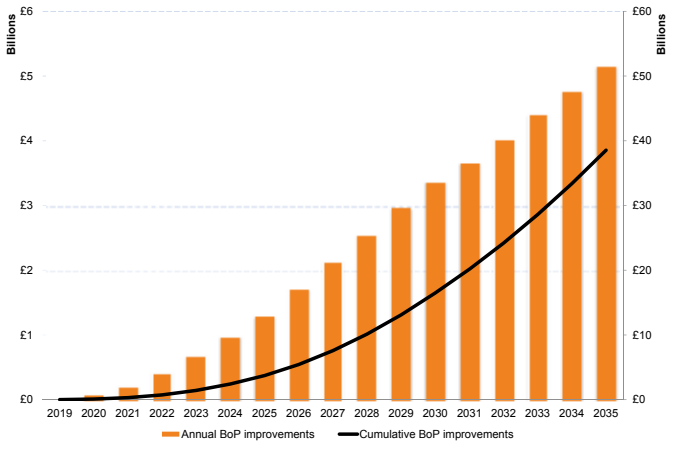


FIGURE 2 – ESTIMATED BALANCE OF PAYMENTS BENEFITS



BOX 6 – TAX CALCULATIONS

Our calculation of applicable corporation tax revenues takes into account projected UK wholesale prices from Pöyry's central scenario under its proprietary market modelling; estimated Cuadrilla CAPEX spending; and tax-exempt revenue equal to 75% of CAPEX as per recent Government announcements aimed at facilitating shale gas development.

For simplification purposes, it has been assumed that any tax allowances are able to be claimed in their entirety in the first year, and/or that there is roll-over of unclaimed tax allowances from the early years to later years, which are more productive and profitable. Any potential limitations in the ability to claim (as per the small-field allowance example) could represent an upside for Government revenue.

Pöyry is conscious that the shale gas production profile and related cost assumptions may be on the optimistic side of the range of estimates available in the public domain. However, the lack of sufficient data from exploratory drilling means any cost estimates remain speculative and subject to revision if or when such information becomes available.

How can the UK realise the potential benefits of shale?

CONCLUSIONS

The commercial production of shale gas in the UK will not begin in 2014/15 as previously thought. In fact, it is more likely to commence towards the end of the decade. This is because the exploration phase is taking far longer than initially envisaged. There are a number of reasons for this, including the permitting, approval and consent processes that we have discussed in this paper.

We have come to the following conclusions:

- Regulations are robust and need to stay that way, but streamlining the process is essential – standard rules permits, for example, could be progressed sooner if the resources are made available.
- Investors and shale gas developers face geological uncertainties which cannot be resolved until exploration wells are drilled, hydraulically fractured, and flow tested.
- Given the likely time and legislative steps required to design and implement a streamlined permitting system, intense focus is needed now improving the efficiency of the permitting and regulatory processes necessary to allow the production phase to succeed.
- Unless streamlining takes place we are unlikely to achieve any scale of production of shale gas in the UK.

The benefits resulting from shale gas production are still potentially very significant. As a result of the delayed commercial start date of shale gas production we have revised our 2012 analysis to quantify the potential benefits of Lancashire shale. These now include:

- additional corporation tax revenues of £2.7billion;
- an 11% reduction in gas import dependence; and
- a balance of payments benefit of £39billion.

The potential benefits are based only on production from Cuadrilla's licence area. In reality, if the shale gas industry develops in the UK, the benefits are likely to be much greater.

WHAT NEXT?

Progress could be made by establishing a cross-industry working group to focus on the critical tasks which need to be completed to ensure that the institutional capacity is in place and that processes are streamlined for the production phase. This should be done as soon as possible so that the certainty investors and developers require can be achieved.

Staying on top of your game means keeping up with the latest thinking, trends and developments. We know that this can sometimes be tough as the pace of change continues...

At Pöyry, we encourage our global network of experts to actively contribute to the debate - generating fresh insight and challenging the status quo. The Pöyry Point of View is our practical, accessible and issues-based approach to sharing our latest thinking. We invite you to take a look – please let us know your thoughts.

Join the debate

www.linkedin.com/company/Poyry

@PoyryPlc
#PoyryPOV

www.youtube.com/PoyryPlc

www.facebook.com/PoyryPlc

PÖYRY
Engineering balanced sustainability™

Pöyry Management Consulting

AUSTRALIA
Melbourne
Phone: +61 3 9863 3700

AUSTRIA
Vienna
Phone: +43 1 6411 800

BRAZIL
Curitiba
Phone: +55 41 3252 7665

São Paulo
Phone: +55 11 5187 5555

CHINA
Shanghai
Phone: +86 21 6115 9660

FINLAND
Helsinki
Phone: +358 10 3311

FRANCE
Paris
Phone: +33 156 88 2710

GERMANY
Düsseldorf
Phone: +49 211 175 2380

Munich
Phone: +49 89 954771 62

INDONESIA
Jakarta
Phone: +62 21 527 5552

ITALY
Milano
Phone: +39 02 3659 6900

NEW ZEALAND
Auckland
Phone: +64 9 918 1100

NORWAY
Oslo
Phone: +47 4540 5000

RUSSIA
Moscow
Phone: +7 495 937 5257

SINGAPORE
Phone: +65 6733 3331

SPAIN
Madrid
Phone: +34 615 457 290

SWEDEN
Stockholm
Phone: +46 8 528 01200

SWITZERLAND
Zurich
Phone: +41 44 288 9090

THAILAND
Bangkok
Phone: +66 2 657 1000

UNITED ARAB EMIRATES
Dubai
Phone: +971 4 6069 500

UNITED KINGDOM
London
Phone: +44 207 932 8200

Oxford
Phone: +44 1865 722 660

USA
Atlanta
Phone: +1 404 351 5707

New York
Phone: +1 646 651 1547

Photos: colourbox.com

www.poyry.com

Pöyry is an international consulting and engineering company. We serve clients globally across the energy and industrial sectors and locally in our core markets. We deliver strategic advisory and engineering services, underpinned by strong project implementation capability and expertise. Our focus sectors are power generation, transmission & distribution, forest industry, chemicals & biorefining, mining & metals, transportation, water and real estate sectors. Pöyry has an extensive local office network employing about 6,500 experts.

PN 0015 2014/02 V1