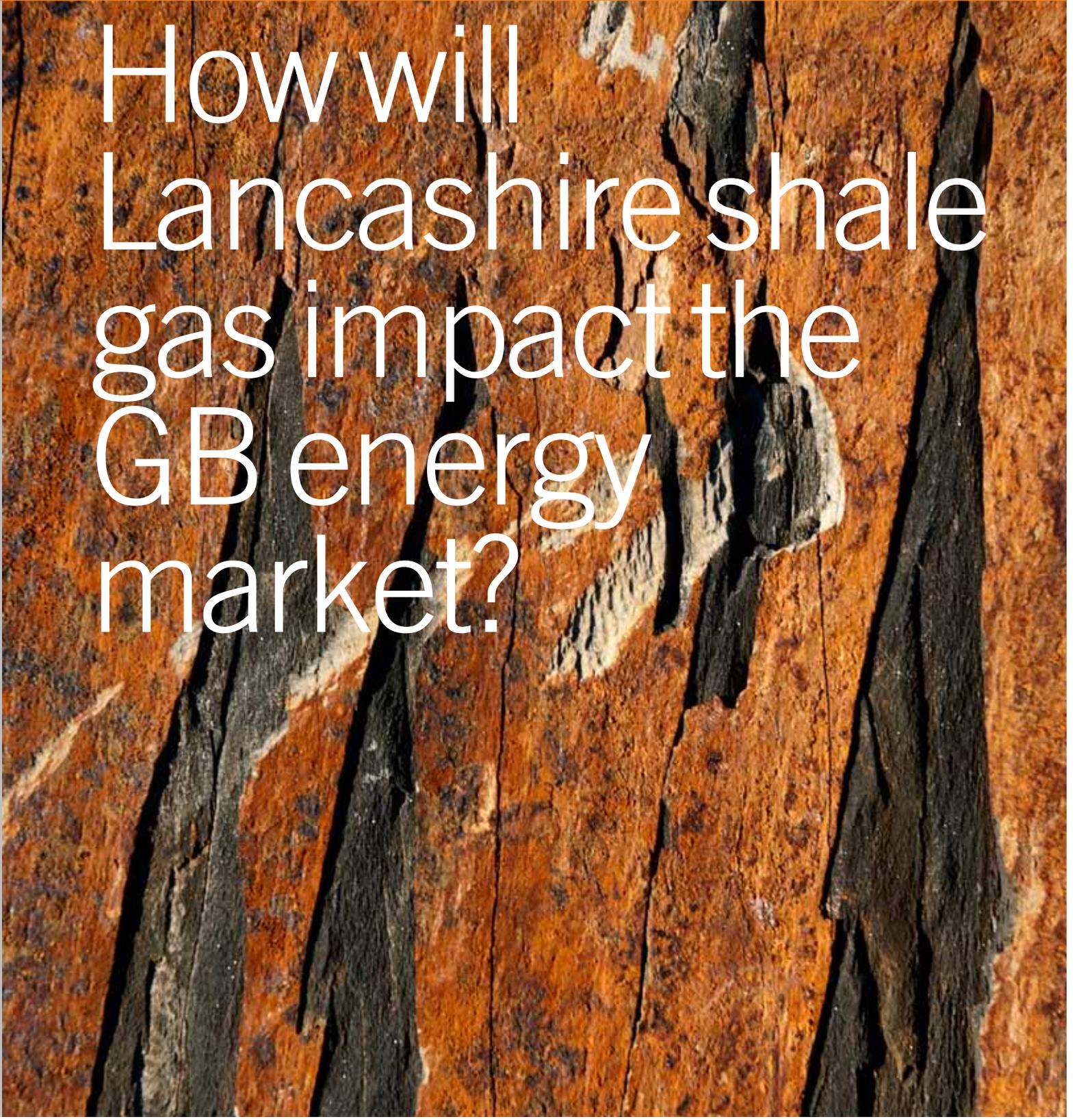


**PÖYRY POINT OF VIEW:
SHAPING THE NEXT FUTURE**



How will Lancashire shale gas impact the GB energy market?

Why are people interested in shale gas?

Shale gas production in the US is massive, exceeding 200bcm per annum. This has led to a dramatic drop in gas prices and has returned the US to near self-sufficiency in natural gas. High volumes of shale gas have even triggered requests for LNG exports. However, the US picture has not been replicated anywhere in the world. In Europe, shale gas continues to be hotly debated. Pöyry investigated this for the GB energy regulator, Ofgem, in 2011 to examine the potential impacts of unconventional gas on European gas markets. However, much has changed recently that has caused us to revisit our analysis.

APPROACH

In carrying out this study we have been able to access the latest information and production estimates of the UK shale gas developer Cuadrilla Resources. They have reviewed the latest technological developments in shale gas production, the potential of the Lancashire shale and what they believe to be a realistic expectation of the future supply chain capability. This has led Cuadrilla to estimate realistic production levels reaching 20bcm/year by 2035, which by then, is likely to amount to more than half of the GB's indigenous gas production. Pöyry used its own estimates on the costs of developing shale, which is consistent with the recently published estimates by the European Commission.

In our analysis we have assumed a baseline case in which no Lancashire shale gas is produced and have compared this to a case which uses the production profile provided by Cuadrilla.

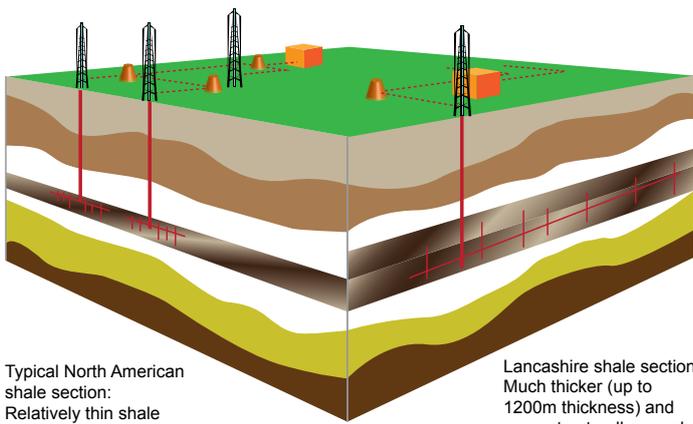
We have modelled these against a future scenario that is consistent with a generation mix and timings that achieve compliance with the 2020 renewables capacity target and similar levels of deployment beyond. To ensure that the relationship between gas prices and power generation are internally consistent, we have iterated the two cases through our gas market model, Pegasus, and our electricity market model, EurEca.

This independent study reviews how the gas and electricity markets of Great Britain would be affected by substantial shale gas production around Lancashire, over the period out to 2035.

In this Point of View, we explore:

- Are there any incremental benefits on wholesale GB gas prices and electricity prices?
- What is the influence of shale gas on import dependency?
- Whether renewable targets can be met if GB exploits the potential of Lancashire shale gas?





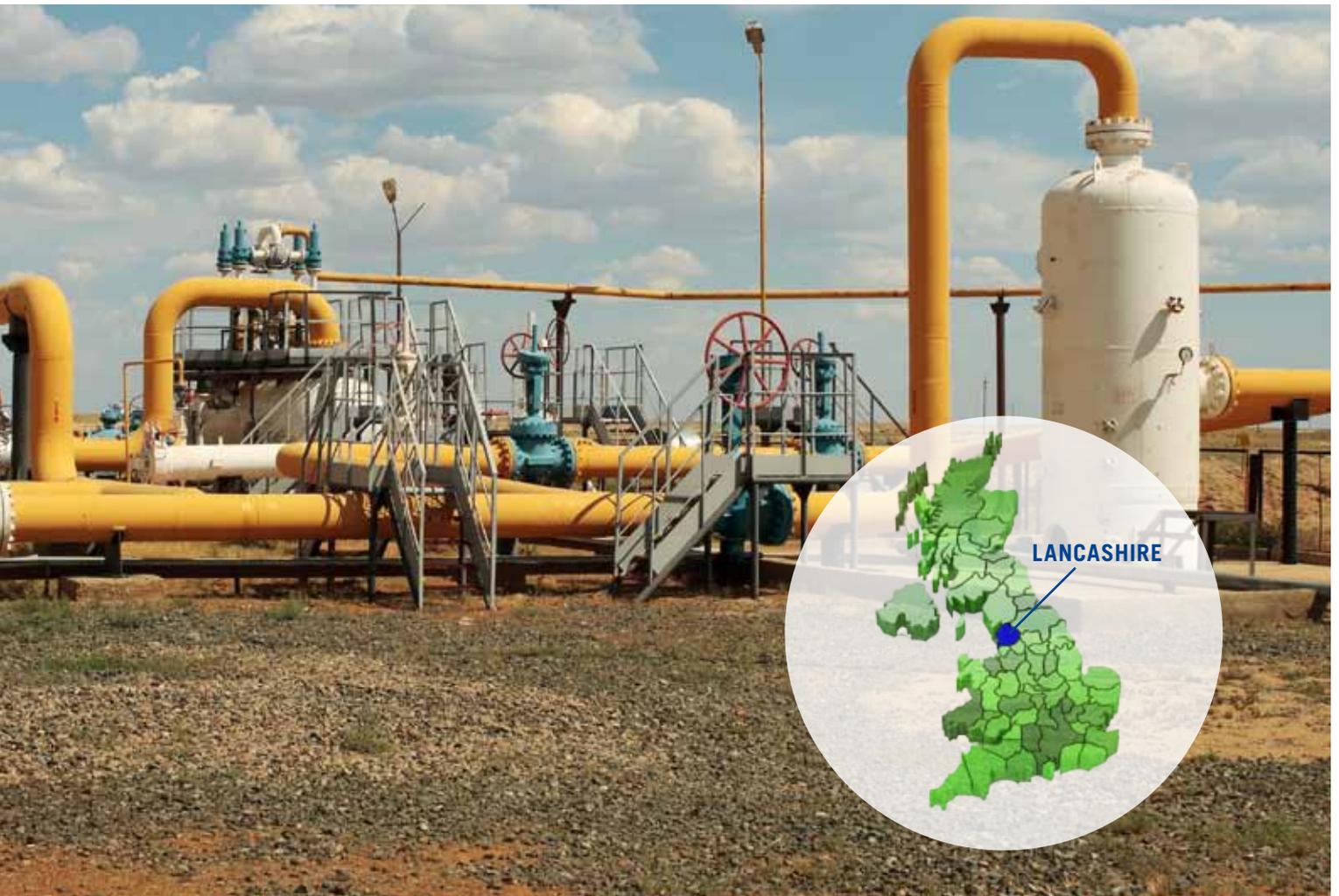
Typical North American shale section:
Relatively thin shale target (<60m thickness)

Lancashire shale section:
Much thicker (up to 1200m thickness) and more structurally complex

SHALE GAS DEVELOPMENT

Shale gas in North America is typically found in a thin layer of shale, which is accessed via numerous vertical wells and horizontal drilling techniques. However, the unique thickness of the Lancashire shale will allow development of shale gas using fewer drilling pads and multiple horizontal wells.

The biggest challenge to maximise the recovery of shale gas in the UK may be socio-political. The public worry that shale gas can be developed safely and sensibly. Ultimately, public trust depends on regulation that is seen to be effective, and operators who uphold these standards consistently.



What is the impact on gas supplies and energy prices?

IMPACT ON GAS PRICES

Our analysis shows that production of Lancashire shale gas begins to have an impact on GB gas prices from 2021, when production reaches 12bcm/year. This level of production is equivalent to approximately half of that expected from the UKCS in the same year.

From 2021, gas prices are between 2% and 4% lower if Lancashire shale gas production proceeds as projected. We have estimated that between 2014 and 2035, taking projected gas demand over the period into account, that the average annual saving on wholesale gas costs is £380million and a total saving of almost £8billion over the period.

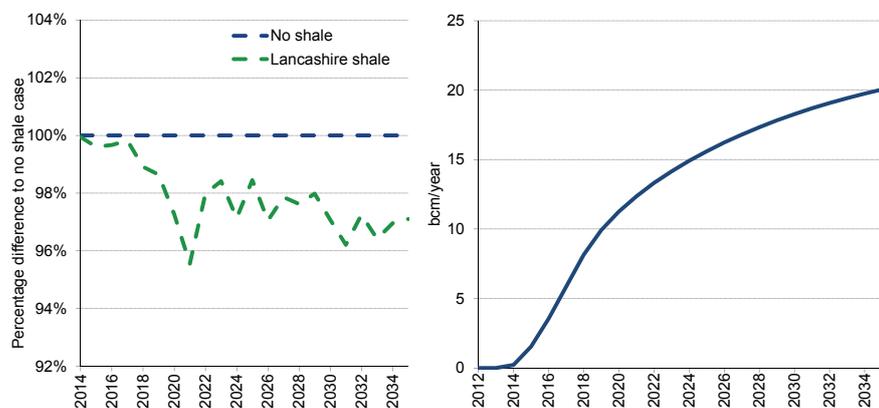
GAS IMPORT DEPENDENCE

By 2030, Lancashire shale could represent 21% of gas supplied to GB, equalling the contribution from conventional indigenous production and keeping the reliance on LNG imports below 50%. Without shale gas, GB is projected to become 60% dependent upon LNG imports.

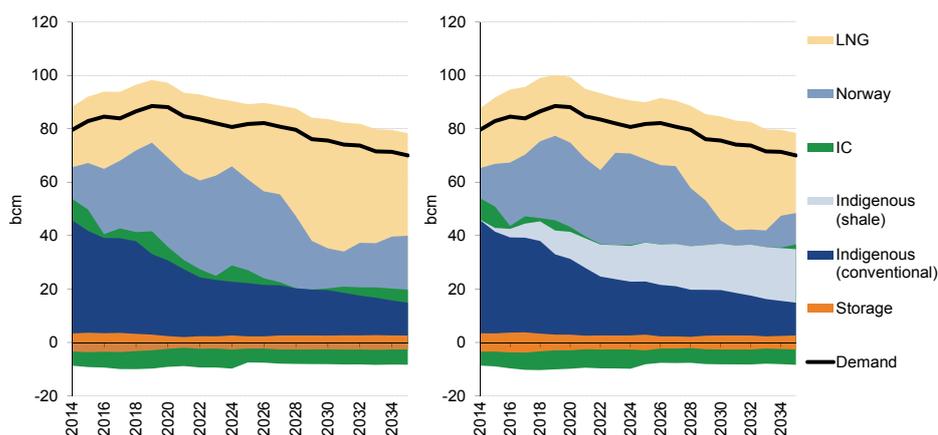
Overall gas import dependence is 58% under the Lancashire shale scenario compared with 79% under the 'No shale' scenario in 2030. Hence, shale gas production leads to transferring an average of £3.3bn per annum of the UK's trade balance from debit to credit.

LANCASHIRE SHALE PRODUCTION & IMPACT ON NBP GAS PRICES

Source: Cuadrilla production for Lancashire shale gas. Pöyry analysis on NBP prices and gas supplies



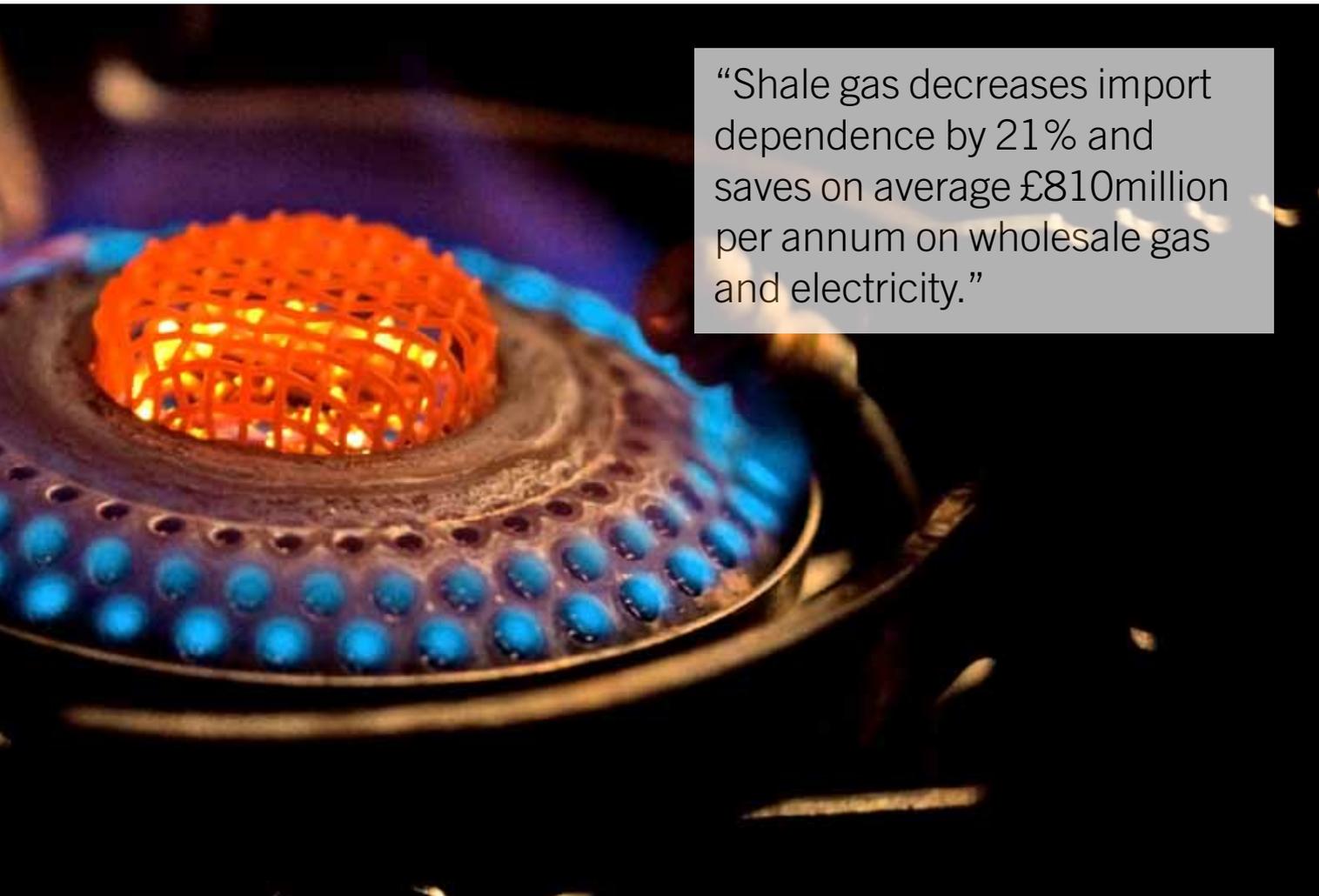
SOURCES OF GAS SUPPLY TO GB WITHOUT AND WITH LANCASHIRE SHALE



GAS IMPORTS

GB used to be self-sufficient and export natural gas, producing a peak of 115bcm in 2000. Since then gas imports have increased to such an extent that they made up 66% of its gas in 2011 and the expectation is for this trend to continue. GB gas imports come from Norway, continental Europe and from around the world via LNG.

Major new facilities have been constructed to support these imports in the last 6 years at a total investment of over £5.3billion.

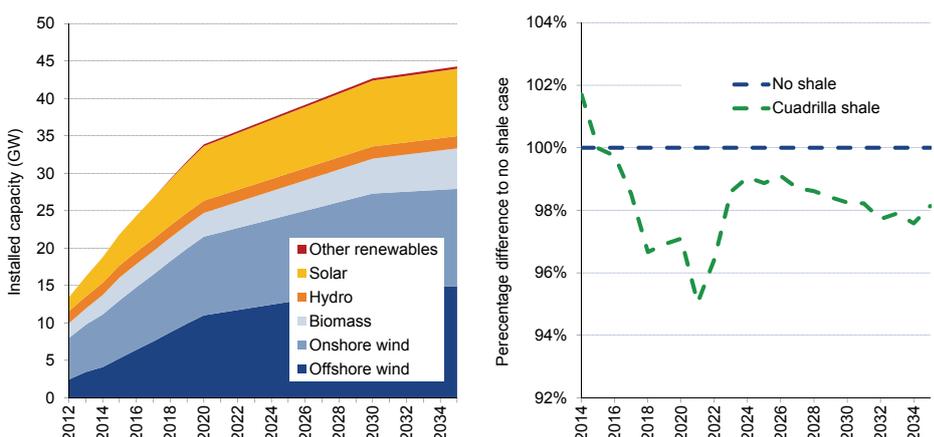


“Shale gas decreases import dependence by 21% and saves on average £810million per annum on wholesale gas and electricity.”

IMPACT ON ELECTRICITY PRICES

The difference made to the wholesale electricity price as a result of Lancashire shale gas production is of a similar magnitude to that seen in the gas price, a reduction between 2% and 4% over the period to 2035. We have estimated that between 2014 and 2035, taking projected electricity demand over the period into account, that the average annual saving on wholesale electricity costs is £430million/year, which represents a total saving in excess of £9billion over the period.

RENEWABLE CAPACITY & LANCASHIRE SHALE IMPACT ON GB POWER PRICES



You can develop shale gas and achieve renewable targets

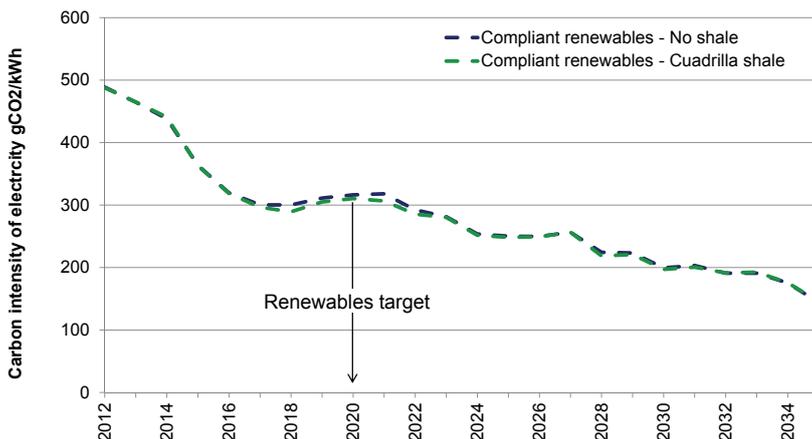
POWER SECTOR CARBON EMISSIONS

The carbon intensity of the GB power market is projected to fall through most of the period modelled, until 2035. However, the carbon intensity of the power market is slightly lower at some times under the Lancashire Shale Production case compared to the 'No shale' case due to some displacement of unabated coal generation. Developing significant levels of shale gas production does not have an impact on the achievement of the 2020 renewables target.

Of course there are carbon emissions associated with the production of all gas, whether shale, LNG or piped gas from Russia. Whilst this currently only represents c.15% of the lifecycle carbon emissions from gas-fired power generation any move to higher lifecycle carbon sources, such as LNG will increase the overall impact. However, the move to significant levels of Lancashire shale gas does not make the future position any worse and could improve the position through its reduction in imports. According to the AEA report for the European Commission, carbon emissions from electricity generated from shale gas would be no worse than that from imported LNG or piped gas from outside the EU and could be up to 10% lower if tighter environmental controls on extraction methods are put in place.



CARBON INTENSITY OF POWER SECTOR WITH AND WITHOUT LANCASHIRE SHALE



CONCLUSION

This study found that shale gas production in Lancashire, to the extent projected by Cuadrilla, is likely to result in:

1. lower wholesale energy costs that could total £17billion between 2014 and 2035;
2. no impact on the ability of GB 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.

About the Pöyry Point of View

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 to accelerate. 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.



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