# Environment and Sustainability Committee

## E&S(4)-08-13 paper 1

## Shale gas and gasification – Evidence from UK Onshore Gas Ltd

### 1 INTRODUCTION

UK Onshore Gas Limited is the holding company of Coastal Oil and Gas Limited and UK Methane Limited. Coastal Oil and Gas Limited and UK Methane Limited hold PEDL (Petroleum Exploration and Development Licences) that have been awarded by DECC and allow the companies to explore for, bore for and get all hydrocarbons within those licence areas on an exclusive basis. Initially the focus of the companies was Abandoned Mine Methane taken from the former mine workings in the coal field and the Coal Bed Methane (CBM) from unworked areas of coal. In recent years the focus has changed to Unconventional Gas exploration in the form of shale gas and Coal Bed Methane. Coastal Oil and Gas Limited are also reviewing the potential for conventional gas in the Devonian Sandstones. The difference between unconventional gas and conventional gas is mainly how the gas is stored in the resource, the constituents of the gas are broadly the same i.e. largely methane (90%+) with some propane and ethane, in essence the same as North Sea gas. Conventional gas is generated from source rocks then the gas is trapped by a seal of other rocks. When a conventional gas source is drilled into the gas will come out under it's own pressure, the pressure being mainly dependent on depth. Unconventional gas, however, such as shale gas lies in mudstones and shales usually of low permeability and the gas has to be coaxed out of the ground. This is achieved by directionally drilling in the shales and mudstones and stimulating the ground either by using Nitrogen or water to create microscopic cracks thereby creating conduits for the gas to migrate back to the well bore and then to the surface where it is transported to market.

### 2 BACKGROUND TO INDUSTRY

The Petroleum (Production) Act 1934, as amended by Section 18 of the Oil and Gas (Enterprise) Act 1982 and others, provided for exploration of and production of onshore hydrocarbon resources. The Act vests ownership of petroleum underground in the Crown and empowers the Secretary of State for Energy to grant to such persons as he thinks fit, Licences to search, bore for and get petroleum.

The main objectives of the Licensing regime are to further the general Government policy of establishing the extent of the Country's indigenous hydrocarbon resources. The regime is also intended to provide a framework within which the search for and production of oil and gas onshore can be undertaken in a safe and orderly manner, and to provide a satisfactory balance of safeguards and rights between the Government and Licensees. This regime also

maintained unproved acreage on short licence and provided a satisfactory longer-term licence for production.

The Petroleum (Production) (Landward Areas) Regulations 1995, introduced on 30 June 1995 comprises a single exclusive and unitary licence now known as a "PEDL", Petroleum Exploration and Development Licence. Licences are awarded for an initial period of six years although some flexibility may be allowed and then, if required and commitments are met, for further terms. Additional acts were passed in 1998 and 2007 to provide further and better governance.

Planning permission will be required before the deep drilling of exploratory wells can be undertaken. DECC will require proof that the necessary planning permission has been obtained for deep drilling and production also that all necessary consultations have been completed before authorising commencement of these activities.

There had been considerable debate between the industry and the former British Coal, as to the ownership of the gas, in this case Coal Bed Methane and Coal Mine Methane. For the avoidance of any doubt Coal derived Methane was confirmed as a Crown Mineral (hydrocarbon) by virtue of Section 9 of the Coal Industry Act 1994.

Forecast future energy shortages are putting pressure on unconventional gas producers to develop suitable fields.

## 3 LICENCE AREAS

The licences are split between UK Methane and Coastal Oil and Gas Limited.

Coastal Oil and Gas Limited hold the licences:-

- PEDL 100
- PEDL 216
- PEDL 217
- PEDL 218
- PEDL 219
- PEDL 220

UK Methane Limited holds the licences:-

- PEDL 148
- PEDL 149
- PEDL 214
- PEDL 215

Figure 1: Location of PEDL Licences

The licence area in South Wales extends from west of Swansea along the M4 corridor to Cardiff West Services. The licence area covers 1,060km$^2$ (260,000 acres) these are split along the national grid lines generally on a 10km x 10km basis. The more recent licences are cut off by the low tide make, however, the older licences are along the high tides mark.

The companies also hold licences in Somerset and Kent

## 4 RESOURCE TARGETS

There are a number of resource targets in the South Wales area that have been identified as having the potential to produce gas. In the coalfield there have been identified 142 separate coal seams in the total sequence; from this sequence 15-20 seams have been recognised to have the best potential to produce Coal bed Methane. Underlying the coal basin is up to 800m of Namurian Measures that are made up of sandstones and shales. Below the Namurian Measures lie Limestones, then the Lower Limestone Shale which is another good shale gas target. The Devonian Sequence below the Lower Limestone Shales is dominated by sandstones and is a potential conventional gas target where the gas has been trapped in pores of the sandstones. Underneath the Devonian strata is older rocks of Silurian and Ordovician age, these rocks are producing gas in other parts of Europe especially in Poland and also have the potential to produce gas in South Wales.

The Namurian sequence has been identified primarily from two boreholes drilled to look for the possibility of Oil. The first was drilled in 1942 by Anglo American as part of the war effort outside Tonyrefail; this identified over 990ft of dark shales in the Namurian. The Second borehole was drilled just north of Maesteg, near Coegnant Colliery, in 1972-3 by Cambrian Exploration to a depth of 2,648m. We have been able to use the records of these boreholes and have tested samples from the Cambrian borehole and other boreholes drilled by the British Geological Survey (BGS) to confirm the possible gas producing targets. Analysis of thee samples at Aberdeen Laboratories confirmed the shales are good targets and are similar to the Barnett Shales in the USA.

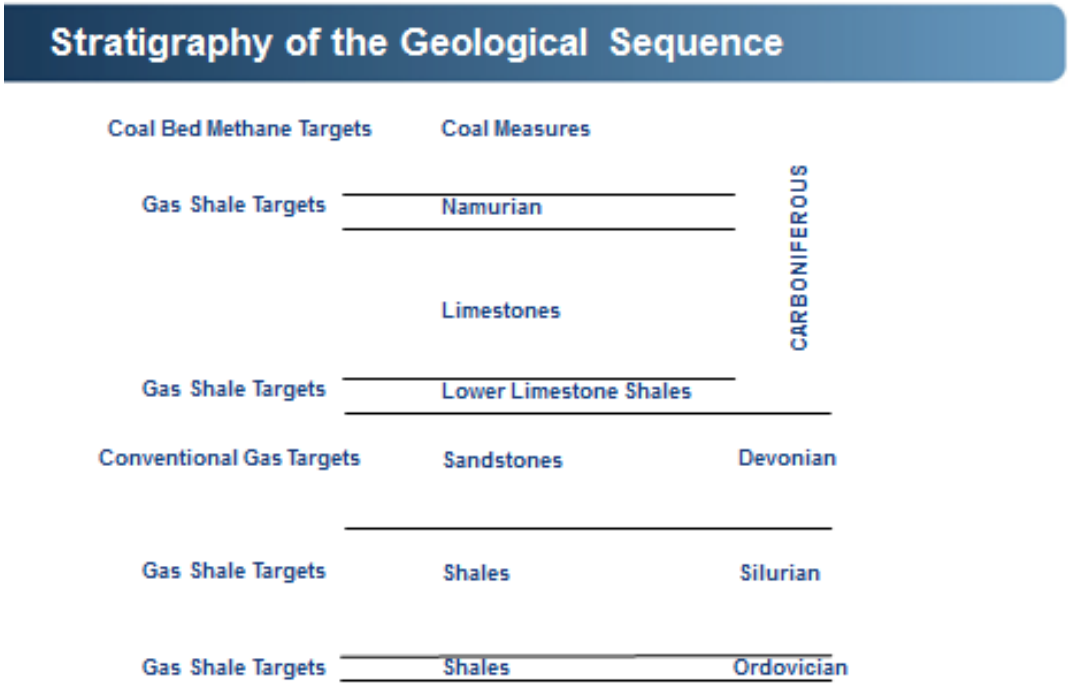


Figure 2: Gas Targets in the Geological Sequence

## 5 WORK TO DATE

Coastal Oil and Gas Limited and UK Methane Limited have developed a large geological model of the South Wales area using data taken from the mine working and numerous previously drilled boreholes. Onto this model surface constraints have been added to show the location of SSSI's, houses, utilities to locate the ideal locations for drilling exploration wells.

In 2008 Coastal Oil and Gas Limited drilled 3 exploration wells on PEDL100 to explore for CBM potential in Aberavon near TATA steel works, Llangeinor near the Georgia Pacific Paper mill and in Pencoed near to the Rockwool Factory. These exploration wells were targeted to provide lower cost energy to major industrial users.

In 2011 UK Methane drilled exploration wells on PEDL 148 and PEDL 149. The borehole on PEDL148 was drilled near Banwen on the northern crop of the coal field to confirm the geo-stratigraphy and to look at the potential in the Namurian for shale gas. The borehole on PEDL 149 was drilled on the site of the former St Johns Colliery.

A further production borehole has since been drilled at Llangeinor to 650m through a 3.5m coal seam. A planning approval is in place to generate electricity on site in an existing farm building and allows export of electricity to the grid. A field development plan has been approved by DECC (only the second in the UK) for a 3.87km$^2$ gas field. The Llangeinor field has a GIIP (Gas Initially In Place) of 33.7 bcf (billion cubic feet) with a potential recovery of 16.9 bcf. The field has been defined in the Westphalian Coal Measures as a Coal Bed Methane play.

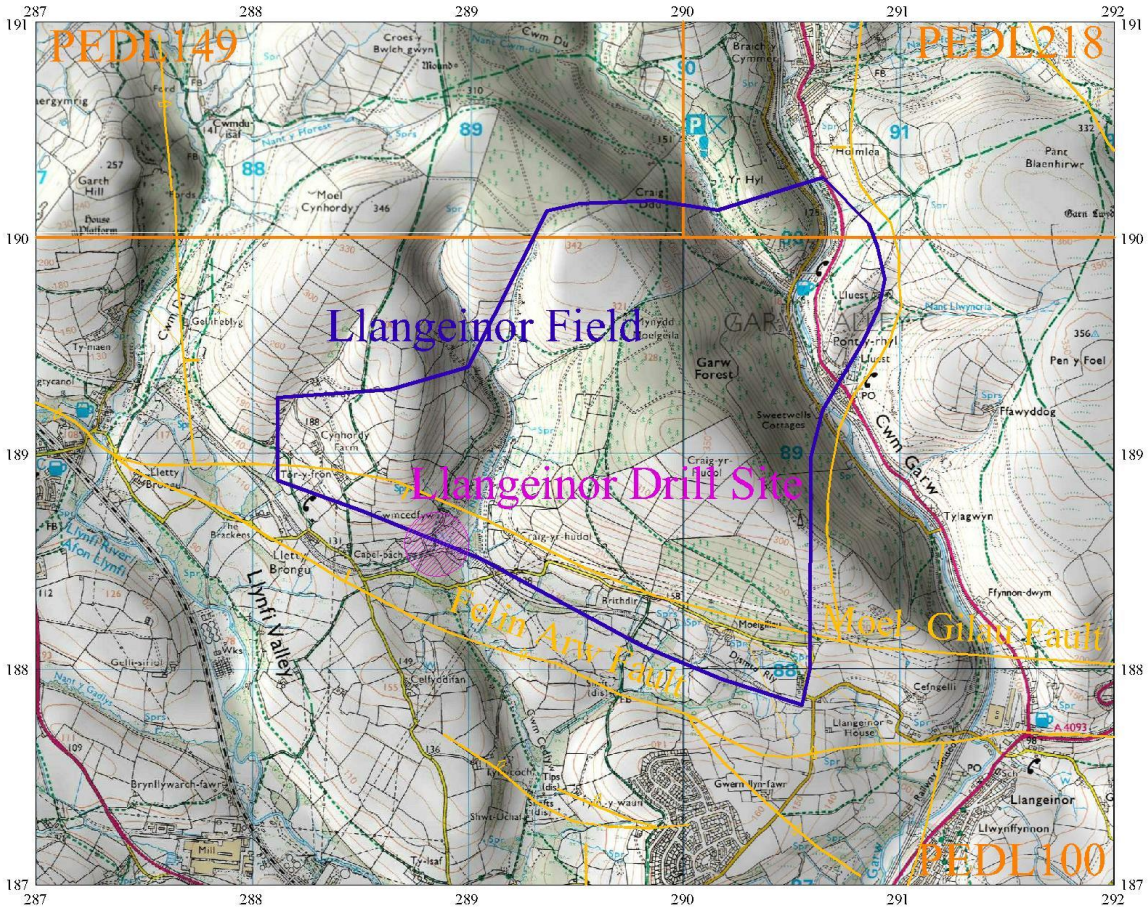


Figure 3: Location of the Llangeinor Field

Figure 4: Drilling of Llangeinor 2 borehole

UK Methane Limited have recently had approved by Bridgend Council the planning for the drilling of 3 boreholes into the abandoned mine workings at the former St Johns Colliery near Maesteg. This is to drill into the void created by the mine workings in the 2ft9 seam and to utilise the gas for onsite power generation. This scheme can be used as a model to look at other abandoned mine methane projects across South Wales.

Previously in South Wales, (1982) Shell shot three seismic lines across the Vale of Glamorgan. These have been utilised in our geological modeling and indicate potential for conventional gas resources in The Vale of Glamorgan.

## 6 GROUND STIMULATION

At this stage, boreholes are for exploration with no ground stimulation (fracing) planned. Any ground stimulation will be subject to additional planning applications once the information derived from the exploration boreholes has been analised.

The science behind ground stimulation has rapidly evolved and the technology utilised has UK central government approval. Following the exploration program the licences will be evaluated for the most suitable area for any production trials. The location of any

appraisal/production site will be selected in conjunction with the Environment Agency and local planning officers.

## 7 PROVEN RESOURCE

The unconventional gas resources in South Wales have been reviewed by independent assessors. The potential shale gas reserves in the Namurian Measures on the companies South Wales licences have been reviewed by RPS in Dallas, USA.

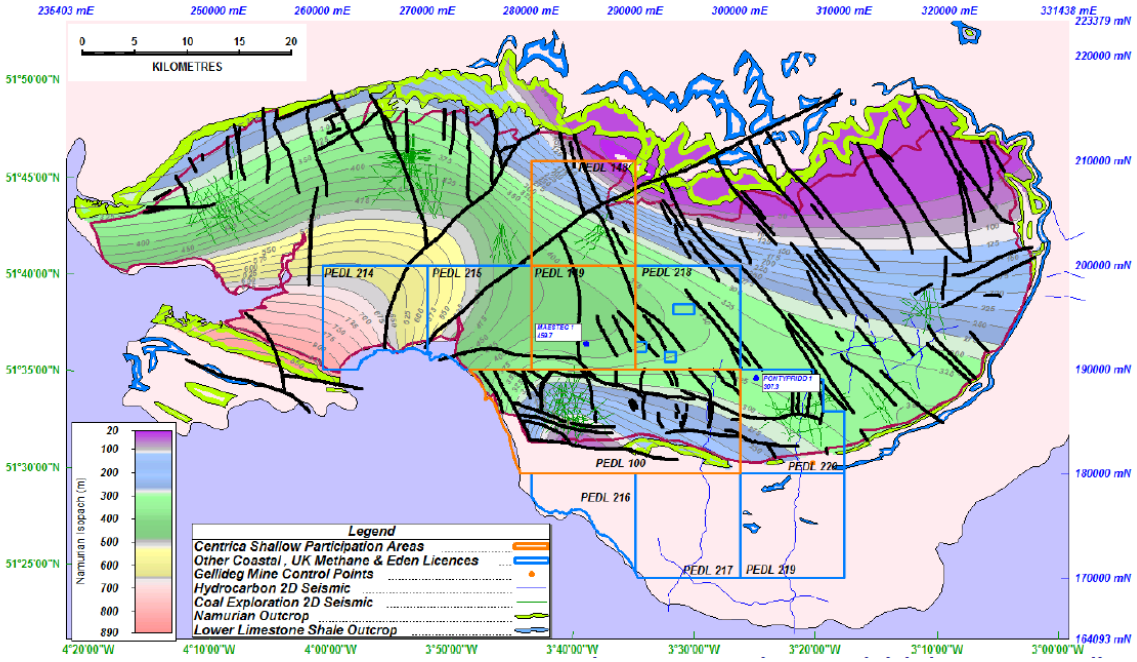


Figure 5: Thickness of Namurian Strata

The RPS report on available data on the Namurian strata indicates gas initially in place (GIIP) of 49,870 bcf (49.87 tcf).

At this stage we have not assessed the potential resources in the other shale gas targets of the Lower Limestone Shale, Silurian and Ordovician. The planned exploration boreholes will sample and test these intervals to prepare reserve calculations. Following further exploration boreholes the Namurian resource is expected to increase substantially. An estimated recoverable recourse of 18tcf+ has been indicated in the report and by way of comparison, the whole of the UK uses some 3tcf per annum.

The Coal Bed Methane resource in South Wales has been assessed by a second consultancy company (RISC of Perth Australia) who have calculated an unrisked GIIP volume of 1,651bcf

(1.65tcf). Additional exploration boreholes that are planned will allow better accuracy and an expected increase in these figures.

## 8 POSSIBLE REOURCES

There have been a number of studies into the global reserves of shale gas. In 2010 the BGS estimated the UK's onshore shale reserves at 5.3 tcf. A recent study, that is yet to be published by BGS, is suggested to say that possible reserves in the UK are over 1,000tcf. This has yet to be confirmed.

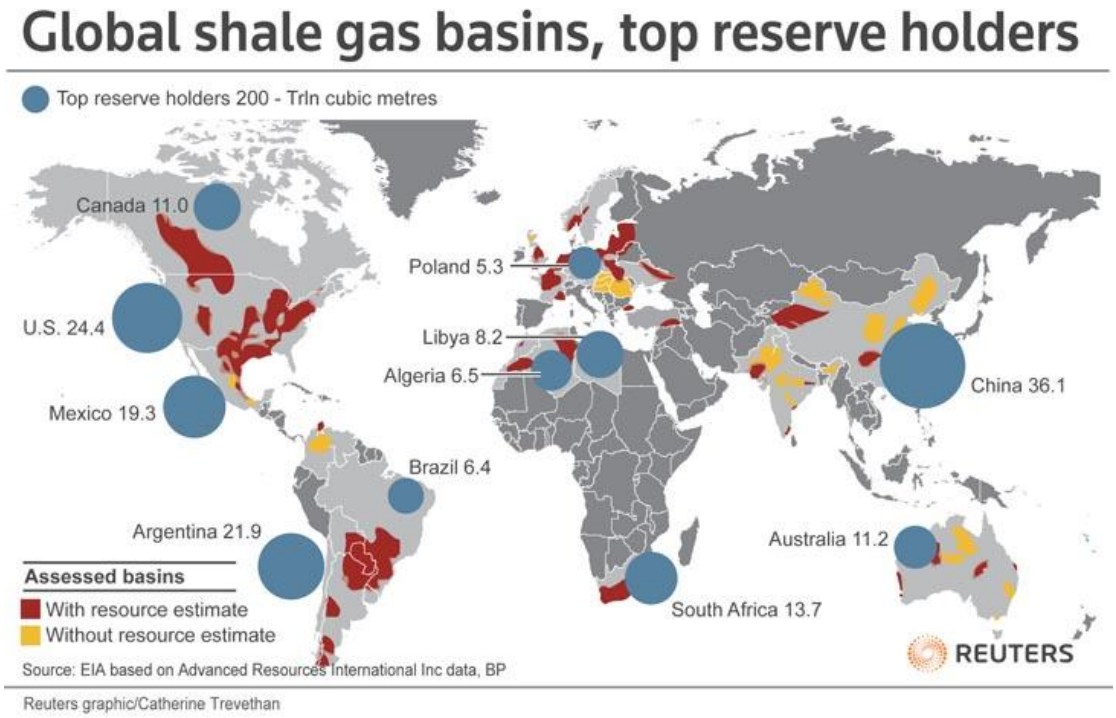


Figure 6: Global Shale gas estimates

## 9 NEED

- The UK could run out of North Sea oil and gas within 17 years.
- Shale gas can provide Security of National Energy Supply
- A number of older oil and gas Power stations will close by 2015 – Power Cuts are Inevitable if new generating stations are not constructed
- Gas and electricity prices are continually rising – 30% increase in 2011
- There are very limited gas storage facilities in the UK
- Unemployment is on the Increase
- National Economy - gas sales can create huge tax revenues for both local and Central government.

## 10 BENFIFITS OF UNCONVENTIONAL GAS PRODUCTION

A recent report from the Institute of Directors (IOD) states that:-

- *In 2011, the UK consumed 2.9 tcf of gas. 10% of 2011 UK gas demand is therefore 0.29 tcf. If 10% of the 300 tcf of onshore reserves estimated by the exploration companies were economic to extract, then 30 tcf would be sufficient to meet 10% of current UK gas demand for 103 years*
- *10% of 2011 UK gas demand is equal to 8 million tonnes of oil equivalent, 8% of total UK oil and gas production in 2011. The UK oil and gas industry provides direct and indirect employment for 440,000 people. Assuming that jobs are directly proportional to production, then an extra 8% of 2011 production would generate 35,000 extra jobs, helping to offset job losses from a decline in conventional oil and gas production in the UK.*

A study in Pennsylvania State University showed:-

- *A recent Pennsylvania State University study reports the Marcellus gas industry generated $3.9 billion in total value added revenue, more than 44,000 jobs, and $389 million in state and local taxes. For 2011, the estimated potential was forecast to be more than $10 billion in total value added revenue, 100,000 jobs, and nearly a $1 billion in state and local tax revenues in Pennsylvania. By Q4 2011 the Marcellus Shale related industries total employment figure was 238,400. (From Pennsylvania Dept of Labour & Industry)*

## 11 THE FUTURE

If Wales is to generate a lower carbon economy and ultimately a nil emission Hydrogen economy, methane can be utilised (in its component parts of Hydrogen and Carbon) as a feedstock.

Methane gas is split into its component parts

- Carbon – To manufacture carbon fibre
- Hydrogen – A Nil Emission Fuel
-

Carbon Can be Used For: -

- Reinforced Concrete – Increased strength and lower weight than steel
- Plastics – Enhanced properties
- Batteries – Longer life
- Carbon Fibre – Lighter vehicles and aircraft therefore increased fuel economy

## 12 Conclusions

- Wales could become self sufficient in energy and potentially be a gas exporter.
- Thousands of jobs could be created by a new unconventional gas industry in Wales, both new jobs for young people and replacement jobs for those lost recently in the coal and steel industries.
- Millions of pounds can be generated in local and central government taxes.

- The produced gas can be used as an alternative to petrol for road vehicles both lowering the cost of fuel and emissions.
- The produced gas can provide energy security in Wales and the UK together with lower emissions.
- The produced gas can be used as a feedstock for Hydrogen production and Carbon fibre.

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