Is fracking in Fermanagh economically sustainable? A cost: benefit approach

EXECUTIVE SUMMARY

A Report on behalf of the
Fermanagh Fracking Awareness Network

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Executive Summary

The debate surrounding the potential gas exploration of the Bundoran shale using the controversial HVHF drilling technique for gas is usually - and erroneously- over-simplified. The economic benefits of the prosed shale play are simply assumed to be positive and the debate has centred on whether this short term gain outweighs the long-term degradation of the landscape. This paper addresses this issue by evaluating the economic benefits using analysis of evidence from existing shale plays in the US, Importantly, it considers the short and long-term displacement costs that are incurred.

The findings indicate that the net economic benefits of the proposed shale play in Fermanagh are negative for three reasons. First, the recoverable gas reserve (and associated revenues) is expected to be considerably lower than forecast by Tamboran. Second, the full cycle costs of HVHF (High Volume Hydraulic Fracturing) drilling may exceed the current gas price. Third, associated gross job creation is principally migratory and short term. Net employment growth is negative due to the displacement impacts. Fourth, externalities such as road damage can outweigh public revenue receipts. Finally, the proposed drilling activity is incompatible with the two major sectors of the economy, tourism and agriculture. The industrialisation of the landscape and environmental degradation that accompanies resource extraction industries is long-term and has the potential to negatively impact domestic and international demand for agricultural products and associated agri-foods from the island of Ireland. In short, the net economic benefits are deeply negative over a short and long-term horizon.

Key findings from the report are:

Sustainability of Shale Gas Industry

- The economic sustainability of the shale gas industry is fragile due to lower than anticipated recovery rates and absolute production of a highly leveraged industry. The associated efficiency rate for HVHF gas is 13%. This is considerably lower than the 75-80% associated with conventional gas.
- In the US, 10% of all shale plays account for 65.6% of gas production and 20% of all shale plays account for 88%. This is mirrored in the productivity of wells within any one field. In the US, analysis of all shale plays indicates that on average, only 20% of wells are commercially viable. Well quality declines over the life-time of the play. IP (initial production) rates per well decline sharply, falling by between 75% to 95% within the first three years of production. This is more pronounced for smaller shale plays.
- In the US, even the EIA has revised estimates of reserves down by some 42%, primarily due to well life-cycles proving considerably shorter than expected; median 5 years, mean 7 years. Tamboran's forecast of 1.3 to 2.6 tcf of gas from activity in Fermanagh is equivalent to one year's gas supply for the UK. However, it is likely to significantly overstate the realisable recoverable gas given that EURs have been consistently over-estimated in the industry. In addition, comparative analysis indicates that Tamboran's projection of the IP rate and subsequent decline is optimistic. Tamboran suggest a well life of 7.5 years which is significantly higher than the median five year life of a well in the US. In addition, Tamboran do not factor in decline in well quality (indeed their projection suggests improving well quality over the life-cycle of the play).

- There is strong evidence of a financial bubble in US energy markets due to the over-exuberance of analysts and the falling price of gas. Full cycle break even cost of production is $8.31 to $8.78 per mcf while Henry Hub price at January 2014 is fluctuating around $3.75-$4.00 and forecast to remain below $6 to 2035. Diminishing returns per well will increase the life-cycle costs per unit. This is reflected in write-downs of shale assets by energy companies.
- Tamboran's financials are based on a flat price of $11 per mmbtu's, but does not appear to account for a price fall as supply increases. Equally, financials do not appear to account for the additional costs associated with constructing a delivery pipeline and / or expansion of the existing gas distribution network.
- Projected royalty and tax receipts are expected to be considerably lower than the projected £6.8 bn given lower expected EUR and narrower margins. Subsequently, data regarding employment within the same report has been revised downwards by some 70%, with a clear impact on associated tax receipts.

Net Local Employment Growth is Negative

- Projections of job creation from Tamboran have been highly volatile and arguably, mis-leading. In April 2012 Tamboran projected that 600 FTEs would be supported by 2025 within both Fermanagh and Leitrim. Tamboran later revised this to 300 jobs in each jurisdiction. This projection assumes that employment levels decline by a mere 25% from 2025 to 2031, despite production decline of 50% over the same period. Employment levels remain constant from 2031 to 2049 throughout the period of exponential production decline. More recently, Tamboran have revised employment projections down yet again by a further 40%, to 180 FTEs.
- Projections continue to overstate job numbers. They are based upon a conventional gas hyperbolic decay constant of 1.5 for a duration of 7.5 years and assume well productivity is homogenous. With IP rates declining by up to 95% within three years and the average life-cycle of a well five years, the life-cycle of the play is considerably shorter. Using available data from Tamboran as to planned drilling, this suggests a maximum of sixteen years productivity across the play. However, it is likely to be considerably shorter as there is financial pressure to front-load drilling activity.
- By nature the industry is labour intensive during the development phase and capital intensive during the production phase. Approximately 98% of jobs associated with well development are short-term, low-skilled and predominantly filled by a transient work-force experienced in the industry.
- The production phase accounts for 2 to 5% of jobs which remain more local and predictable. Given Tamboran's job projections, this accounts for 3.6 to 9 FTEs.
- Research in the US demonstrates that employment impacts are modest, while the earnings impact is more significant. The latter is skewed by a transitory labour force that results in strong inflationary pressures at the local level, especially in rented accommodation.
- Associated jobs are not accretive. That is, the industry has significant displacement costs.

Displacement Costs

- A Texas Dept of Transport (TxDOT) survey in 2012 revealed that 1,184 loaded lorries are required to bring a well into production. A further 353 are required for annual maintenance and 997 are required to re-frack each well. This equates to 8 mn car journeys for the development of each well and a further 2 mn cars p.a. for maintenance.
- Research indicates that fracking activity reduces the life-cycle of roads by 75% (from 20 to 5 years) in every state where drilling has occurred.
- In the US, the cost of road damage relative to public revenues raised from the fracking industry represents a net cost to public finances: TxDOT estimate rad damage in 2012 at $4 bn v revenues of $3.6 bn.
- Displacement of low cost workers due to rising cost of living and inflationary pressure on private rented sector.
- Destruction of GVA, employment and revenue receipts within important tourism and agriculture sectors.
- New investment in manufacturing sector deterred due to rising cost base (eg transport, labour) and cost of living.

Long-term economic cost of fracking in Fermanagh

- USP of Fermanagh is its environmental purity and underpins tourism, agriculture and agri foods. To this end, shale activity is simply incompatible with the principal economic sectors in the county. In short, shale gas exploration would replace existing economic activity. It is not accretive. The destruction of the natural landscape is irreversible within even a long-term horizon.
- This environmental economy was identified as early as 2005 in a specially commissioned report as a growth sector for N Ireland and accounted for 32,749 jobs and £573 mn of GVA. This data has not been updated, but is expected to have increased given the growth in tourism numbers.
- The N Ireland tourism industry generated consumption of £683 mn in 2012, representing strong growth of 7% year on year. Underlying this was 19% growth in the number of visitors holidaying. Beyond Belfast, the Fermanagh Lakelands represented the second most visited destination within the region.
- The environmental degradation, whether real or perceived will reduce demand for agricultural products and agri-foods from the island of Ireland.
- The loss of economic output is long-term and even on a purely economic basis outweighs the potential gain from shale activity whether considered in terms of tax revenues , employment, direct, indirect or induced GVA. The devastating impact of the industrialisation of the landscape on the tourism sector is long-term. Thus, the annual contribution of the environmental economy must be capitalised. Even using 2005 figures and a conservative 8.5% capitalisation rate this outweighs Tamboran's headline revenue projections, based on inflated inputs. Moreover, given

the variability in shale plays, even lower projections associated with more appropriate inputs would be subject to considerably greater risk and uncertainty than those from established agriculture and tourism industries.

- Any scare associated with the food supply chain would impact on the agriculture and agri food sector across the island of Ireland as experienced during the foot and mouth crisis. DARD estimates indicate that the Food Processing Sector enjoyed a gross turnover of £3.7 billion in 2010 (an increase of 8.3%). Gross-value added in the sector was estimated at £608.2 million in 2009, an increase of 8.6% over the previous year. Net employment in the sector in 2010 was 19,700 FTEs, an increase of 1.1% over the previous year. In the republic of Ireland, the value of agri food exports within the dairy sector alone amounted to €3 bn in 2012. This includes the export of baby milk formula, for which the Republic of Ireland has a global market share of over 20%. Underlying this success is the quality of the environment with relative environmental purity being the key criteria used by Chinese buyers in selecting trade partners for this product.

Economic Sustainability:

Assessing the net economic benefit of HVHF opportunity in Fermanagh

1.0 Introduction

The economic value add of permitting HVHF of the Bundoran and Dowra shale in Fermanagh is usually stated in terms of the generation of public revenue through the granting of drilling licences and taxation, creation of jobs in the local economy and securing a low cost, domestic supply of energy. However, such projections fail to consider the associated costs, even from a purely economic standpoint. In failing to estimate the net economic benefit, short-term gains are over-stated, while an assessment of the longer-term impact on economic sustainability is entirely absent. This paper attempts to estimate the net economic benefit (dis-benefit) of the HVHF fracking opportunity in Fermanagh. First, the scale and longevity of the opportunity in Fermanagh are considered in the context of the economic sustainability of the industry itself. Second, the net benefit to public revenues is considered drawing on evidence from the US. Third, the net benefit to the local economy is considered.

2.0 Economic Sustainability of the Industry

In the US, the shale gas revolution has contributed to the transformation of the economy from being a net importer to a net exporter of oil and gas at present. In a decade, shale gas has risen from 2% to 37% of supply. However, the anticipated longevity of supply is being revised downwards. There is rising evidence that initial estimates of reserves have over-estimated the proportion of gas that is recoverable and under-estimated depletion rates. Moreover, given the dynamics of energy pricing and emerging limitations of new technologies, there is a rising concern that over- exuberance has created a bubble in energy markets.

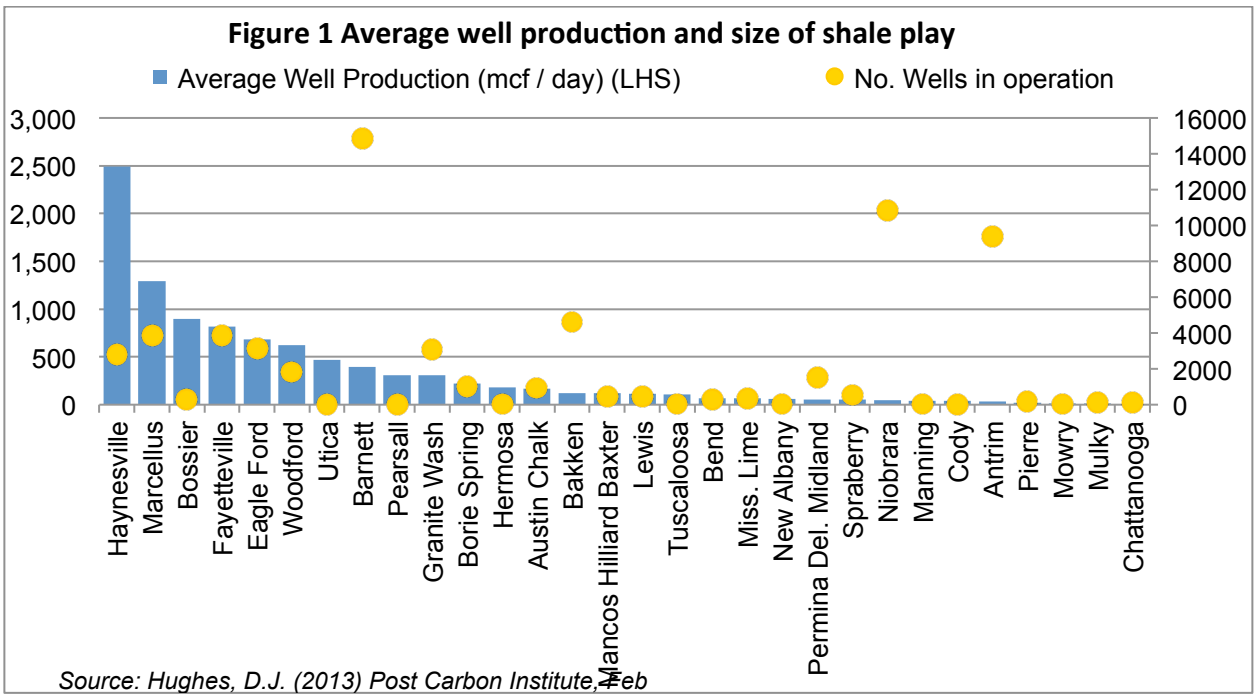
2.1 Estimating Reserves

Tamboran's estimate is that between 1.3 and 2.6 TCF of gas is recoverable from exploitation of the Bundoran shale in Fermanagh[1]. In estimating reserves, recoverable gas is usually defined as the estimated volume commercially extractable within a specific, technically feasible recovery project. The Potential Gas Committee (PGC) uses three categories of technically recoverable gas resources: probable, possible and speculative. Thus, if the current estimate of the scale of recoverable gas provided by Tamboran is the total of all three categories it is significantly over-stating the opportunity as it will include reserves that are too small to be commercially viable to extract, reserves that are inaccessible to drilling and reserves that are too deep to recover economically.

It is also unclear as to whether Tamboran's estimate of recoverable gas refers to the estimated size of the recoverable resource or the proportion that can actually be extracted given average energy efficiency rates for shale gas. Conventional natural gas fields have a 75-80% recovery efficiency rate in comparison to an average recovery efficiency rate of 13% for HVHF, which is declining as the industry matures[2]. This is due to differences in the quality of the gas, with a much greater dispersion of poly-carbons in shale gas. In short, shale gas is much less pure. Tamboran assume an above average recovery rate of 15% for the Bundoran shale play[3].

Recovery rates and absolute production is also highly variable across geographic locations of shale plays. In the US, 10% of shale plays (Haynesville, the Barnett and Marcellus) account for 65.6% of total shale gas production in the US, while a further 10% (Fayetville, Eagleford and Woodford) account for a further 22.4% of production. This is not simply a reflection of their scale, with large plays such as Niobrara contributing a mere 1.77% of production. When average well production is considered it is clear that smaller fields tend to have lower rates of production per well, although this relationship is not ubiquitous (Figure 1).

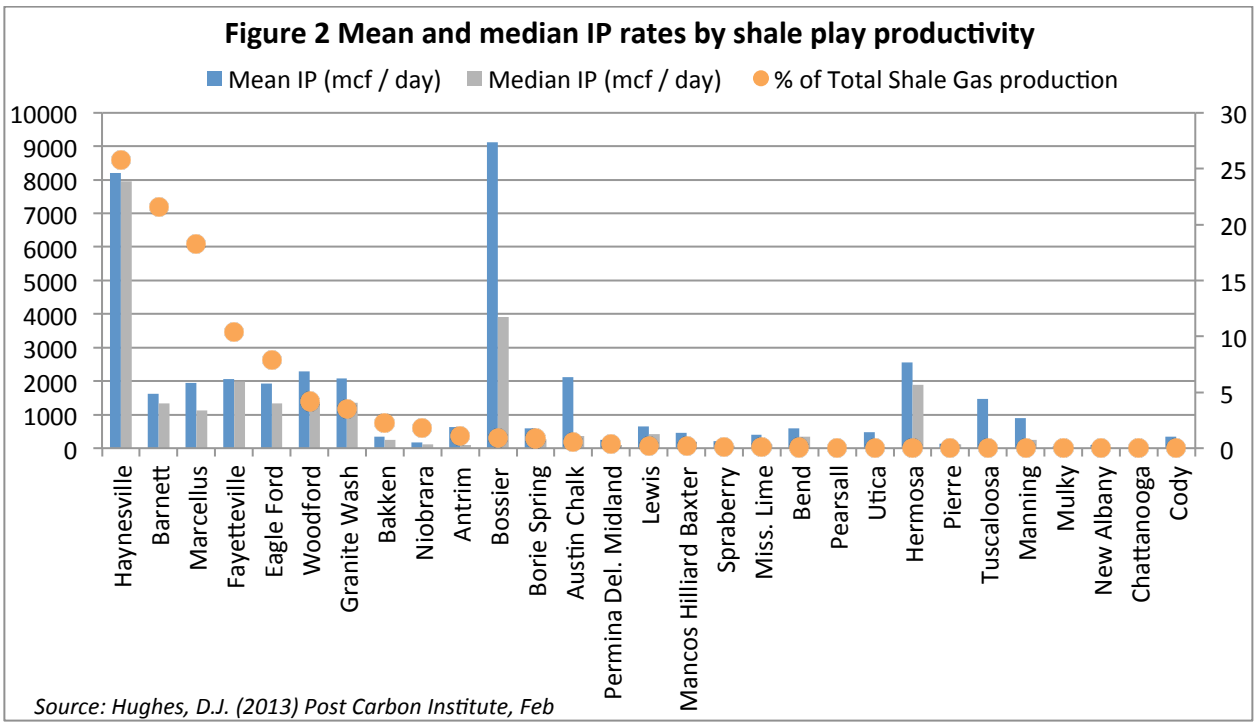
[1] Natural Gas Europe (2013) Interview: Tony Bazley, Regional Director at Tamboran Resources, August 27th
[2] EIA (2012), US Department of Energy
[3] Tamboran Resources Pty Ltd (2012) Northern Ireland PL 2/10, Progress Update and Project Overview, 11th January



Similarly the larger fields are also characterised by the highest initial productivity rates (IP) (Figure 2). IP is a measure of well quality. It is the highest monthly recorded production rate and usually occurs around two months after drilling. Despite being a considerably smaller scale play, Tamboran project an IP rate of 1556 mcf / day. This suggests its rate of productivity is second only to the exceptional performance of the Haynesville in the US. Such projections have no basis, with core drilling to examine the properties of the shale yet to take place.

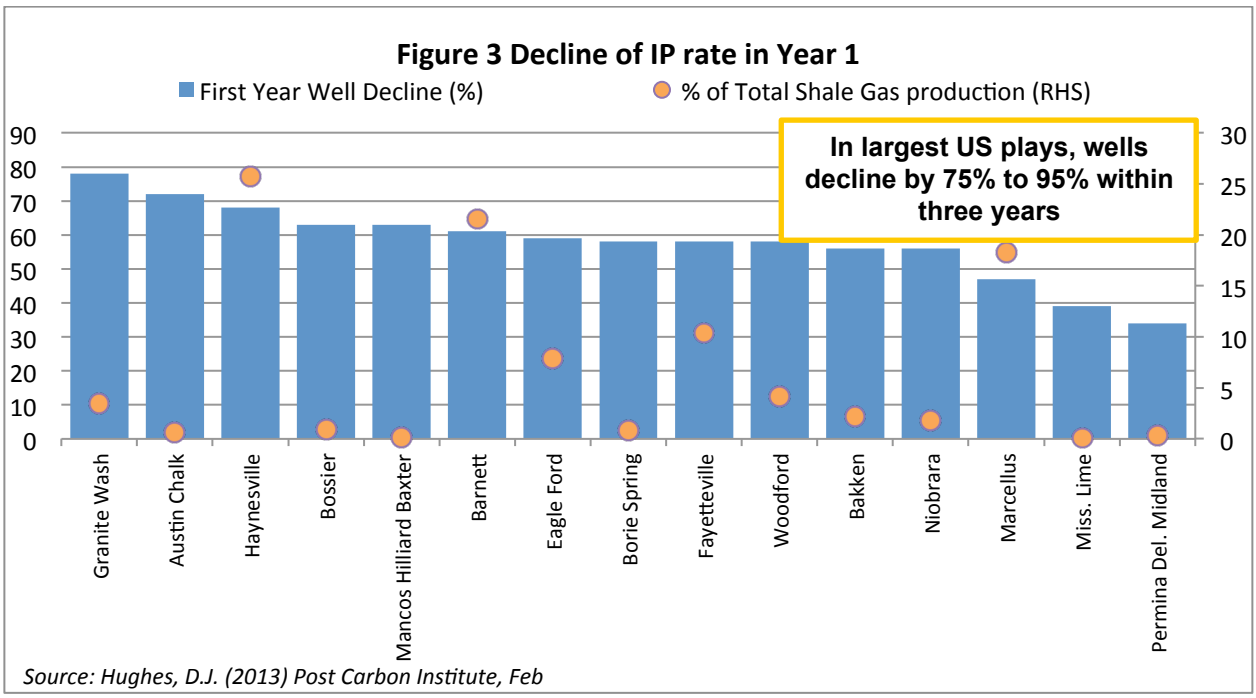
The wide variation in the productivity between shale plays is also evident across wells within any one play. The Haynesville shale play encompassed 2,802 wells at May 2012 and is characterised by an exceptionally high mean IP rate in comparison to other shale plays. However, analysis of the distribution of IP rates indicates a strong skew with around 2% of wells proving high quality and delivering IPs in excess of 20 mmcf per day, while 75% have IPs of less than 10 mmcf per day. Analysis indicates that on average, 20% of wells carry the play with the remainder uneconomical[4]. This skew is evidenced in the difference between mean and median IP rates. Again, the skew is more marked in smaller plays (Figure 2).

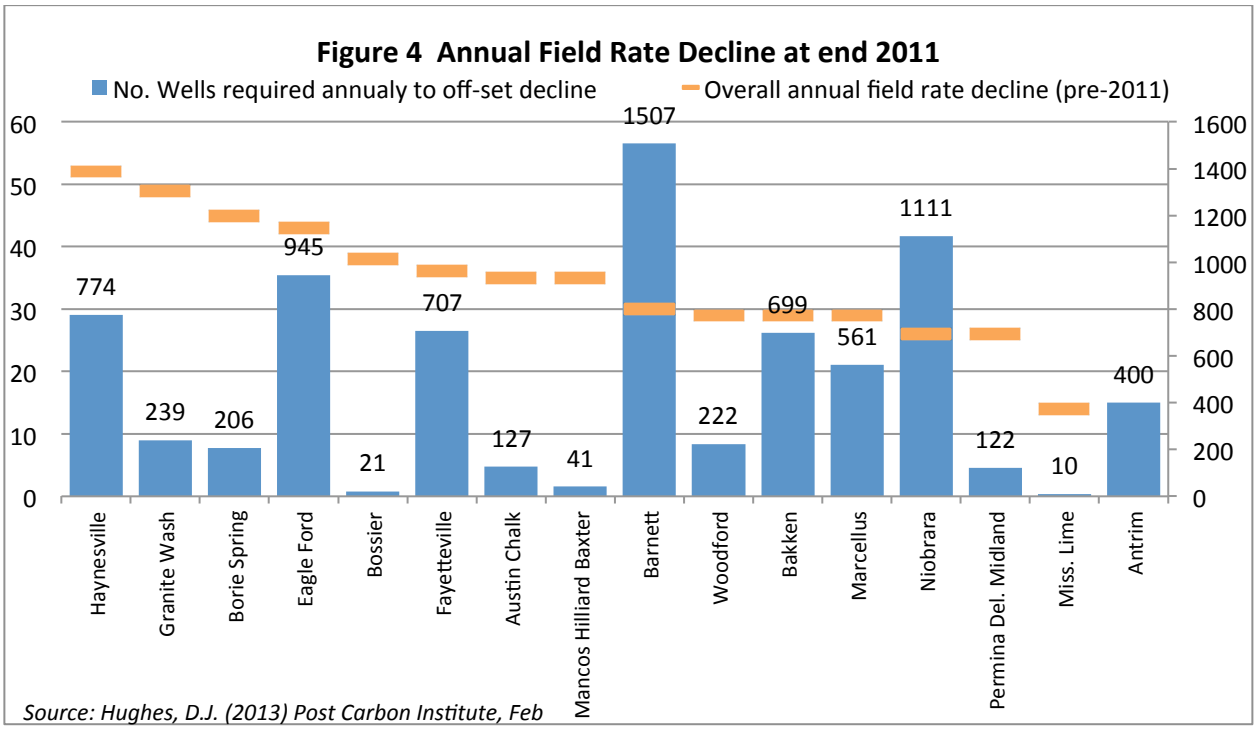
[4] Rogers, D (2013) Shale promises of shale spin? Energy Policy Forum



This reflects the uneven distribution of recoverable gas across a shale play. Initially, it was thought that the distribution of gas was fairly homogenous across a play, however the experience of the US has proved otherwise with the dispersion of IPs and productivity rates per well clearly indicating there are 'sweet spots'. Drilling activity initially focuses on exploiting identified sweet spots. As a result, well quality and therefore IP rates for new wells decline over the life-time of the play, with the number of wells required to simply maintain productivity rates across the field increasing sharply.

This is exacerbated by the short lifespan of wells and their very steep decline rates. In contrast to conventional gas, shale gas provides very strong IPs which drop by around 60% after year one and fall exponentially thereafter (Figure 3). More detailed analysis of the Haynesville, the Barnett and Marcellus provides analysis of Type well decline within each play. The Haynesville and the Barnett are considered relatively mature plays (although well productivity commenced in Haynesville as recently as 2008) while the Marcellus is a relatively young play. Together with the decline in IP rates from new drilled wells, the short life-span of well productivity results in a steep decline of productivity rates for the field. Figure 4 shows the overall annual field rate decline from the analysis of productivity from all wells within each play up to 2011.



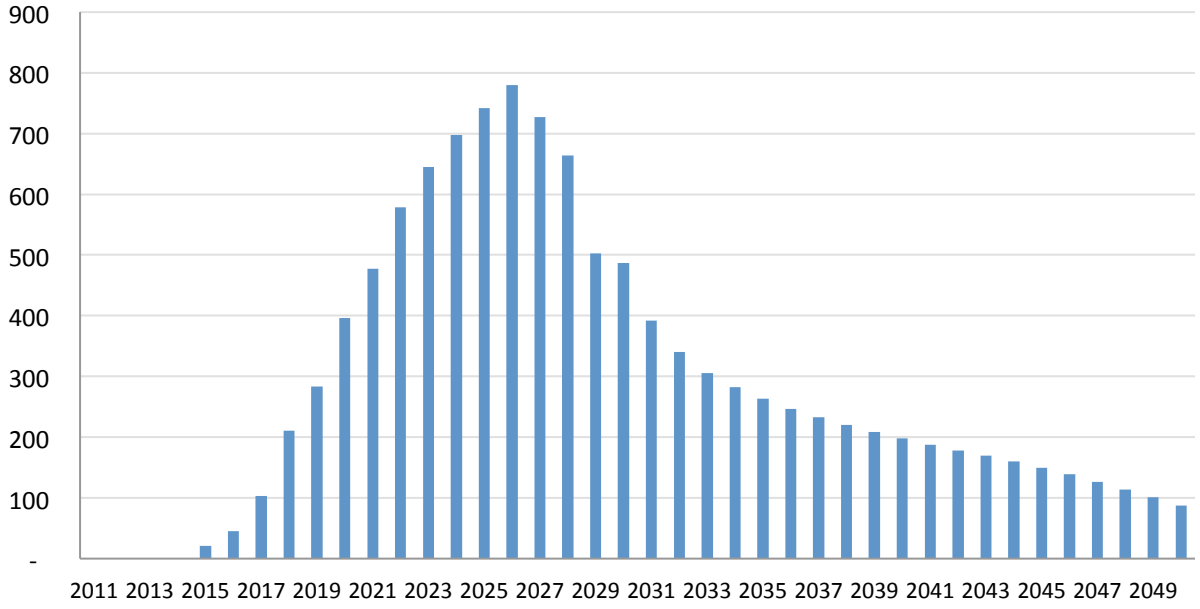


The experience of the US suggests that Tamboran's estimate of 1.3 to 2.6 tcf of recoverable gas within Fermanagh is highly likely to be overstated. Tamboran adopt a significantly above average IP rate and a below average rate of well decline and a longer well life-span. Moreover, the experience of the US suggests that initial expectations of EURs have not been realised due to the unexpected speed of well decline and the unanticipated heterogeneity of well quality. Analysis of actual shale gas productivity and

decline rates against operator's predictions suggest that achieved EURs per well are approximately 50% of the values predicted by operators[5]. This is largely due to the considerably longer life-cycles adopted in operator's forecasting models which have proved erroneous. This has contributed to even the US Energy Information Agency (EIA) reducing its estimate of unproved technically recoverable shale gas resources by 42%[6].

Tamboran forecast a 35 year life-cycle of production (Figure 5). While they anticipate a sharp fall in well decline it is considerably less steep than indicated by analysis of actual well productivity in the US. In addition, Tamboran's gas depletion curve is defined by a number of parameters including a beta or hyperbolic decay constant which they have assumed takes a value of 1.5. This is very high compared to evidence from existing shale plays (where the average is lower than 1.0). The net impact of using industry-standard values would be to make the wells uneconomic a full ten years prior to the 2050 cut-off date given by Tamboran. Moreover, Tamboran do not project a decrease in well quality and in turn productivity. This is evident in the life-cycle of the shale play and the ten years of accelerating productivity from 2017 with field productivity remaining elevated to 2032. Forecast productivity per day is considerably higher relative to shale plays of a similar scale in the US (Figure 6).

Figure 5 Tamboran Projection of Daily Production (MMcf/d)

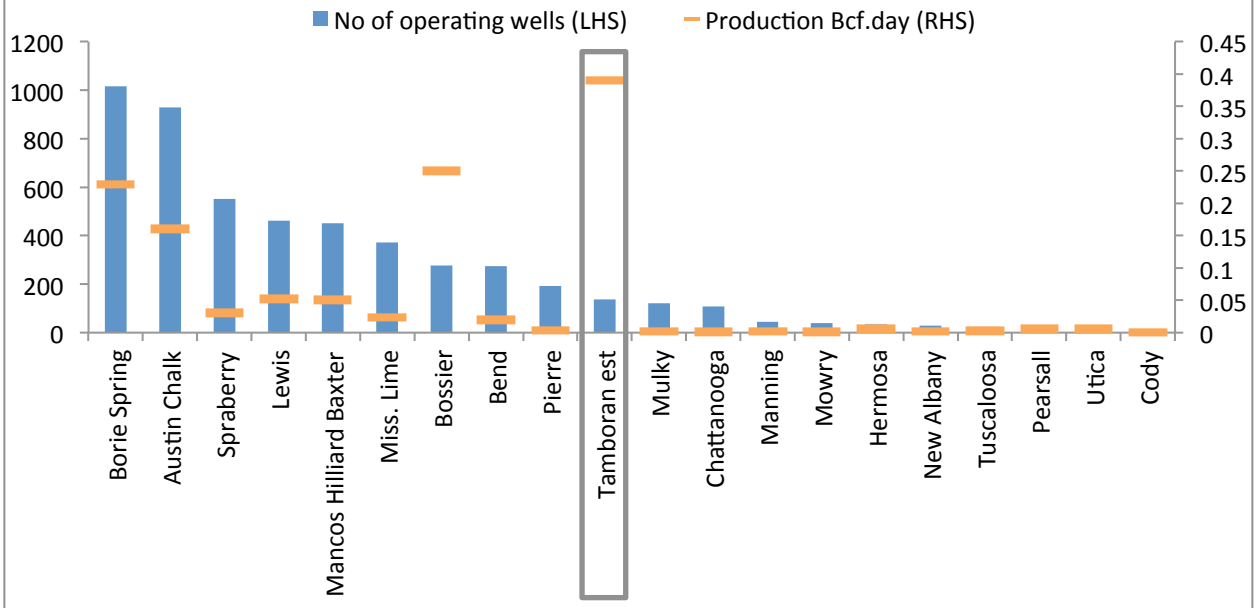


Source: Tamboran

[5] Berman, A. E. (2012) After the gold rush: A perspective on future US Natural Gas Supply and Price, The Oil Drum, February 8

[6] EIA, 2012, Annual Energy Outlook 2012,

Figure 6 Comparison of Tamboran Projected Productivity at peak with Highest Achieved in Smaller US Shale Plays



Source: Hughes, D.J. (2013) Post Carbon Institute, Feb; Tamboran Resources Pty Ltd (2012)

Any over-estimation of the lifecycle and rate of productivity of the Bundoran shale will be mirrored in the duration and scale of revenues receivable by the treasury and landowners. In the US, evidence from existing shale plays indicates that gas wells decline by between 75% and 95% within three years, while overall field productivity declines by 32% per year[7], with the law of diminishing returns underlying the investment required to maintain productivity. That is, productivity per well declines. Since 1990, the number of operating gas wells in the United States has increased by 90% while the average productivity per well has declined by 38%. Moreover, it is highly uncertain.

Production history of the Barnett shale indicates that 94% of wells have proved uneconomical as the field declined. This is reflected in revenues. For example, while the number of wells quadrupled between 2008 and 2010, revenues received from gas by the Fortworth municipality declined from $50 mn to $19 mn in 2009 and $38 mn in 2010. Similarly in Denton county, revenues declined by 23% despite a 58% increase in wells[8]. This has been termed the 'drilling treadmill' reflecting the need to rapidly increase drilling activity to standstill in terms of productivity. However, it also impacts on pricing and in turn sharply degrades profitability.

[7] Bloomberg (2013) The American Myth of Cheap Oil and Gas, Sept 17; Cobb, K (2013) Can the US export its way to energy independence? OilPrice.com, 18 August

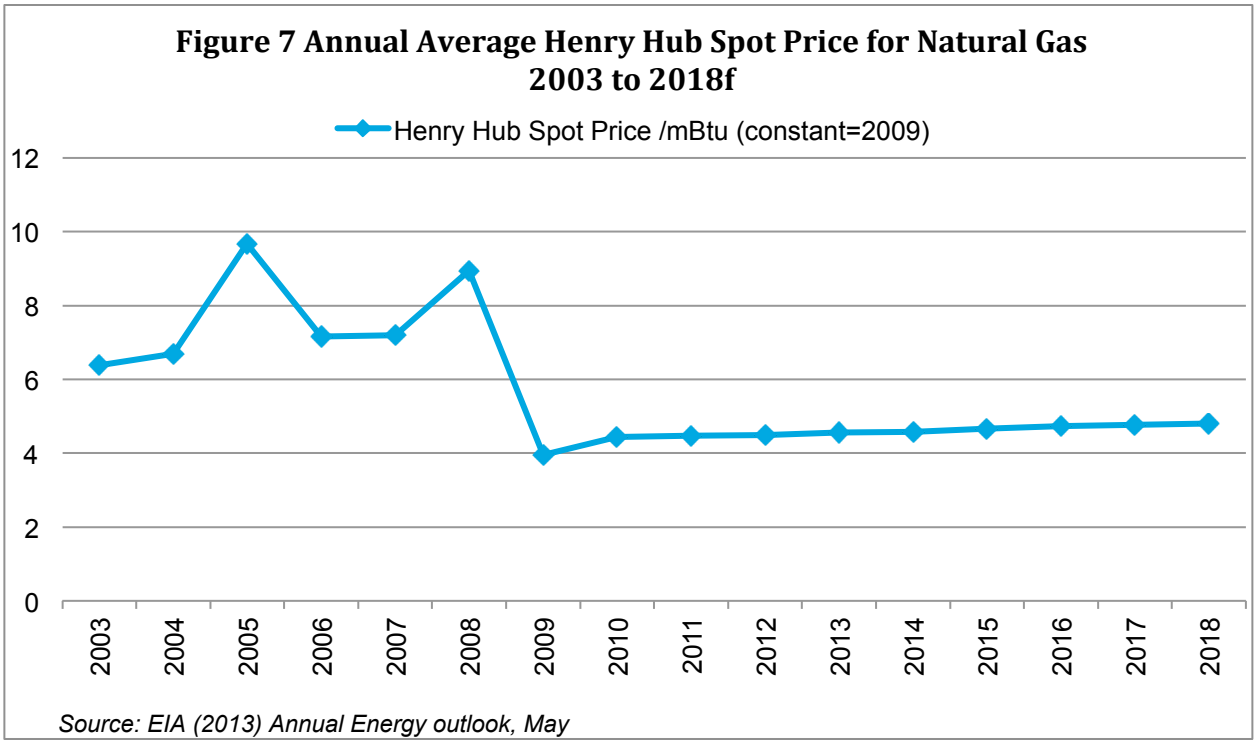
[8] Rogers, D (2013) Shale promises of shale spin? Energy Policy Forum

2.2 Pricing and profitability

The industry remains in its infancy and therefore the speed of decline in production rates of new wells are emergent. Since 1990, the number of gas wells in the US has increased by 90% while productivity per well has decreased by 38%[9]. This negative relationship is accelerating as the quality of new wells declines sharply and existing wells follow their steep decline curve. In short, a greater number of wells are required to simply maintain productivity levels. However, given the lower productivity per well, the costs of drilling are proving uneconomic. This is exacerbated by the declining price of gas.

Since 2007 shale gas extraction increased from less than 2 mcf in 2007 to 8,500,000 mcf by 2011 representing a 37% increase in its share of dry gas extraction[10]. This resulted in a sharp decline in the price of gas (Figure 7). In conventional oil and gas fields, supply is able to respond more dynamically to underlying demand and pricing. However, the rapid diffusion and depletion of shale gas from drilled wells and limitations of new technology means that existing wells cannot be shut-off temporarily. This resulted in an over-supply of gas and a corresponding collapse of gas prices with the Henry Hub price falling from $13 per mcf in June 2008 to $3.50mcf in August 2012. Current pricing is at $3.75 mcf and EIA forecasts project gas prices below $6 per mcf to 2035[11].

Figure 7 Annual Average Henry Hub Spot Price for Natural Gas 2003 to 2018f



Source: EIA (2013) Annual Energy outlook, May

[9] J. David Hughes (2013) Drill, Baby Drill: Can unconventional views usher in a new era of energy dependence? Post Carbon Institute, February; EIA (2013) Annual Energy Outlook

[10] GlobalResearch.ca (2013) The Fracked-up USA Shale Gas Bubble

[11] EIA (2013) Annual Energy Outlook.

At this pricing, shale gas plays are uneconomic. Detailed analysis of full life-cycle costs and productivity indicates that the break even shale gas price is $8.31 per MMbtu to $8.78 per MMbtu[12]. This indicates that the net economic benefit is deeply negative, unsustainable and has been since mid- 2010. Overall field declines require from 30 to 50 percent of production to be replaced annually with more drilling. Over $42 bn of capital investment, net of additional leasing and infrastructure costs, would be required annually to maintain end 2011 productivity rates in the top 14 US shale plays which account for over 99% of production. By comparison, shale gas produced in 2012 was worth about $32.5 billion at a gas price of $3.40/mcf (which is higher than actual well head prices for most of 2012).

It is perhaps surprising that drilling activity has accelerated, however this is explained by a review of shale gas operators' business models. The initial high IPs from shale plays, together with financial analysts favouring companies investing in an expanding energy reserve, led to energy operators pursuing a land grab for shale plays from 2007. The land grab was characterised by short-leases with an optionality to begin drilling within a 3 to 5 year time-frame of forfeit. This capital expenditure was highly geared and based on the anticipated life-span of wells mirroring that of conventional gas fields. This led to an overestimation of reserves with the median life of a well being a mere 5 years, with diminishing returns over that short life-span. Given the requirement to service debt on this capital expenditure companies were keen to generate cash flow through drilling and are unable to respond to pricing dynamics by reducing drilling activity until pricing stabilises. Indeed, given the depletion rates of gas once drilling is initiated and the diminishing returns, the pace of drilling accelerated to off-set both price decline and falling productivity across the field. This resulted in further price declines as supply escalated.

Currently, energy companies are attempting to restructure balance-sheets and business strategies to reflect revised estimates of recoverable resources, lower efficiency recovery rates and lower unit prices of gas. This is reflected in a slump in capital expenditure on North American gas deals which fell by 52% to $26 bn over H1 2013 on year on year basis. This follows a sharp decline in asset values as the unit price of gas plunged to a ten year low and while some fields thought to be energy rich disappointed.

This is reflected in an analysis of energy companies' financial statements which show a deterioration of free cashflow[13]. That is, the net income generated from capital expenditure on acquisitions and drilling is insufficient to sustain operations, indeed they are running at a loss. For example, from end 2010 to end 2012 free cashflow for Continental resources fell from -$430 mn to -$2.4 bn, for Devon Energy it declined from - $1.2 bn to $3.5 bn. This deterioration on free cash-flow is expected to accelerate further as capital expenditure requirements to off-set field decline increase going forward as sweet spots within fields are exhausted. The short-life cycle of wells and rate of depreciation in field productivity and slump in the gas price was unexpected, undermining the rate and duration implied in initial financial models.

[12] Berman, A and Pittinger, L. (2011) US Shale Gas: Less Abundance, Higher Cost" The Oil Drum, August
[13] Rogers, D (2013) Huge Capex=Free Cash Flow? Not in Shales, Energy Policy Forum, June

As a result energy companies have been making significant write-downs and selling assets at a loss. For example, BP announced a write down of $1 bn in respect of US shale gas assets[14], Shell made a $2 bn write-down in Q2 2012 in respect of N American energy assets it purchased for $ 6.7bn in 2009[15]. Similarly BHP Bilton booked losses of $2.8 bn in respect of its Arkansas shale assets. Other companies, particularly those which have over-leveraged, have engaged in fire sales to reduce debt repayment liabilities and to raise cash to finance existing drilling requirements. For example, Chesapeake Energy, formerly the second largest energy operator in the US and a large shale player, has sold $13 bn of assets, including some 2.4 mn acres of energy fields in an attempt to off-set its estimated financial obligations of $20.5 bn with little gain to free cash-flow.

This analysis demonstrates that in the US, the financial model underpinning shale plays have been flawed being based on over-estimations of recoverable gas and the duration of energy fields, underestimations of the costs of retrieving that gas and the number of drills required, and insufficient analysis of demand and supply dynamics on gas pricing. As a result, even large energy companies with strong exposure to shale plays are financially exposed.

Despite the rapid growth in gas production, the US remains a net importer of gas. However, the cost:price ratio in the US and deterioration of energy company balance-sheets is resulting in the granting of permits for gas exports. To date, four LNG (liquefied natural gas) plants have been granted permission with a further sixteen applications in the pipeline[16]. This enables operators to take advantage of the larger cost pricing spreads achievable in Asian and European gas markets. While this will inevitably shorten the estimated 24 year duration of domestic energy security provided by shale plays in the US, it may assist in supporting energy company financial balance-sheets and in turn, their creditors[17]. However, Shell suggest that the costs of storing, liquefying, transporting and re-gasifying involved in exporting gas to international markets erodes the current price premium[18]. Moreover, with China and Russia evaluating the potential of gas reserves within their vast jurisdictions, this pricing differential will evaporate in the short to mid-term.

Analysis of shale plays in the US suggests that Tamboran's estimates of recoverable gas, duration of the field and financial benefits are significantly over-stated. The opportunity to exploit shale gas reserves in Fermanagh represents a limited, short-term gain. However, any such gain is not necessarily a net benefit, even when considered in purely economic terms.

[14] GlobalResearch.ca (2013) The Fracked-up USA Shale Gas Bubble
[15] Bloomberg (2013) Shale Grab in US Stalls as Falling Values Repel Buyers, August 18
[16] Bloomberg (2013) The American Myth of Cheap Oil and Gas, Sept 17; Cobb, K (2013) Can the US export its way to energy independence? OilPrice.com, 18 August
[17] Berman, A and Pittinger, L. (2011) US Shale Gas: Less Abundance, Higher Cost" The Oil Drum, August
[18] Gosen, E (2013) US Shale Gas exports on't cut bristish energy bills, Shell Chief Peter Vosper warns, The Telegraph, 16 Oct

3.0 Net Benefit to Public Revenues

Analysis of the US experience also demonstrates that the development and exploitation of shale gas resources creates a number of externalities that represent a significant cost to local authorities. In particular, the damage to roads from activity related to shale plays represents a major cost carried by public authorities and local tax payers that outweighs any benefit from revenue receipts[19]. There are additional costs involved in crisis / water management and externalities on public health.

3.1 Road Damage

In the Marcellus Shale, a typical well requires 5.6 mn gallons of water, delivered and removed by truck in addition to additives, drilling and fracturing equipment. The initial drilling phase accounts for approximately 50% of the required 625 to 1,148 lorry loads required per well[20]. A survey by the Texas State Department of Transport (TxDOT) in 2012 to assess road damage by drilling operations detailed that it takes 1,184 loaded lorries to bring one well into production, with 353 required for annual maintenance and 997 every five years to re-frac a well. TxDOT recalibrate the data into car journeys to enable comparison of pre- shale gas projected use of roads and post-shale gas actual use of roads. Each well requires the equivalent of 8 mn cars for its development and a further 2 million cars per annum for maintenance.

In the US, beyond state highways, even county primary roads have proved unable to withstand the volume and weight of required traffic. Sinkhole, 6" to 8" rutting and complete road failure are common[21]. It is recognized in every state where drilling occurs that the life-cycle of roads is reducing by 75% from 20 years to 5 years.

As a consequence, the PennDOT District 3 (Pennsylvania Department of Transport) in the Marcellus posted weight limits on 1500 miles of road and more than 4,000 roads have been posted across the state. However, during 2010, Pennsylvania State Police conducted 5,800 roadside inspections of industry trucks and found that 42% violated weight restrictions.

In Texas, TxDOT estimate the damage to Texas roads from drilling operations in shale plays total some $4 bn while the state accrued some $3.6 bn in taxes from oil and gas production in 2012. In early 2013, Pennsylvania state estimated that $3.5 bn would be required to maintain existing roads and a further $8.7 bn to repair bridges. In developing best practice, Road User Agreement are sought by public authorities requiring the operator to off-set the predicted road damage at the cost of reconstruction.

[19] Rogers, D (2013) Externalities of Shales: Road Damage, April
[20] Berman, A and Pittinger, L. (2011) US Shale Gas: Less Abundance, Higher Cost" The Oil Drum, August
[21] Randall, C.J. (2011), Hammer Down: A Municipal Guide to protecting Local Roads in New York State, CARDI Reports, Cornell University, Issue 14, September

4.0 Net Benefit (Deficit) to Local Economy

Estimation of the impact of shale gas exploration on the local economy has been narrowly assessed and centres on the potential number of jobs created. However, such analysis assumes that such jobs are accretive in the short and long-term. By failing to consider displacement effects and other negative impacts of drilling the direct and indirect effects of shale gas activity are over-estimated. Moreover, such analyses solely focus on the drilling period and fail to consider the long-term economic impact. In this analysis the short and long-term impacts of shale gas exploitation in Fermanagh on the local economy are considered.

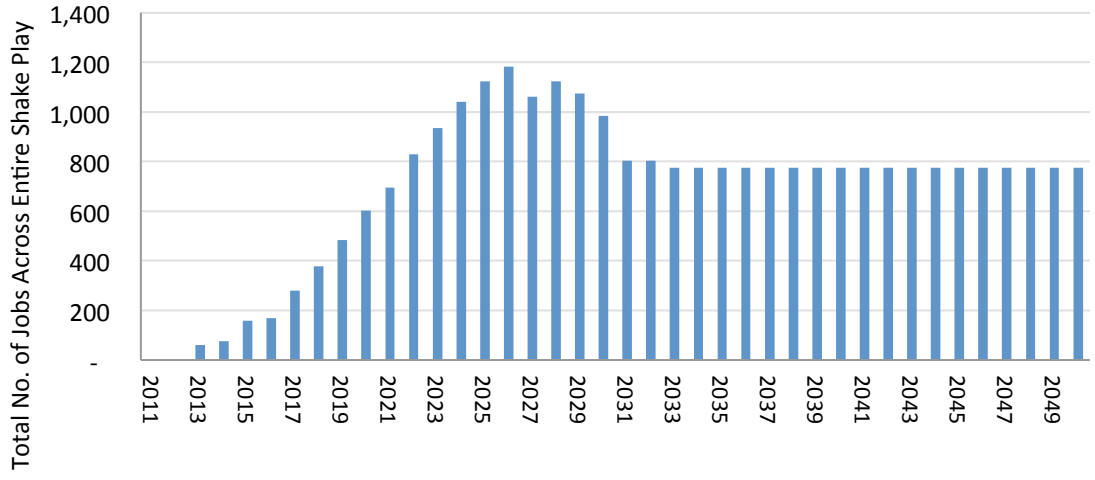
4.1 Short-term Impact on Local Economy

The assertion that shale gas drilling will have positive economic benefits in the short-term is primarily based upon employment projection figures from Tamboran. However, this does not in itself represent the net benefit to the local economy. It is therefore essential to consider direct employment growth, indirect employment growth, displacement costs and social costs in order to assess the short-term economic impact of shale gas exploration in Fermanagh (Figure 10).

4.1.1 Employment Growth

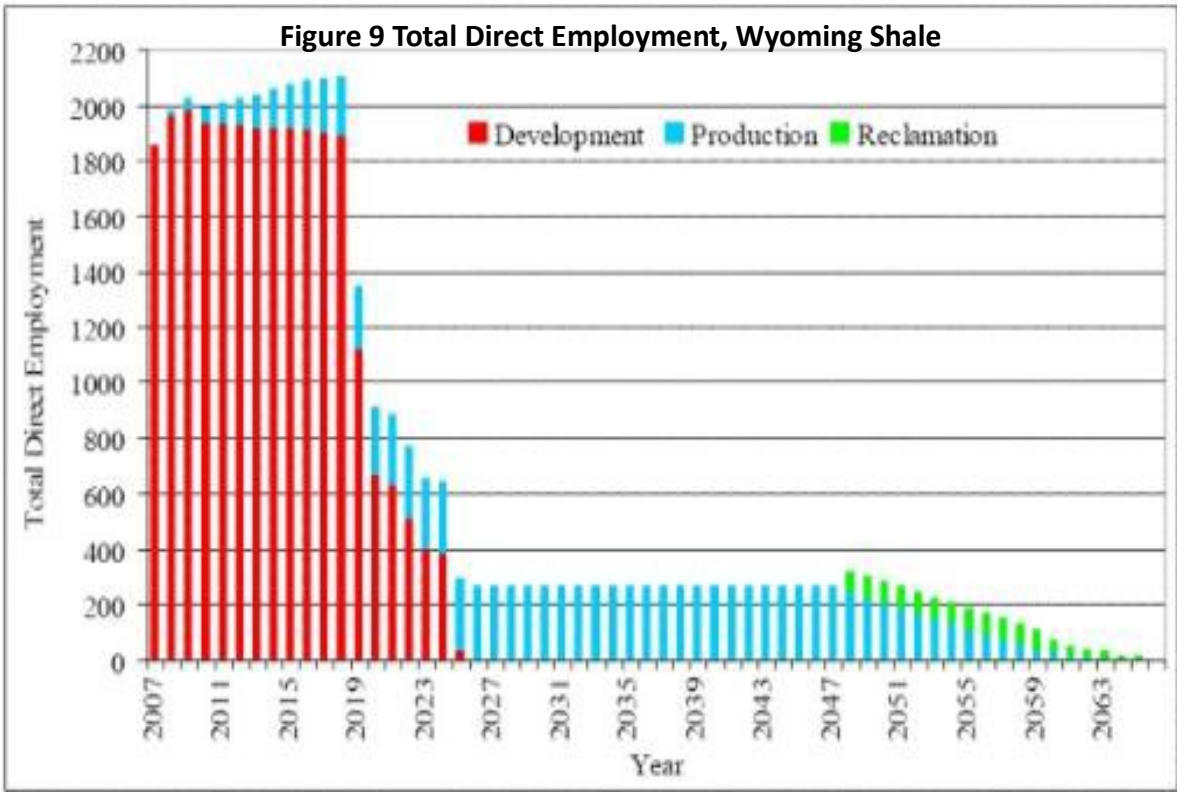
Employment projection figures provided by Tamboran have proved dynamic. Currently they project 180 FTEs over a thirty year period. As recently as April 2012, Tamboran estimated that 600 FTEs would be directly supported by the industry by 2025 across the shale play. In response to enquiries, Tamboran clarified that Fermanagh would account for approximately 50% of such employment, or approximately 300 FTEs. In FFAN's previous report to DETI, the exceptionally high staffing levels implied by Tamboran's post-production employment projections were highlighted relative to those characterising existing shale plays (Figures 8 and 9). In order to justify an average job creation across the whole field of 600 FTEs over a 30 year period, Tamboran had to assume a constant employment rate even after gas production halved (in 2031) from its peak (in 2026) until it falls to less than one-eighth of peak production. It would appear highly unlikely that any company would continue to employ a full complement of maintenance staff while production falls exponentially.

Figure 8 Former Tmaboran Projection of Total No. of Jobs Across Entire Shale Play



Source Tamboran (2012)

Figure 9 Total Direct Employment, Wyoming Shale



Perhaps in response to this analysis Tamboran more recently reduced their initial employment projections for Fermanagh by 40%. They now forecast 180 direct FTE jobs will be supported by the industry. However, this is likely to continue to overstate employment as it is based upon productivity

projections that are significantly out of line with existing shale plays. . Moreover, a continuous rate of productivity decline in line with a hyperbolic decay constant of 1.5 for a duration of 8.5 years is employed. As discussed above well decline is much steeper, with wells declining by up to 95% within 3 years. The median llifespan of a well is a mere 5 years[22]. This significantly shortens the life-cycle of the play and the quantity and duration of jobs. This will also be driven by the pace and scale of drilling activity.

However, there is little updated information provided as to the timing and duration of drilling activity. Using Tamboran's initial estimates of production from 2012, it appears that Tamboran will construct wells over an eleven year period with the last wells drilled in 2026. Assuming the last wells have an average lifespan of five years, this suggests a maximum of sixteen years productivity. However, the economics of shale plays usually demand a much faster pace to drilling[23]. Production in shale plays is unpredictable and only a small number of wells may prove to be commercially viable with evidence from the Barnett and Haynesville shale plays indicating that between 10% and 20% of wells carry the entire play[24]. However finance has usually been attracted by companies presenting productivity on a hyperbolic decline projection based off IP rates. However, with production rates abruptly departing from hyperbolic decline as early as 12-18 months into the production cycle the pace of drilling needs to accelerate to maintain productivity and ultimately, service debt repayments[25]. Industry investment advisors are cautious about the long-term productivity of the US shale gas plays and advise investors to front load drilling activity as 'the more oil and/or gas that you can make up front the better the economics'[26].

Moreover, while estimates are usually based upon anticipated expenditure per well they do not expand on how many actual jobs will be created, the skill requirement of such jobs, expected location of labour (local v migratory) or what they will pay. The fact that projections provide job *estimates* is often ignored, and those estimates are portrayed incorrectly as real job numbers. The volatility of Tamboran's own employment projections which have been subject to successive downward revisions, underline this uncertainty.

In terms of timing, the industry is characterised by a boom-bust business cycle in which a rapid increase in economic activity is followed by a rapid decrease. This reflects the fact that the industry is capital intensive beyond the initial phase of more labour intensive well construction. Moreover, given the high depletion rates of wells and the wider speed of decline of the field the boom phase is brief, lasting under

[22] J. David Hughes (2013) Drill, Baby Drill: Can unconventional views usher in a new era of energy dependence? Post Carbon Institute, February

[23] Christopherson, S and Rightor, N (2011) How should we think about the economic consequences of shale gas drilling? From Working Paper Series A comprehensive economic impact analysis of natural gas extraction in the marcellus shale, City and regional planning, Cornell University

[24] Rogers, D (2013) Shale promises of shale spin? Energy Policy Forum

[25] Berman, A and Pittinger, L. (2011) US Shale Gas: Less Abundance, Higher Cost" The Oil Drum, August

[26] McFarland, G (2010) "Shale Economics: Watch the Curve". *Oil & Gas Evaluation Report*. Website published by Obsidian Energy Company, LLC. March 17.

ten years in even some of the larger shale plays in the US. Given the comparatively small geographic scale of the Fermanagh play the development phase is likely to be considerably shorter.

In the US, research at Cornell University demonstrates that the vast majority of jobs supported by the industry are predominantly short-term[27]. Approximately 98% of associated jobs are related to the development of wells and are redundant once the well is in production. These jobs are largely low skilled including excavation and rigging crews, machinery operators as well as drilling and engineering specialists. Thus Tamboran's projection of 180 FTE jobs represents a capitalisation of a much higher number of short-term jobs that further contribute to the de-stabilising boom-bust economic profile of shale plays. However, in contrast to the building construction industry, such jobs are predominantly filled by a transient workforce. This is due to the fact that HVHF is significantly more industrial and more technologically advanced than even traditional well drilling. As a result, even low skilled jobs require an understanding of the industry, its technology, terminology and experience in the field.

According to a study by Marcellus Shale Education and Training Centre local residents will be able to find relatively few opportunities for accessible and stable employment in the short-term. In this early phase, local employment opportunities will centre on lorry drivers and construction of site access roads. Once in production, wells are considerably less labour intensive and the production phase, or long-term employment, accounts for 2% to 5% of jobs which are filled more locally. Applying this to Tamboran's projection, this accounts for 3.6 to 9 FTEs which will remain local and predictable.

4.1.2 Indirect and Induced Employment

The establishment of the shale play will result in further indirect employment and induced employment. Again, this growth must be considered in the context of the impact on established economic sectors within the locality, that is, the net benefit is not necessarily positive. It is also unlikely to be long-term given that direct employment growth is predominantly short-term and front loaded to the development phase. Indeed, it is this trend that drives the boom-bust profile of the industry. It is during this period that activity drives employment growth in other sectors. However, such growth is temporary and slumps as drilling activity ends due to the sharp decline in the workforce associated with the industry.

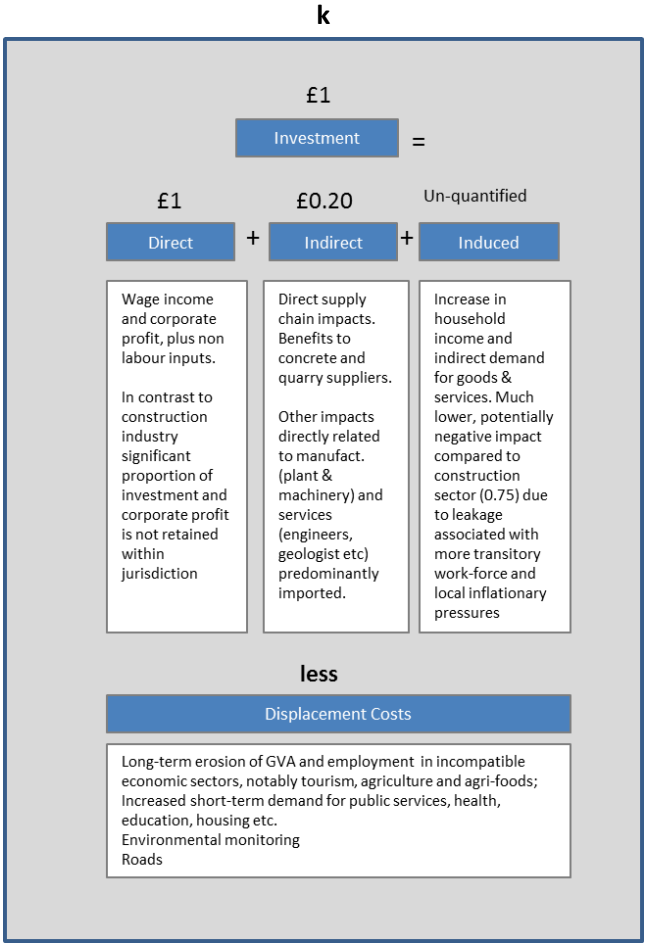
Previously, Tamboran have suggested a Type 1 multiplier of 5.0[28]. Given the temporal nature of the industry, such multipliers which relate to sustainable job creation are not appropriate. However, it is worth noting that in comparison to other industries the multiplier adopted by Tamboran is extremely high. The building construction industry is considered to have a high Type I multiplier effect of 2.09 and an additional Type II local economic impact of 0.75. However, the shale industry would be expected to be considerably lower for a number of reasons. First, the indirect impact estimates the effect of

[27] Jacquet, J (2011) Workforce Development Challenges in the Natural Gas Industry, CARDI Reports, Issue 14, September

[28] Defined as the ratio of direct plus indirect jobs created to the number of direct jobs created; like all multipliers it assumes a permanent stimulus of economic demand so is not applicable to short-term or temporary job creation or stimuli.

increased activity in the sector across the supply chain. In contrast to construction which has a very local supply chain of goods and materials, the absence of significant oil and gas industries or sub-supplier chains in N Ireland suggest that beyond concrete, capital expenditure will focus on imported goods, specialist plant and equipment. Second, the induced impact is also significantly lower due to the pre-dominance of a transitory workforce. While this will result in some increased spending on accommodation and retail services, the impact of increased disposable incomes may be experienced in the home domicile of employees. Energy workers tend to work long shifts, over seven days for long periods in the field, matched to periods of extended leave. This is reflected in the multiplier of 1.2 calculated by the Scottish Executive in assessing the economic impact of their oil and gas industry in 2007 (Figure 10). Similarly, statistical analysis of counties in Pennsylvania demonstrate that employment impacts are modest while the short-term earnings impact is more significant, if temporal[29]. This is due to the strong cyclical boom-bust impact of shale gas and creates inflationary pressures on pricing, especially in rented accommodation.

Figure 10 Low Economic Multiplier Effect of Shale Gas Investment



[29] Weinstein, A (2013) The Economic Value of Shale in Ohio, Agricultural, Environmental and Development Economics, The Ohio State University, July 19

4.1.3 Social Costs

The scale of industrialisation would impact the entire local economy, not merely the area within the fracking zone. The region as a whole is industrialized to support continued drilling, storage, and transportation of water and natural gas. These more widely distributed impacts need to be taken into account when anticipating what effects natural gas drilling will have on communities, their revenues, and the regional labour market, as well as on the environment.

The pace and scale of development is an important factor as the faster the pace of drilling, the higher the social cost. At the same time, tax revenue produced by drilling will be short-lived and take the form of a windfall, which the local authority or local assembly is unlikely to be able to draw on. The sharp population growth that occurs as rigging, drilling and associated crews migrate to the area creates pressures on housing, public services including schools and childcare. For example, research into population growth in a small shale play area in the US demonstrated that population growth in a Wyoming county subject to drilling increased at a rate five-fold to that of the state and the largest population growth occurred in the 15-24 year old segment[30]. Given a sharp, albeit short peak in such demand, inflationary pricing is evident.

In the US, the same research has indicated that driven by the high wages of workers and their increased demand for goods and services, local prices increased by twice the national rate over the six-year study period. The private rented housing sector is subject to excess demand and rents escalate sharply, displacing local low income workers. This population growth also generates costs for public authorities as increase demand for services exceed the administrative capacity, staffing levels, equipment and expertise required.
Many of these costs fall on local governments. These social costs are likely to have short-term impacts during the drilling period and regional consequences sustained into the longer-term because of the widespread industrialisation that accompanies contemporary hydraulic fracturing.

4.1.4 Displacement Costs

The projected number of predominantly short-term jobs supported directly and indirectly by the proposed shale exploration are not accretive. That is, the net employment growth will be much lower and over the long-term, negative. The establishment of the industry will also create significant displacement costs that will reduce employment in incompatible economic sectors and in other sectors competing for resources of human capital.

Displacement costs associated with the Bundoran shale play are high due to the importance of the tourism and agriculture sectors to the local, regional and island of Ireland economy. The

[30] Jacquet, J (2011) Workforce Development Challenges in the Natural Gas Industry, CARDI Reports, Issue 14, September

shale industry is incompatible with the tourism and agriculture sectors for two reasons. First, the shale industry industrializes the landscape. The scale of the proposed development is substantial. Tamboran's figures estimate that an area of 80,000 acres will be developed of a 100,000 acre zone within the license area (overall area 280,000 acres). The 20,000 acres not included in the initial target area are identified by Tamboran as being non-drillable due to being special areas of scientific interest.

The fracking area is estimated to roughly fall 50% in each jurisdiction with an estimated 120 pads being constructed. Tamboran's own estimates are that the initial pad size will be 7 acres at first drilling and a final pad size of 4 acres after removal of tanks and water pond. However, the industrialisation of the landscape is not limited to well pads. Water extraction sites must be developed in order to fill lorries transporting water to and from the well pads. After extraction, the gas has to move from the well sites to the main transmission lines via a network of pipelines and compressor stations. Flowback and produced water from the wells has to be transported to treatment facilities, which must be built to handle any toxic waste present. In addition to the well pads, these must be regulated by public authorities. These facilities typically include accommodation parks for short-term migratory workers; depots for equipment; staging areas; gravel quarries; water extraction sites; wastewater treatment plants capable of handling toxic material; injection wells; disposal areas (landfills) and gas storage facilities[31].

Such industrial facilities create a wide range of potential environmental hazards and externalities stressors that detrimentally impact on the local economy and its adjacent industries, especially tourism and agriculture. For example, apart from the blighting of the natural landscape and risk of contamination there are further risks inherent in a widespread array of pipes transporting methane and other high-pressure equipment. Noise is a major concern related to compressor stations. They produce noise levels in the 85 to 95 decibel range.

Second, during the boom period when drilling crews and other gas-related businesses move into a region to construct wells and extract the resource, sectors such as agriculture and tourism which rely on a supply of low cost labour are crowded out. While competition for labor will result in income growth amongst some locals such as lorry drivers, it also raises costs for other businesses in the wider region. For example, dairy farmers in Northern Pennsylvania and the Southern Tier of New York, who are already in a marginal economic situation, are being further squeezed because of rising costs for transporting produce to market. Moreover, other business such as manufacturing are deterred from investing in a resource extraction economy due to the high cost and shortage of labour and existing industry may re-locate. As a result, when drilling ceases and the bust inevitably follows the short-lived

[31] Christopherson, S and Rightor, N (2011) How should we think about the economic consequences of shale gas drilling? From Working Paper Series; A comprehensive economic impact analysis of natural gas extraction in the marcellus shale, City and regional planning, Cornell University

boom, population and jobs depart the region.[32] Post-drilling, the economy is less diverse and more volatile.

These risks are accentuated for Fermanagh given the strategic importance of the agriculture and tourism sectors to the local economy. Although the hospitality and retail services industries are likely to benefit from a short-term escalation of demand reflected in inflationary pricing, this is at the expense of the tourism industry and the local population who are subject to a rising cost of living. However, it is the long-term impact that is of even greater concern. The scale of industrialisation of the landscape is incompatible with the tourism industry which is founded on the environmental landscape, while the likelihood of contamination scares, whether perceived or real, to the agriculture and, in turn, food manufacturing sectors will destroy their economic value over a long-term horizon. Their decline would be irreversible.

[32] Feser, E. and S. Sweeney. 1999. “Out-migration, Population Decline, and Regional Economic Distress." Report prepared for the U.S. Economic Development Administration,Washington: U.S. Department of Commerce.

5.0 Long-term impact on local economy of shale gas development

Research from the US suggests caution in projecting long term economic development from natural gas drilling. Evidence from other shale plays indicates that long-term economic outcomes are negative[33]. A study of 26 counties in western states in the US indicates that locations that have based their economic development on the extraction of fossil fuels (a minimum of 7% of FTEs in resource extraction associated with natural gas, oil, and coal) have not performed as well as similar counties without extraction industries[34]. This was evidence in lower average personal income growth, lower employment growth, lower economic diversity, lower levels of educational attainment, higher income inequality, lower rates of inward investment and de-population for counties with extraction industries over a fifteen year period to 2005. The role of tourism is identified as being a key factor in relative performance; its rate of growth in non industrialised counties has outpaced employment growth within extraction industries.

This supports the assertion that shale exploration in Fermanagh will result in a net economic dis-benefit due to the associated costs to established industrial sectors, the public sector and to the local population. While investments in a region can stimulate economic development, they are not sufficient to engender long-term sustainable economic development. Successful economic development is measured by long-term population growth, the presence of a diversified economic base, and a higher standard of living for most of the region's residents, not only in income but also in the quality of public facilities, services and the shared environment. Thus, in assessing how shale drilling will benefit (disbenefit) the local and regional economy, it is essential that the short and long-term impact is considered.

Shale gas drilling will have negative consequences for sustainable economic development in Fermanagh. While it is evident that drilling will create job opportunities over a short-term horizon of five to ten years, the negative externalities on traditional sectors, especially tourism, agriculture and related industries arises immediately and is sustained into the long-term. Research indicates that rural regions whose economies become dependent on natural resource extraction frequently have poor long-term development outcomes[35]. After the initial construction and drilling phases, the industry is capital rather than labour intensive resulting in a minor number of long-term jobs that represent between 2 to 5% of FTEs supported by the play. Utilising Tamboran's projection of 180 FTEs this amounts to between 3.5 and 9 FTEs. The loss of jobs from the tourism and agriculture sectors will outweigh this growth by several hundred fold.

[33] Berman, A. 2009. "Lessons from the Barnett Shale suggest caution in other shale plays."
[34] Headwaters Economics 2009. "Fossil Fuel Extraction as a County Economic Development Strategy: Are Energy-focusing Counties Benefiting."
[35] Barth, Jannette. 2010. "Unanswered Questions About The Economic Impact of Gas Drilling In the Marcellus Shale: Don't Jump to Conclusions." J.M. Barth & Associates, Inc., March 22.

5.1 The Tourism Sector

The tourism industry accounted for spending of £683 million in N Ireland in 2012, representing growth of 7% on the previous year. The Fermanagh Lakelands represent the second most visited region beyond Belfast. Importantly, strong growth was driven by the segment of visitors identifying N Ireland as a holiday destination, which increased by 19%. Visits to tourist attractions increased by 6% with the Minister for the department of Enterprise, trade and Investment stating that is was proof that "if you give tourists more to see and do … they will spend more money and the economy as a whole will benefit"[36]. Of course the reverse also holds true.

Fermanagh unique selling points are its distinctive product-offering with a strong, environmentally friendly branding. The county's promotional logo is 'Fermanagh Welcomes you Naturally'. This would be entirely undermined by extensive mining activities across 100,000 acres. Indeed, the area which is the primary target zone for fracking is almost entirely contiguous with that of the UNESCO world heritage cross-border Geopark. UNESCO are anticipated to rescind this designation should fracking proceed. The Destination Fermanagh strategy sets out a vision for the sector locally which is coherent with DETI's own Draft Tourism Strategy (2020). In short, it seeks to 'value what the tourist values'. Fermanagh District Council's Tourism Strategy specifically highlights the importance of the Geopark as a 'key marketing tool, putting Fermanagh/Cavan on an international platform in the environmental tourism arena.'

This success stems from the identification of the potential of the 'Environmental Economy' in N Ireland as a major contributor to, and growth sector for, the N Ireland economy and the subsequent development of a strategy to realize its potential. In a report commissioned by the Environment and Heritage service in N. Ireland to develop environment and economic policy, the inter-dependence of economic and environmental objectives were identified. The outstanding natural and bio-diverse landscape was identified as an economic asset that needed to be maintained and enhanced as it provides significant economic opportunity if exploited sustainably[37].

The environmental economy was defined as all activities that are concerned with the management and enhancement of the environment, and that benefit from the quality of the environment. Tourism and agriculture were identified as the principal economic sectors underlying the environmental economy and the potential of these activities in Fermanagh was highlighted. In 2005, the sector accounted for 32,749 FTE jobs and £573 mn. Tourism accounted for a fifth of the sector and represented a GVA of £21,224 per FTE. Agriculture accounted for a third of employment and 20% of GVA.

The area comprises a high proportion of the most significant visitor destinations in N Ireland including, but not limited to:

[36] N I Executive (2013) Foster Comments on latest tourism figires, 4 July
[37] DOE NI (2007) , Valuing our environment: The economic impact of the environment in Northern Ireland,

- Belleek Pottery – 165,297 visitors in 2011;
- National Trust Properties including Florencecourt Castle (40,314) – adverse impact to the Fermanagh product will also impact dramatically on visitor numbers to Castlecoole (34,875) and Crom Castle (17,252)
- Marble Arch Caves Global Geopark (the first cross-border Geopark in the world and one of the largest in Europe) – 54,092 visitors in 2011;
- Visitors to local Forestry plantations (extensive throughout the licensed area in Fermanagh) amounted to an estimated 79,000 (Forest Service NI figures, Planning Review 2011) – and extensive fracking will impact pedestrian access to 240km of Forest roads and 28km of pathways;
- There are four Special Areas of Conservation (SACs) within the immediate frack-zone.
- The extensive industrialisation of Fermanagh will also threaten the wider development of Outdoor Activity Tourism in Fermanagh. This is a burgeoning growth sector with over 75 water based events having taken place since 2008. In 2007 the market value of Activity Tourism was approximately 10% of total visitor spend and is expected to have increased substantially.

Given the natural landscape is the underlying asset to Fermanagh's tourism industry the industrialization of the landscape would impact upon the county as a whole. In addition to road congestion and deterioration, noise, water and air pollution, the water requirements to frack each well (2.5 million gallons per frack) will significantly lower water levels in rivers/lakes impacting on boating safety, fishing and increase the risk of eutrophication. Almost 3,000 angling licences are sold to visitors annually in Fermanagh. This accounts for over 85% of the Northern Ireland total, generating direct revenue of over £178,000. In 2005, the angling industry alone was identified as underpinning 778 full-time jobs.

The area is a pioneer in the development of the eco-tourism sector supported by the cross-border INTERREG-funded GreenBox initiative. The large-scale industrial development of the area would be highly damaging to the ability of local businesses to promote the area as a centre of green-tourism. The area has benefited from considerable SEUPB and Northern Ireland Executive funding for a range of rural tourism investments which would be undermined by the proposed industrial development.

The industrialisation of the landscape associated with drilling activity would destabilise the long-term sustainability and growth of the tourism sector during and post the lifecycle of shale drilling activity. While the hospitality sector may benefit during the boom period, this would decline immediately after the construction of wells is completed and the transient workforce departs. The risks to the industry are long-term and would result in a negative and irreversible impact on total employment in the region. This loss of direct employment in the tourism sector would impact on indirect employment across the tourism supply chain. Given the decline in disposable incomes with the local area this would further impact on induced employment in retail and other services.

This negative multiplier effect would outweigh the positive impact of employment growth from the shale gas industry for three reasons. First, the decline is long-term while the impact from the shale industry is short-term. Second, the total number of jobs affected by the decline of the tourism sector is considerably higher than those supported by the shale industry. Third, with a more local supply chain to the industry and a local workforce, the multiplier effect from employment in the tourism industry is considerably higher than that associated with the energy industry.

5.2 The Agriculture and Food Sector

Agriculture and the wider agri-food sector remains a core segment of the Northern-Ireland economy. In 2011, total output associated with the Agricultural sector was £1.71 billion (up 13% on 2010) employing 3.1% of the workforce. Gross-value added by the sector was £437 million (an increase of 23%). In addition to tourism, Fermanagh's economy is highly dependent on agricultural production and it is a focus of economic innovation. Total employment in 2011 within the sector in Fermanagh was estimated by DARD Statistics Department at just under 4,996, or approximately 18% of the total labour force. The development of niche agri-food and organic food production represents an emerging value-added sector to the economy. The contamination risks to air and water including radioactive elements or benzene-related hydrocarbons inherent in shale gas exploration represent a major risk to the long-term future of this emerging high value sector.

The agri-food and food processing sectors also contribute heavily to the Northern Ireland economy. Provisional DARD estimates indicate that the Food Processing Sector enjoyed a gross turnover of £3.7 billion in 2010 (an increase of 8.3%). Gross-value added in the sector was estimated at £608.2 million in 2009 (latest available), an increase of 8.6% over the previous year. Net employment in the sector in 2010 was 19,700 FTEs, an increase of 1.1% over the previous year.

Moroever, any scare associated with the food supply chain would impact on the agriculture and agri food sector across the island of Ireland as experienced during the foot and mouth crisis. The value of agri food exports within the dairy sector alone amounted to €3 bn in 2012. This includes the export of baby milk formula, for which the Republic of Ireland has a global market share of over 20%. Underlying this success is the quality of the environment with relative environmental purity being the key criteria used by Chinese buyers in selecting import markets for this product.

The impact of pollution, whether perceived or real, on the agricultural sector across the island of Ireland would have devastating consequences on demand for exports. The NI economy is more dependent upon agriculture than any other UK region. This can be illustrated through its share of the economy and employment. The agriculture, forestry and fishing sector accounts for 1.6 per cent of Northern Ireland's GVA. This represents the largest share of any of the UK regions and compares with just 0.6 per cent for the UK as a whole. The reliance on the wider agri-food sector is evident given the additional contribution of the manufacturing industry's food and drink sector.

The short-term benefit of predominantly short-term jobs supported by the proposed shale exploration must be offset against much larger losses in the short and long-term in key tourism and agriculture sectors of the Fermanagh and N. Ireland economy. The industrialisation associated with shale gas exploration of the scale proposed for this unspoilt, natural landscape is incompatible with the dominant industry sectors of the economy. It will severely undermine attempts to brand the area as an Eco-Tourism destination, threaten the long-term viability of the Geopark project, repel tourist visitors and subvert attempts to develop high value-added, specialist or organic farming and agri-food opportunities locally and potentially across Northern Ireland.

This conflict results in the net economic benefit being negative even in the short-term given displacement, public and social costs. In the longer-term, any associated benefit is greatly out-weighed by its detrimental impact on the future diversity, strength and growth of the local economy.

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