

# **Economics of Shale Gas**

Frackonomics

## **Whole Economic Cycle hasn't been Seen yet.**

### **However a few observations**

- Shale Gas has not created as many jobs as forecast by industry
- Shale Gas wells have not performed as well as forecast
- Shale Gas is not as abundant as once thought
- Shale Gas is not as cheap as once thought
- Displacement of jobs and people need to be accounted for.
- How do we factor in public health and environmental costs?

## Jobs and Employment

Tamboran 600 direct Jobs in Northern Ireland and 600 in Rep. of Ireland.

\* NI assembly briefing paper - no verification and also believed 600 jobs for whole island.

Shale Gas is a **Capital Intensive** industry.  
\$1 million dollars invested in

Shale Gas	3.7 jobs
Wind/Solar/Biomass	9.5/9.8/12.4 jobs

Oil and Gas Industry 10 times more capital intensive than average US industry - Alan Kruger, Chief economist and assistant secretary for economic policy at the US Treasury. Also stated that encouraging Oil and Gas production is not an effective strategy for creating jobs.

Investment of \$1m dollars in Shale v Renewables : Source "The Economic Benefits of Investing In Clean Energy". University of Mass. Economics and Policy Research Institute June 2009.

## **Indirect Jobs -**

Tamboran claim 2400 indirect jobs.

- Scottish Oil&Gas Mackay Report : 600 Jobs.
- figures from US IHS report 2012 : 1200 jobs
- Capital intensive industries have lower indirect job multipliers.
- Control of many services will be sought by Tamboran

### **Mackay Report on Scottish Economy**

Available here: [http://news.bbc.co.uk/1/shared/bsp/hi/pdfs/09\\_06\\_11\\_macakyreport.pdf](http://news.bbc.co.uk/1/shared/bsp/hi/pdfs/09_06_11_macakyreport.pdf)

15.29 From other studies we have undertaken on the industry we believe that the indirect and induced employment in Scotland is about the same as the direct employment, i.e. another 42,000 jobs giving an overall total of about 84,000. In this case the multiplier would be 2.0.

Page 135. Goes on to suggest the Oil and Gas Industry inflates figures.

### **IHS Report**

This industry funded report can be downloaded from here.

<http://www.ihs.com/info/ecc/a/shale-gas-jobs-report.aspx>

Pg 20 shows direct : indirect + Induced jobs with a multiplier of 2.0x in 2035.

### **Tamboran CEO Richard Moorman stated in Address to Engineers Ireland Conference - 4 April 2012**

Mr Moorman expressed a wish to fund local services but **"to have full control over those services"**

## Resources Estimations

- US Marcellus Shale Gas reserves downgraded by USGS by 80% Jan 2012
- Polish Shale reserves downgraded by 85 % Feb 2012
- India Shale reserves downgraded by 90% May 2012
- Cuadrilla UK claim 200 TCF of Gas, when BGS claim 4.7 TCF for same resource.

**Important to note what may be recoverable. 5-15%  
[Tamboran claim top of range]**

<http://www.bloomberg.com/news/2011-08-23/u-s-to-slash-marcellus-shale-gas-estimate-80-.html>

<http://www.petroleum-economist.com/Article/3008838/Polands-down-but-not-out.html>

<http://www.naturalgasasia.com/indias-first-shale-gas-four-years-away-5580>

### **BGS v Cuadrilla estimates discussed in this article.**

<http://millicentmedia.com/2011/11/02/british-geological-survey-cuadrilla%E2%80%99s-shale-gas-estimate-unreliable-to-release-new-figure/>

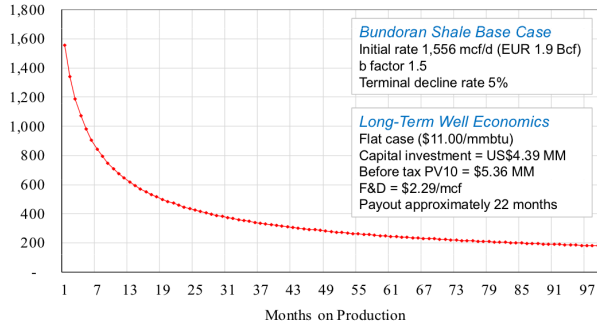
### **Question**

What does GSNI and GSI make of Tamboran's figures ? As GSNI are funded by the taxpayer, what figure are they going to produce and when ?

# Tamboran Well Eur

## Single Well Performance

Daily Natural Gas Production (mmcf/d)



Source: Tamboran Resources Internal Estimates

27

This well curve is only displayed out to month 97 (year 8).. An interesting action is to draw this graph out to its conclusion (28 years)

## ARPs Formula - Berman

- Shale Gas companies used ARPS formula to model Shale Gas wells.
- Berman compared actual results with modeled results
- Using B factor greater than 1 extends well production far beyond economical well life
- Society of Petroleum Engineers (Lee et al) agree
- Information has been in public domain since 2009

### Lee / SPE

<http://www.spe.org/ejournals/jsp/journalapp.jsp?pageType=Preview&jid=EREE&mid=SPE-108176-PA>

From the abstract “Our work indicates that, as observed in field data, transient effects and coexistence of different flow regimes between layers lead to abnormal decline behavior ( $b > 1.0$ ) in multilayer tight gas wells, which leads to errors in production forecasts. Our new procedure provides a method to minimize these errors.”

### Arthur Berman - a summary here :

<http://aspousa.org/2009/08/lessons-from-the-barnett-shale-suggest-caution-in-other-shale-plays/>

Berman also postulated that many of the costs are hidden off the books through accounting mechanisms. (eg Chesapeake leases costs) but these costs still have to be paid.

## The Shale Industry is Aware

- Assets in Barnett Shale being sold off or JV'd. Barnett was going to be 30yr powerhouse for the US economy.
- Insider emails and reports leaked to NY Times.
- SEC subpoenas Aug 2011 to Shale Gas companies reference valuations of Reserves
- 2012 - 2Q results - multi-billion dollars worth of impairment charges on Shale Gas assets
- 2012 - August - USGS releases its estimation of shale gas well EUR in various Shale plays.
- Fayetteville Shale Southwestern estimate 2.4 bcf EUR / well - USGS estimate 1.1bcf average and .8bcf median.

if there's huge well life, and therefore significant economic worth - 'a true cash cow' then why sell or Joint Venture ?

- a) There isn't economic value
- b) Sell off required to service debt
- c) True answer is a combination of above.

Times leaked documents <http://www.nytimes.com/interactive/us/natural-gas-drilling-down-documents-4-intro.html>

<http://energypolicyforum.com/?p=489>

Impairment charges overview by Deborah Rogers former Financial Analyst working for many investment banks on Wall St. Rogers served on the Advisory Committee for the Federal Reserve Bank of Dallas from 2008 to 2011. She joined a regional steering committee for the Oil and Gas Accountability Project (OGAP) in 2011.

USGS publications <http://pubs.usgs.gov/of/2012/1118/OF12-1118.pdf> page3.

SPE - Page 53 an overview of Asset Estimation techniques. <http://www.spe.org/jpt/print/archives/2011/12/15RAMFocus.pdf>



## Mapping USGS to Tamboran

Tamboran Estimate 1.9bcf and 28yr life

Using similar figures to SWE:USGS ratios.

- Average Tamboran well 0.855 bcf 11 yr life
- Median Tamboran well 0.64bcf 8 yr life

Associated Find&Development costs rise.(F&D=costs/gas produced)

Southwestern Energy are active in the Fayetteville Shale. Mr Moorman CEO of Tamboran and Richard Lane (also on board of directors of Tamboran) have both formerly worked for SWE. The Fayetteville shale is most analogous to Lough Allen basin. SWE have claimed 2.4 bcf EUR average for their wells in the Fayetteville. The USGS claims 1.1 bcf average with 0.8bcf mean EUR for Fayetteville wells.

Another article was written by **Powers Associates** which is a well known industry investors guide.

Powers Associates report on Fayetteville. <http://www.financialsense.com/contributors/bill-powers/2011/05/02/the-fayetteville-shale-peaks>

## Some Other Observations

- Bermans research identified core areas in all Shale Plays
- Even in the Core Areas there was great deviation between well production rates
- US Geology more Uniform than European Geology
- **extra costs for Shale Gas in Europe**
- 20% of wells carry the play (John Lee). Therefore out of 3000 wells, 2400 non-economic. [Environmental vandalism]

These points are valid. Shale is based on the 'land rush' model. Essentially attempting to lease acreage at low cost. Initially 2-3 Million acres before condensing down to after 5-6 yrs to 100-500K acres. There is great variation in Shale. It was initially thought one could just drop a drill bit anywhere in a Shale play and strike gas. This is now proving not to be the case.

Shale also varies in the vertical plane as well as the horizontal plane, so the thickness of the Shale in Lough Allen Basin doesn't necessarily construe gas is plentiful. Eg Union Springs shale at the bottom of the Marcellus is rich black shale and higher production than overlying shale.

In general US plays have more information. More drilled wells and more log reports. Here Tamboran have stated they need to drill more exploratory wells indicating this is a more wildcat play.

Lee made this point in a personal communication to Deborah Rogers. It is referenced in Rogers speech given at Rio 2012. <http://energypolicyforum.com/?p=465>  
"Dr. John Lee, a petroleum engineer and the architect of the U.S. Securities and Exchange Commission (SEC) rule change for oil and gas stated "It is sometimes said that 20% of shale wells carry a project...the other 80% can easily be uneconomic."

## EU Shale Gas Economics

- Europe Costs 2 to 3 times higher than US
- Tamboran costs are low even compared with US
- Increasing costs x2, Double F&D costs
- How does one factor in Environmental damage into costs ?

**Europe 3 Studies** September 2012, available here: [http://ec.europa.eu/energy/studies/energy\\_en.htm](http://ec.europa.eu/energy/studies/energy_en.htm)

**Personal Communication from Art Berman to Tom White** discussing Tamboran's model. 13/05/2012.

indicating that some costs do not appear to be accounted for.

"The assumptions in the attached type curve appear optimistic as do the projected costs. What are land, overhead, lease operating and interest expenses? What are taxes and royalties? I would request a full-cost, discounted net present value analysis with all assumptions itemized. I am certain that payout is not in 22 months.

There is little precedent for 5% terminal decline rate except theoretical since no well drilled and completed with modern technology has yet reached full boundary-dominated flow to determine terminal decline. If you run a NPV10 analysis on their type curve using all of their assumptions about IP, price, decline rate, etc., I imagine that you will find that 70% of NPV occurs in the first 5 years, 85% in the first 10 years, and little NPV beyond 15 or 20 years. So, regardless of well life, decline rate, etc., if there is no NPV, there are no reserves in that range of the well's life. "

## **Job Displacement**

IHS Global recognises there will be job displacement

Displacement of Tourism jobs

Displacement of Farming jobs

Possible reputational effects on Agricultural Produce

Future Economic model for Fermanagh ?

The IHS global report doesn't dwell on this Job Displacement very much, however its evident from some diagrams, and also from just thinking about job displacement in the coal mining industry. If Shale Gas takes over from coal in energy generation, then there will be mining jobs displaced.

The EU reports reference Job displacement in Agriculture and Tourism.

If pollution is reported in livestock that subsequently get into the food chain there would be huge repercussions for Agricultural Produce. Fermanagh has large beef, dairy, pork and poultry business.

## Characteristics of Counties not focused on fossil fuel extraction

- Higher growth rates
- More diverse economies
- Better educated populations
- Smaller gap between high and low income households
- more retirement and investment income

Source : [Headwaters Economics 2008](#)

From a presentation by Jannette M Barth, PhD of J M Barth Associates Inc.

A review of studies on economic effects of Shale Gas. Given in Kirkland New York, May 22nd 2012.

Available on Youtube here : <http://www.youtube.com/watch?v=CsnRw3kXs78>

**"Resource-dependent counties exhibit more anemic economic growth"** -

Source : James A Aadland D. 2011. "The Curse of Natural Resources : An Empirical Investigation of U.S Counties" in Resource and Energy Economics. Peer Reviewed.

Also worth checking Susan Christopherson - <http://www.youtube.com/watch?v=w8q4N71ZruE>