

# DRAFT - STUDY INTO THE ADVERSE IMPACTS OF UNCONVENTIONAL OIL AND GAS ACTIVITY IN FERMANAGH AND OMAGH



*Artist's Impression of How UOG may look in Fermanagh and Omagh*

**Mace**  
June 2022

V2.0 Draft

Draft Study into The Adverse Impacts of Unconventional Oil and Gas Development  
V3.0 June 2022

### Accountability for this document

Prepared by:	Andrew Booth
	Matt Wileman
Date:	1 <sup>st</sup> June 2022

Approved by:	Richard Dinsdale
Position:	Operations Director
Date:	29th June 2022

Signed\*:

\*Alternatively approved electronically through document management system or email correspondence.

### Version Control

All revision and amendments to this document are to be recorded in this section.

Ref	Date	Section	Page	Details	Authorised
1.0 (Draft)	28 04 22				
2.0 (Draft)	01 06 22			Response to client feedback	
3.0	29 06 22			Response to client feedback	

## Contents

<b>1</b>	<b>Executive summary</b>	<b>6</b>
1.1	Introduction	6
1.2	Current Status of UOG Activity in Northern Ireland	6
1.3	Scale	7
1.4	Environmental Impacts	8
1.5	Economic Impacts	9
1.5.1	The Local Economy	9
1.5.2	The Possible Benefits Of UOG Activity	10
1.5.3	The Possible Costs of UOG Activity	10
1.6	Social Impacts	13
1.6.1	Mace Model Of Place	13
1.6.2	Demographics	14
1.6.3	Security	15
1.6.4	Infrastructure	15
1.6.5	Housing	16
1.6.6	Community	17
1.7	Public Health Impacts	18
1.8	Human Rights Impacts	19
1.9	Conclusions	19
<b>2</b>	<b>Introduction</b>	<b>23</b>
2.1	Background	23
2.2	Model of Local Change	24
2.3	Objectives	24
2.4	Methodology	25
2.5	Structure	26
<b>3</b>	<b>Unconventional Oil and Gas Background</b>	<b>28</b>
3.1	Overview of UOG Processes	28
3.2	Water Requirements of UOG activity	31
3.3	History of UOG development in Northern Ireland and England	31
3.3.1	General UK context	31
3.3.2	Northern Ireland Context	33
3.4	How UOG Development Will Likely Work in Fermanagh and Omagh	36
<b>4.</b>	<b>Environmental impact</b>	<b>43</b>

4.1.	Introduction.....	43
4.2.	Road Damage and Increased Carbon Emissions.....	43
4.3.	Development of UOG Infrastructure .....	44
4.4.	Increase in Methane Emissions.....	44
4.5.	Large Water Requirements .....	45
4.6.	Production of Toxic Water .....	45
4.7.	Surface Contamination & Radioactive Elements .....	46
4.8.	Noise Pollution .....	47
4.9.	Impact on Agriculture and Food Sector .....	47
4.10.	Air Quality.....	47
4.11.	Industrialisation of the landscape .....	48
4.12.	Effects on Biodiversity .....	48
4.14	Induced Seismicity .....	51
4.15	Conclusions.....	52
<b>5</b>	<b>Economic Impact .....</b>	<b>55</b>
5.1	Introduction.....	55
5.2	Economic Analysis .....	55
5.3	The Economics of UOG Development.....	57
5.4	Potential Economic Benefits of UOG Activity .....	59
5.4.1	Royalty Payments.....	59
5.4.2	Employment Benefits.....	61
5.4.3	Summary Benefits .....	62
5.5	Economic Implications on Agriculture.....	62
5.5.1	Supply Curve Analysis.....	62
5.5.2	Demand Curve Analysis .....	64
5.6	Economic Implications on Tourism.....	65
5.6.1	Demand Curve Analysis .....	66
5.6.2	Supply Curve Analysis.....	68
5.7	Economic Implications of Manufacturing .....	69
5.8	Cost Benefit Analysis.....	70
5.9	Conclusions.....	71
<b>6</b>	<b>Social Impact.....</b>	<b>74</b>
6.1	Introduction.....	74
6.2	Demographic Analysis.....	75
6.3	Security .....	78

6.4	Infrastructure .....	79
6.5	Housing .....	81
6.6	Education .....	83
6.7	Community .....	83
6.8	Conclusions.....	84
<b>7</b>	<b>Public Health Impact.....</b>	<b>87</b>
7.1	Introduction.....	87
7.2	Potential Individual Exposures .....	88
7.2.1	Water Pollution .....	89
7.2.2	Air Pollution .....	89
7.2.3	Physical Hazards.....	91
7.2.4	Psychosocial Hazards .....	92
7.3	Potential community health outcomes.....	93
7.3.1	Birth weights of newborn babies.....	93
7.3.2	Increased prevalence of Asthma .....	94
7.4	Conclusion.....	95
<b>8</b>	<b>Human Rights Impact .....</b>	<b>97</b>
8.1	Introduction.....	97
8.2	The European Convention on Human Rights .....	97
8.3	The United Nations.....	99
8.4	Conclusion.....	100
<b>9</b>	<b>Conclusion.....</b>	<b>103</b>
9.1	Introduction.....	103
9.2	Revisiting The Model Of Change.....	103
9.3	Discussing The Environmental Justice Questions.....	104
9.3.1	Does UOG Activity Deliver Distributive Justice? .....	104
9.3.2	Does UOG Activity Share Its Benefits? .....	105
9.3.3	Does UOG activity deliver procedural justice?.....	105
<b>10.</b>	<b>References .....</b>	<b>107</b>

# 1.

# EXECUTIVE SUMMARY

## 1 Executive summary

### 1.1 Introduction

Unconventional drilling for oil and gas (UOG), commonly known as “fracking”, has been one of the most controversial issues in global energy supply over the last 15 years. The Fermanagh and Omagh district sits above the Bundoran Shale formation. Most of the formation sits in the Erne West area of the district. Erne West is also a key part of the UNESCO recognised Cuilcagh Lakelands Geopark, that also covers parts of County Cavan in the Republic of Ireland. In 2019 park management estimated the Geopark had over 474,000 visitors.

The Northern Ireland Executive estimates there are extractable reserves of about 3.2 trillion cubic feet (tcf). At the current market rate of about £2.00 per therm (1 therm is 96.7 cubic feet) these reserves are worth about £66 billion. Given that Fermanagh and Omagh’s Gross Value Added (GVA) is about £1.6 billion, this would seem to represent a significant opportunity.

The market price of gas has been volatile since May 2021 due initially to supply constraints as covid restrictions eased and then since February 2022 because of Russia’s invasion of Ukraine.

Many countries in Europe have enacted bans or moratoriums on UOG activity. As of April 2022, there are moratoriums or bans in every jurisdiction in the United Kingdom and the Republic of Ireland, except for Northern Ireland. Even in Northern Ireland, there is a general planning policy presumption against exploitation of UOG sites, whilst the then Minister for the Economy told the Northern Ireland Assembly on 8<sup>th</sup> February 2022 that he would support a legislative ban.

There are well documented concerns about the environmental damage caused by UOG activity and its subsequent negative effects on the public health, economy and society of communities living in or near UOG areas.

Kroepsch et al (2019) noted that UOG activity would impact on the environmental justice of an area. They asked 3 pertinent questions that are worthy of note here.

- Does UOG activity deliver distributive justice (that the environmental burdens of development are not disproportionately borne by vulnerable populations)?
- Does UOG activity share its benefits with those who take on the burden of development?
- Does UOG activity deliver procedural justice, in that decisions about development are made in an inclusive and representative manner?

This study will attempt to answer these questions.

### 1.2 Current Status of UOG Activity in Northern Ireland

In 2011, four hydrocarbon licenses were awarded in Northern Ireland by the then Department of Enterprise, Trade, and Investment (DETI). These were Fermanagh (Tamboran Resources), Larne Basin (Infrastrata ), Rathlin Island (Providence plc)

and Rathlin Basin (Rathlin Energy). The Department for the Economy has since replaced DETI.

Since 2011, these licenses have either been cancelled, aborted or unsuccessful.

The Strategic Planning Policy Statement for Northern Ireland creates a "presumption against" the extraction of unconventional hydrocarbons "until there is sufficient and robust evidence on all environmental impacts". Fermanagh and Omagh District Council's Local Development Plan (LDP) states in policy MIN04 that "the Council will not permit exploitation of unconventional hydrocarbon extraction until it is proved there are no adverse effects on the environment or public health."

Northern Ireland's Shared Environmental Services team support the Councils to meet their statutory responsibilities as competent authorities when assessing planning applications to ensure they meet the requirements of the Conservation (Natural Habitats, etc) Regulations (Northern Ireland) 1995 (as amended), known as the Habitat Regulations. They would assess the impact of any development where that development is likely to have a significant impact on a designated European site. Planning policy makes it clear that planning permission should be granted only for projects that will not have an adverse effect on European protected sites. The Habitats Regulations require councils to take a precautionary approach, with the legal test being that it is beyond reasonable scientific doubt that the proposal will not have a lasting adverse effect.

In November 2019, a report for the Department for the Economy in Northern Ireland highlighted a consultation on an application for a licence to test a large area in the Southwest of Co Fermanagh for natural gas, with more than 3,000 responses being analysed by the Department.

In 2021 the Department for the Economy in Northern Ireland commissioned the Hatch report to investigate the issues surrounding onshore drilling for gas and minerals in Northern Ireland.

On 8<sup>th</sup> February 2022, the Northern Ireland Assembly debated a private member's bill that would ban UOG activity in Northern Ireland. The then Minister for the Economy participated in this debate. He commented

*As it is a cross-cutting and controversial policy area, on 31 January, I circulated a paper to Executive colleagues outlining the position not just on fracking but on all onshore petroleum licensing activity. My paper recommended that the Executive agree a preferred policy option of a moratorium on all forms of exploration and extraction of oil and gas, to be followed by the introduction of a legislative ban.*

### 1.3 Scale

In order to extract the maximum amount of gas (3.2 tcf), the industry would probably need to build 1,600 wells if local wells met the average productive capacity for a well in the USA of 2 billion cubic feet (bcf) over its life. Tamboran in 2011 estimated they would build 1,440 wells, whilst Belcoo Frack Free, a local campaigning group against UOG activity in the district estimates there would be 1,500 wells. In the USA UOG



companies typically group wells into well pads with about 4 or 6 wells per pad. This implies that there would be 270 well pads in Fermanagh and Omagh, predominately in Erne West. .

The industry may decide to scale back its investment for both economic and political reasons but there is probably a minimum scale of operations that it would need to operate. The industry incurs significant fixed costs, in terms of management and regulatory overheads and in terms of any pipelines it requires. Both these factors suggest the minimum efficient scale is likely to require several hundred wells.

Assuming that all the UOG activity would take place in the Erne West area (500km<sup>2</sup>/193 square miles, 15,000 population in 2020), this produces about 2 well pads and 488 people within a 1 square mile radius area. By comparison on average the USA has 65 people and 1 well pad in the same area.

This would represent a significant industrialisation of the landscape. Mace has commissioned an artist's impression of how a section of Erne West looks today and how it may look following the introduction of significant UOG activity.

**Figure 1.1: Artist's impression of the impact of UOG on the landscape.**



## 1.4 Environmental Impacts

Fermanagh and Omagh contains some beautiful landscapes that are rich in biodiversity. There are several species of fish which are unique to the area, several species of butterfly which are found nowhere else in Northern Ireland and 8 resident species of bat. Most of the area is farmland cultivated by family-run small to medium size farms.

If UOG activity takes place in the district, there are likely to be wide ranging implications for the area. Firstly, the increased HGV movements are likely to devastate the natural tranquillity of the area, damaging roads and leading to hazardous lorry movements through rural communities as well as increasing the levels of hazardous emissions realised by the HGVs. UOG development is likely to severely scar the landscape.

Gas released from the wells is likely to increase background levels of methane in the local area as well as creating consistent noise pollution from fracking processes disturbing residents in the area. As mentioned above on average 488 people will live

within a 1 mile radius of a well pad. Added to this is the risk posed from the deep-earth radioactive elements such as bromide, barium, radon, radium, sodium, uranium, chloride, arsenic which are brought back up to the surface and increase background radiation.

Water levels in the area may drop as water is diverted to shale gas wells. This has implications for boating, plant growth, angling and even electricity production (via more blue green algae affecting hydroelectric plants).

The main environmental impact of UOG activity, however, stems from the use of toxic chemicals used to frack the well. This may have wide ranging implications, from the contamination of drinking water to the surface contamination of farmland. UOG companies guard their chemical recipes closely and so it is impossible to make definite statements, however, 75% could have, respiratory, gastrointestinal, dermatological, and ocular effects whilst 40 to 50% could be neuro-, immune-, and nephrotoxic; whilst 35% percent could be endocrine disruptors; and 25 percent could be carcinogenic.

In addition, these environmental impacts will have a profound ecological impact on the area. Noise, light, and air pollution will affect local fauna such as bats and deer, whilst polluted rivers and loughs will affect fish, and increased seismic activity will cause problems for subterranean animals. All of this of course is taking place in the middle of a UNESCO geopark.

A study by the UK oil and gas authority noted that the geology of UK shale formations was more prone to seismic activity than US shale formations as they were generally smaller in area but deeper in formation.

## 1.5 Economic Impacts

### 1.5.1 The Local Economy

UOG companies usually emphasise the potential economic gains that an area may make if UOG activity commences. These potential gains were the focal point of Tamboran's pitch to the community in 2011. Studies in the USA (Christopherson 2017) have though queried the benefits claimed by UOG companies.

Fermanagh and Omagh has a diverse economy, based on agriculture, manufacturing and tourism, and so introducing a significant new activity into the district is likely to upset the balance of economic activity already taking place. This change may stimulate some sectors but may also lead other sectors into decline. This study focusses on calculating a cost benefit analysis for the local area.

Fermanagh and Omagh's economy is more dependent on agriculture (4.3% of GVA), construction (10.9% of GVA), distribution, transport, accommodation, and food (21.1% of GVA) than Northern Ireland as a whole, the Republic of Ireland and the UK's economies. The share of its economy created by manufacturing activity (17.3% of GVA) is higher than for Northern Ireland as a whole and the UK.

Most farms in the district are relatively small livestock owning farms, operated by a single family. The average farm occupies 35 hectares of land and has about 100

head of cattle and sheep. In addition, there are over 2 million poultry on farms in Fermanagh and Omagh.

The Cuilcagh Lakelands Geopark with its associated attractions such as Marble Arch caves and the 'stairway to heaven' walking trail is the key tourism attraction in Erne West. In 2019 park management estimated 474,000 people visited key attractions in the park.

### **1.5.2 The Possible Benefits Of UOG Activity**

Most of the value of UOG activity in the district will not remain in Fermanagh and Omagh. Profits will go to external shareholders, taxes to the UK HMRC, UOG companies will bring in senior management and technical staff on high wages from outside, and they will import equipment from outside the area. The only 2 benefits that will be retained in Fermanagh and Omagh are any royalty payments made and any increase in local employment (mainly site based).

The Shale Gas industry's trade body, "UK Onshore Oil and Gas" has proposed a charter which sets royalty payments at 1% of revenues and £100,000 per site. For an industry operating 1,600 wells at 270 sites extracting 3.2 tcf, this will generate between £319m and £1,593m using a range for the price of a gas therm between £0.40 and £2.00. Other key assumptions include using a standard NISRA mining and quarrying GVA multiplier of 1.6 and a standard Green Book discount rate of 3.5%. This report uses £295m (assuming a long price of a therm of £0.60).

Tamboran initially assumed UOG activity would create up to 600 local jobs. Christopherson (2017) noted that Texas had seen 4 times the employment benefit compared to Pennsylvania during the latter's UOG boom between 2007 and 2012 as most of the senior and technical staff employed in the industry live in Texas as that is centre of the US energy industry. We would expect a similar pattern to occur in Fermanagh and Omagh. Local people would fill the site based roles rather than the management and technical roles, which would be filled by experienced industry staff from elsewhere. As such the roles would be at close to the local average salary of approximately £25,000 per annum. Over 20 years, using the same multiplier and discount rates as above, this generates a present value of £73m.

These benefits have a total present value of £368m.

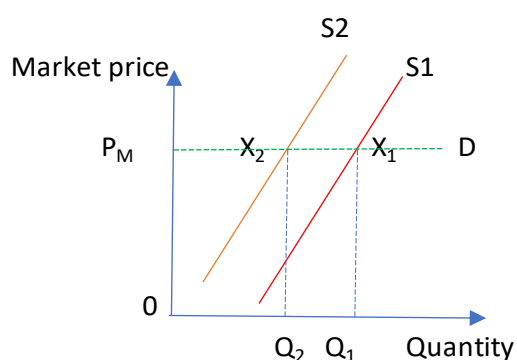
### **1.5.3 The Possible Costs of UOG Activity**

UOG's main economic cost will be its indirect effects on agriculture, tourism, and manufacturing. These are established industries with established demand and supply curves, which will be affected by the introduction of UOG activity.

The main impact on supply curves for agriculture and manufacturing will be that UOG companies will compete with these sectors to procure key resources. They will compete for haulage contracts, labour, and land. The inevitable impact of this increased competition will be a rise in supply chain costs for agriculture and manufacturing. This increase will be local to Fermanagh and Omagh. These sectors compete in wider markets, across the UK, Republic of Ireland and the European

Union. A localised cost increase suggests that Fermanagh and Omagh's farmers will lose market share as the least profitable farms either go out of business or scale down their activities. Manufacturing companies will face a similar problem. Figure 1.2 demonstrates the impact of UOG on local supply costs and their effect on local markets.

**Figure 1.2: The impact of UOG on local supply curves.**



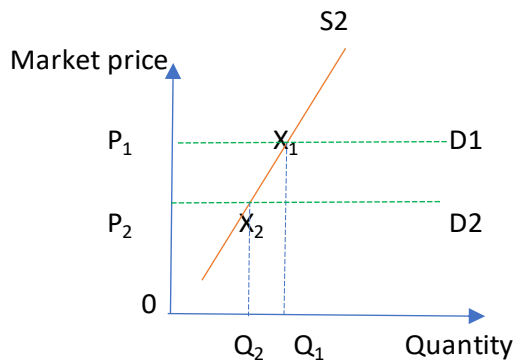
In figure 1.2 the demand curve (D) is assumed to be elastic as local suppliers are competing in much larger geographic markets where customers can easily switch suppliers. The Introduction of UOG activity, causes the supply curve to move from S1 to S2, as input prices for labour and haulage increase. This causes quantity to fall from  $Q_1$  to  $Q_2$  and the value of the sector falls from  $Q_1 X_1 P_M$  to  $Q_2 X_2 P_M$ . Studies in Pennsylvania highlight a 30.3% reduction in the size of the dairy herd in those counties that have seen the most UOG activity (Christopherson and Rightor 2011). Manufacturing will suffer higher costs as UOG companies outcompete it for key resources such as haulage and staff. This study assumed a 5% reduction.

The main effect of UOG activity on demand curves is that it makes the area and the area's offer less desirable for customers. This will almost certainly be true for tourism as the local tourist industry trades heavily on the natural beauty of the Cuilcagh Lakelands Geopark. Introducing 270 well pads covering 370 hectares radically reduces the attractiveness of the area. Kelliman's 2015 study into users of US parklands indicated that a plurality of respondents believed that UOG activity would negatively impact their ability to access parkland. A majority of respondents to the same survey said they would consider visiting another parkland area if it was not affected by UOG activity. Lee and Ramasamy (2021) noted that a key attraction in a Japanese geopark witnessed a doubling in visitor numbers after it secured UNESCO status. The implication being that visitor numbers could fall by 50% if the UNESCO status were withdrawn. The authors also noted the importance of the UNESCO status in marketing an area to foreign visitors.

The impact of UOG activity on the demand for agriculture is perhaps harder to gauge as it depends on whether consumers associate UOG activity with a reduction in food safety. If there is a major contamination event, then this is highly likely but without one the impact is less clear. Ong (2014) noted that farmers in Pennsylvania were struggling to sell into the premium food sectors (like organic).

Figure 1.3 shows the potential impact of reducing demand for a market.

**Figure 1.3: The impact of UOG on local demand curves.**

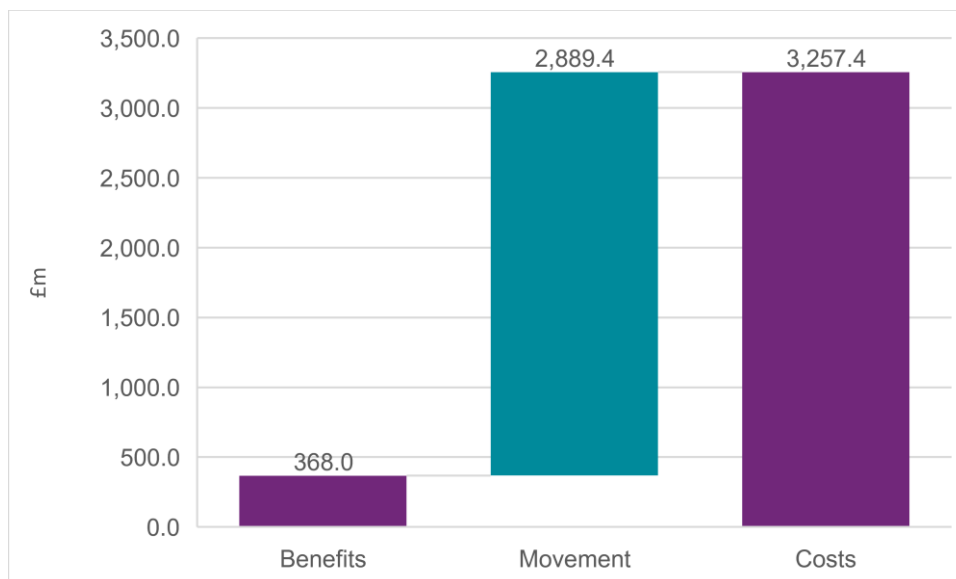


In figure 3, the demand curve falls for local industry from D1 to D2. This causes the price to fall from P<sub>1</sub> to P<sub>2</sub>, the quantity to fall from Q<sub>1</sub> to Q<sub>2</sub> and the value of the sector from Q<sub>1</sub>X<sub>1</sub>P<sub>1</sub> to Q<sub>2</sub>X<sub>2</sub>P<sub>2</sub>.

Modelling these reductions, produced a possible reduction in annual GVA for the district of £114m, with a total present value of £3,257m.

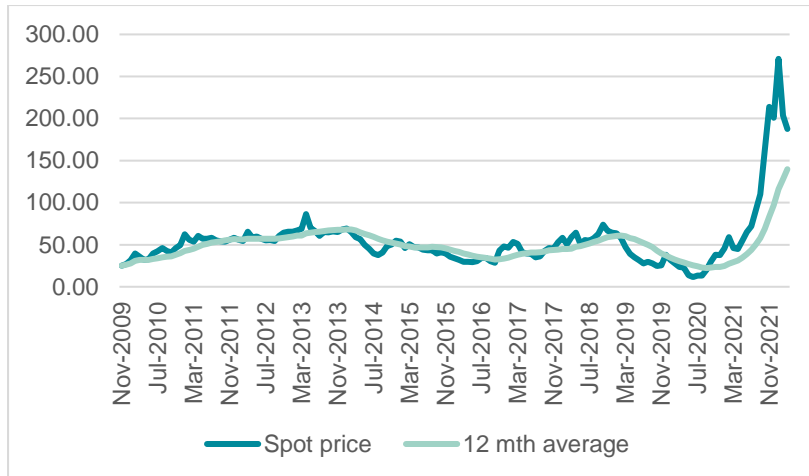
The costs are 9 times the benefits. This cost benefit ratio will deteriorate if a greater impact on tourism and manufacturing are assumed and/or if other external costs such as the impact on public health and public infrastructure (hospitals and roads ) are factored in.

**Figure 1.4: Cost benefit analysis summary**



The ratio needs a price of over £7 per therm for 20 years to bring the benefits into line with the costs. For context, the price was stable at about 50p per therm from 2011 until May 2021. Since then, it has risen up to £2.00 per therm. It has since dropped back to approximately £1.50 per therm, though daily volatility is high. The chart below shows the movement in gas prices over time.

**Figure 1.5: Price of a therm of gas (UK) Cost benefit analysis summary**



Source: <https://www.ofgem.gov.uk/energy-data-and-research/data-portal/wholesale-market-indicators>

## 1.6 Social Impacts

### 1.6.1 Mace Model Of Place.

Mace uses a 7 factor model to analyse the social relations within the community to understand the dynamics within that community. This model assumes that the outcomes for a place depend on the strengths, weaknesses and interactions of its health, education, economy, housing, infrastructure, security, and community.

**Figure 1.6: Mace’s model of place**

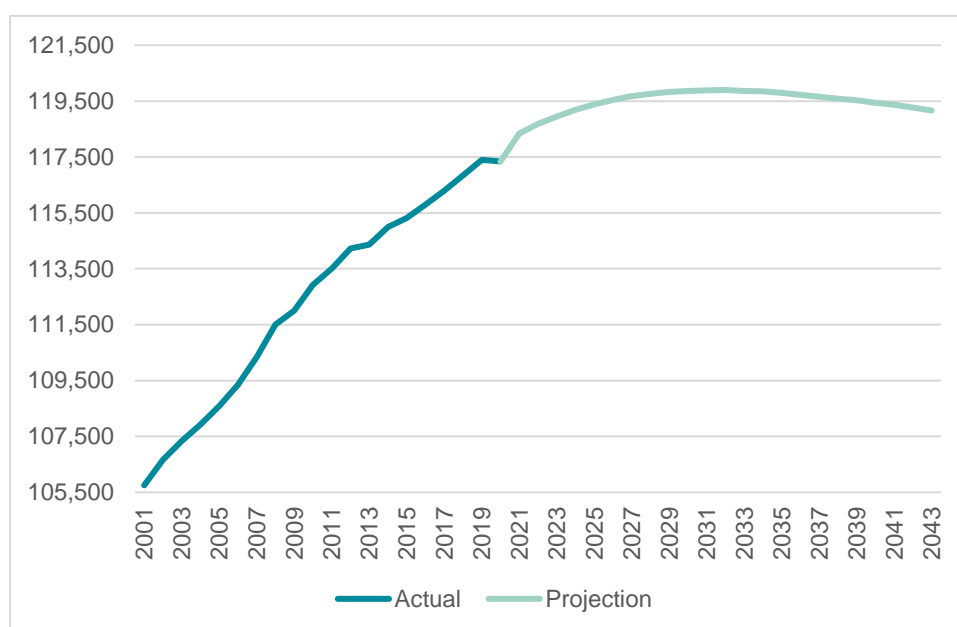


### 1.6.2 Demographics

The demographic analysis of Fermanagh and Omagh presents a familiar picture for a Western European rural area. The general trend has been for population growth rates to slow this century until population figures either stagnate or decline from about 2030 onwards. Whilst numbers are forecast to stagnate, the age profile of the population though is becoming ever older. The proportion of older people (defined as 65 or older) will increase from 13% in 2001 to 32% by 2043.

The population has increased since 2001 at a compound annual growth rate of 0.52% to reach 117,337 in 2020. However official population projects expect growth to slow between 2020 and 2032, before the population stagnates and falls slightly to 2043.

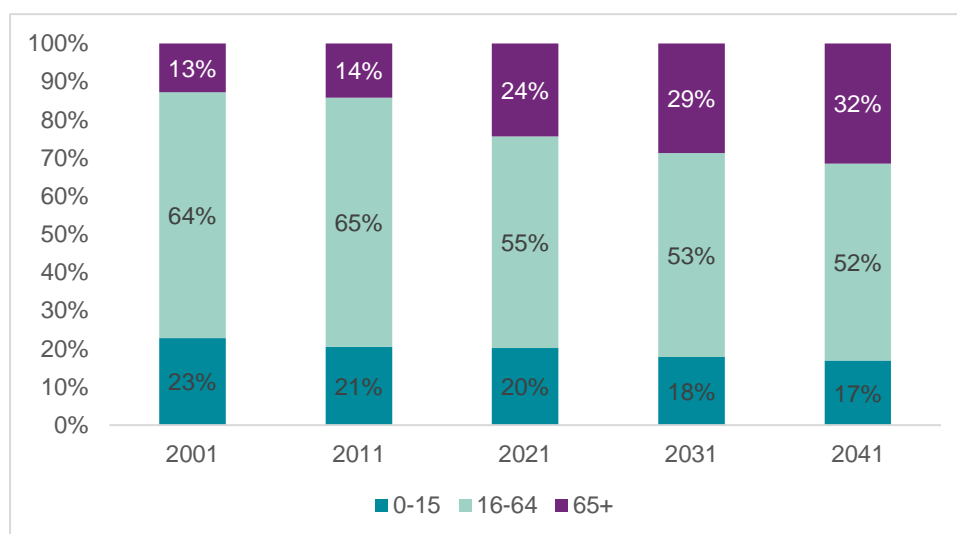
**Figure 1.7: Fermanagh and Omagh's population 2001-43**



Source: NISRA Mid-Year Population Estimates and 2018 Based Sub National Population Projections

Fermanagh and Omagh's population growth was slightly lower than Northern Ireland's and the UK's, whilst the Republic of Ireland's growth rate was significantly higher than any other geographical area under consideration.

In common with most areas of Western Europe, Fermanagh and Omagh is experiencing an aging population.

**Figure 1.8: Fermanagh and Omagh district's age profile over time**

Source: UK NOMIS Database for F&O.

The demographic numbers suggest that in the long term the major challenge facing Fermanagh and Omagh will be to attract and retain younger people to the area. This will require the area developing a compelling offer for this segment.

### 1.6.3 Security

This refers to a general sense of wellbeing.

As well as air pollution, UOG wells create a number of detrimental side effects that will make people less happy and so less secure. One of the main issues is the risk of increased seismic activity. Williams et al (2017) noted that in focus groups held in the UK, seismic activity came up as a key issue for participants. A strong tremor will be felt for several kilometres from the site of the well and so will have a community affect.

UOG activity also produces significant noise and light pollution for its neighbours. Sites usually have a gas compressor (to compress the captured gas, so it is easier to store and transport) which run constantly and generate a noise of 85-95 decibels. This is the equivalent of motorcycle engine running. Most noise charts produced by hearing specialists regard 90 decibels as "loud to very loud." In addition, once a well produces gas, it will produce gas continually until all the recoverable gas in that given fracture has been recovered. As mentioned earlier there will be on average about 488 people living within 1 mile of a well. One cycle of drilling takes place over weeks and months. As such sites are 24 hour 7 days per week operations and require large industrial lights to maintain operations during darkness. This will create significant light pollution and day and night noise for anyone living nearby.

### 1.6.4 Infrastructure

UOG activity will place a burden on a place's public infrastructure. The most immediate problem concerns the impact on the roads. A 2012 study by the



University of Texas estimated it took an average of 1,184 lorry movements to set up a well, 353 annual movements to maintain a site and 997 movements to redrill a site (about every 5 years). These movements assume that the gas is transported out by pipe, rather than by lorry. If transport is by lorry there will easily be a further 365 lorry movements per year. These heavy lorries (weighing 30-40 tonnes when fully laden) will create significant wear and tear on the district's roads.

In addition, the health implications of poor air quality will put pressure on local health services. There will likely be more people with chronic breathing conditions such as asthma and bronchitis, and illnesses which affect breathing (such as covid 19) may be more severe than previously.

UOG activity will bring with it a large transient labour force of engineers. Many of these people will be temporary immigrants to the district. However, they will still put pressure on key public services, such as GP services and Accident and Emergency services during their stay in the district. This pressure may increase if some of the engineers decide to settle for a period of time in the district and so bring their families with them.

The Bengoa Report of 2016 highlighted Northern Ireland's health care system is under huge pressure compared to other parts of Great Britain and Ireland. Table 1.1 shows the relative performance of Northern Ireland's health service compared to its English counterpart on 2 key health service measures (cancer treatment and A&E stays).

**Table 1.1: Health service outcomes in Northern Ireland and England**

Key Health statistics	Northern Ireland (Dec 2021)	England (Jan 2022)
%age of cancer patients receiving 1 <sup>st</sup> definitive treatment within 62 days of referral.	43%	62%
%age of A&E patients being treated with 4 hours.	48%	75%

Source: NI Dept of Health for NI statistics. NHS England for English statistics.

A Northern Ireland Water report in March 2022 identified that 16 (3 of these are in the Erne West area) out of 66 wastewater treatment works in Fermanagh and Omagh have no capacity at all to serve more developments in their catchment, whilst another 13 (5 in Erne West) have limited capacity for growth. Well pads, as places of work, will need to provide staff with adequate kitchen and bathroom facilities. This may be an issue for new well pads near these wastewater treatment works, and temporary treatment systems may not be appropriate given the location to Lough Melvin SAC which has an unfavourable total phosphorus concentration (Schulte, D.G. Doody, 2009).

### 1.6.5 Housing

UOG activity may have an impact on local housing markets due to the increased demand for housing that may result from a transient population of engineers wanting accommodation in the area.

NISRA statistics that use a standardised housing model (that accounts for differences between districts in terms of the mix of property types) suggest that Fermanagh and Omagh's house prices have maintained a fairly constant relationship with Northern Ireland's house prices (at about 90-95% of the average). Ulster University's quarterly housing index shows that Fermanagh and Omagh's raw house prices are the highest in Northern Ireland as at quarter 4 2021, presumably because the local housing market is more weighted towards larger properties than other districts in Northern Ireland.

Any UOG activity within the district will put pressure on this already overstretched housing market. The extent of the pressure will depend on how many transient engineers work in Fermanagh and Omagh and what proportion of them seek to buy a house in the district. Engineers working on setting up wells will seek to stay in hotel rooms, but those individuals involved in the operations and maintenance of wells may decide to rent or buy in the area. Experienced engineers are likely to earn above the mean wage for the area and so these individuals would be able to participate fully in the local housing market, which given the low volume of transactions in Fermanagh and Omagh will drive prices up.

### 1.6.6 Community

Community means the relationships and networks that link individuals and groups in a place. A major change to a place, such as the introduction of a new economic activity such as UOG drilling is likely to disrupt the settled pattern of relationships and networks. It will inevitably create winners and losers. Whether this is beneficial to an area depends on the numbers of winners and losers and the degree to which groups and individuals feel they have benefitted or otherwise.

The interaction of these 2 factors means there is, theoretically 4 potential outcomes of introducing a major change on a community.

**Figure 1.9: Potential impact on a community of a major change**

Net Winners	Status quo	Thriving
Net losers	Disengaged	Disenfranchised
	Weak	Strong

Introducing UOG activity into Fermanagh and Omagh produces a clear list of groups who may experience a deterioration in their quality of life. These groups include:

- Farmers who will pay more for labourers and haulage and may see a reduction in demand.
- Anglers and hikers, and other visitors to the Cuilcagh Lakelands Geopark
- Tourist industries who see their key attraction, which is the natural beauty of the area, undermined.
- People with breathing difficulties.
- People seeking to purchase houses in the district.

- The roads authority and local communities seeing a deterioration in road quality due to truck movements.

The potential winners from introducing UOG activity into the district include.

- Haulage contractors
- Hoteliers (in the short term)
- People selling their houses and leaving the district.

Generally, the losers are widespread and numerous whilst the winners are concentrated in some groups. The winners will probably experience a small increase in their income due to UOG activity, whilst certain losers will lose significantly, for example tourist businesses and farms that either close or scale back and residents who suffer deteriorating physical and mental health. This probably means UOG activity will lead to a weakened, disengaged and possibly disenfranchised community.

## 1.7 Public Health Impacts

The following schematic sets out how the introduction of UOG activity may affect local health outcomes.

**Figure 1.10: Link between UOG activities and health outcomes.**



Studies have repeatedly shown that UOG activity increases water, air, noise, and light pollution in an area. In addition, the increase in lorry movements makes the place more dangerous and there is a risk of increased seismic activity.

Individuals then become exposed to these increases, and it will affect health outcomes. Gorski and Schwarz (2019) highlight that the most obvious health outcomes will be a rise in asthma cases and a deterioration in health outcomes. Rasmussen and colleagues in 2016 conducted the major study into the links between UOG activity and asthma, involving 35,508 asthma patients treated 2005 to 2012. The authors' concluding remarks were "Residential UNGD [UOG] activity metrics were statistically associated with increased risk of mild, moderate, and severe asthma exacerbations."

In addition, 6 studies in the USA have found a link between expectant mothers living near UOG wells and a deterioration in birthing outcomes (either more underweight babies and/or more early births). Low birth weight babies are more prone to a range of adverse health outcomes in later life.

Northern Ireland is still recovering from the period known as “the Troubles”. This has left Northern Ireland with a complex community mental health situation. As a 2011 report by the Commission for Victims and Survivors notes

*“The prevalence of PTSD in Northern Ireland is the highest of all countries that have produced comparable estimates including the USA, other Western European countries and countries that have experienced civil conflict in their recent history. The prevalence of lifetime mental health disorders and ‘post-conflict’ disorders amongst those exposed to conflict-related events.”*

UOG activity is likely to exacerbate this situation for 2 main reasons. UOG activity will despoil the landscape and create significant pollution, which will then impact on people’s overall sense of wellbeing. In addition, the introduction of UOG will probably take place in an environment where many local people will be opposed to its introduction. The feeling of powerlessness if UOG activity commences without popular support will be significant and may cause “collective trauma” (Short and Szolucha 2019).

## 1.8 Human Rights Impacts

The European Court for Human Rights has ruled in 5 cases that Article 8 of the European Convention on Human Rights (ECHR) that covers the individual’s right to a private and family life includes the right to be consulted on major local changes.

Citizens in Fermanagh and Omagh could sue local authorities at the European Courts. In addition, they could try to sue in UK courts for a breach of the UK Human Rights Act. This act incorporates the ECHR into UK law and UK Courts must acknowledge European rulings in their cases.

The International Court of Justice handles disputes between states. It has ruled on cases where a claimant state has alleged a defendant state has polluted a joint asset causing harm to the claimant state. If the Republic of Ireland thought that UOG activity in Fermanagh and Omagh had adversely affected it, it may have grounds to sue the Northern Ireland authorities.

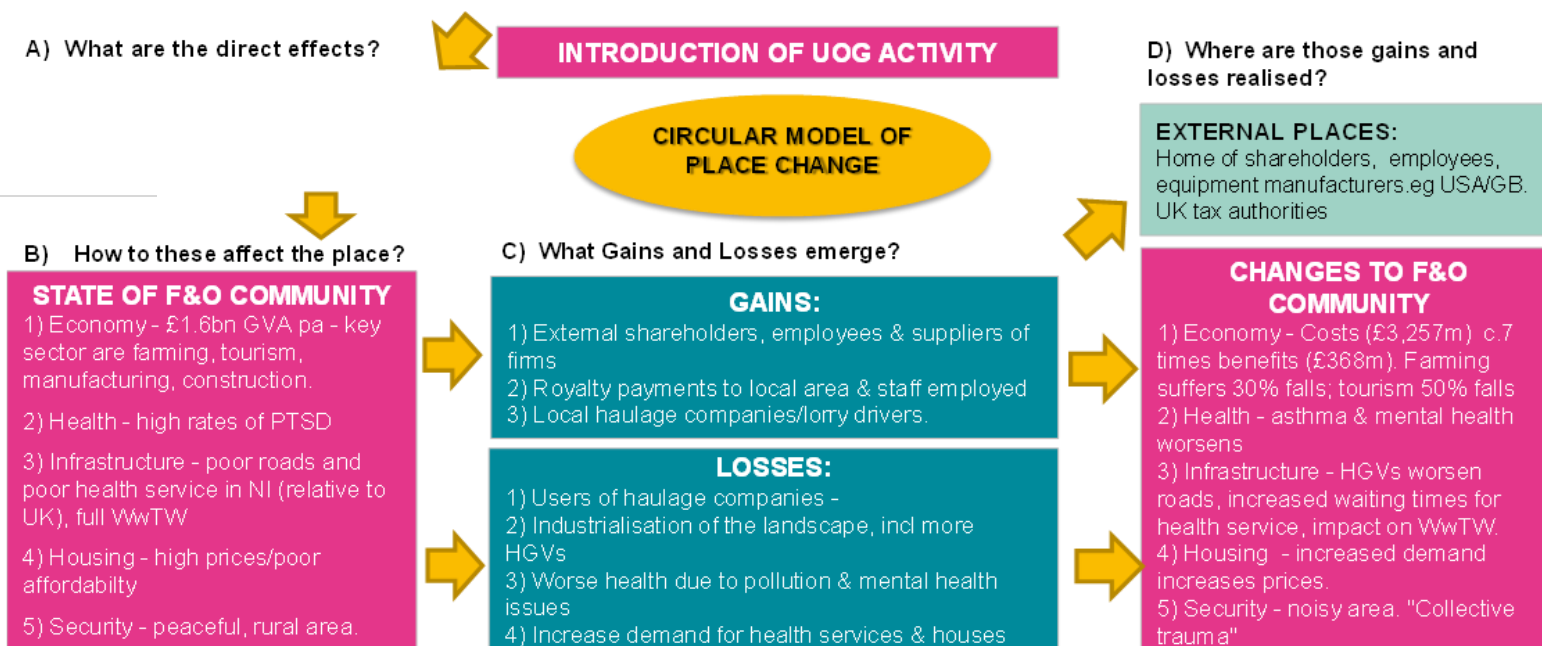
## 1.9 Conclusions

### **Mace model of change**

The diagram below sets out how the introduction of UOG activity will cause some direct effects that will interact with the people and place to create winners and losers. These will change the nature of the place.

### **Figure 1.11: Model of change**

Draft Study into The Adverse Impacts of Unconventional Oil and Gas Development  
V3.0 June 2022



The main conclusions from this model are:

- The introduction of UOG activity on a significant scale into Fermanagh and Omagh will represent an industrial revolution at light speed for the area. Large tracts of land will be transformed from agricultural to industrial use in the space of 5 years.
- The speed and scale of change will produce significant winners and losers due to new investment and jobs, balanced by increased competition for resources and significant increases in pollution levels.
- The issue for Fermanagh and Omagh is that it will be left with all the losses but most of the major gains will leak outside the district to external shareholders, external employees, and external equipment manufacturers.
- This produces a significant economic cost relative to the local benefits for the area, as well as a despoiled landscape, adverse impacts on public infrastructure and worsening public health outcomes.
- After 20-25 years the UOG industry will wind down in the area, leaving no long term gains but plenty of long term losses. The losers will be unlikely to be able to recover once UOG activity ceases.

### Discussing the Environmental Justice Questions

This study opened by listing Kroepsch et al's (2019) 3 questions concerning environmental justice. The analysis in this study provides some possible answers to those questions.

*Does UOG activity deliver distributive justice?*

A key principle of environmental justice is that a change does not make a disadvantaged group weaker. Any UOG activity within Fermanagh and Omagh will have major adverse implications for at least 4 disadvantaged groups – children,

young people, farmers, and those with mental health issues, such as Post Traumatic Stress Disorder (PTSD)

Given these factors then the introduction of UOG activity is likely to worsen distributive justice in the district.

*Does UOG activity share its benefits?*

The industry has usually claimed that UOG activity creates a significant economic benefit for the area affected.

However, as the economic analysis suggests, the economic costs of UOG activity are likely to be significantly higher to Fermanagh and Omagh than the benefits it provides. A lot of the economic benefits may not accrue to the district at all. Foreign shareholders, foreign equipment manufacturers, and foreign senior and technical staff will take the majority of the benefits, leaving the local area with just royalty payments and some site based roles. Against that this study suggests significant economic damage to farming (through higher costs and lower demand), tourism (through lower demand), and manufacturing (through higher costs).

This analysis did not factor in the environmental, health or public infrastructure costs which will be significant but will be harder to quantify.

*Does UOG activity deliver procedural justice?*

Short and Szolucha (2017)'s analysis of the introduction of UOG activity in Lancashire shows the impact of introducing a new activity into an area without local support. People feel disenfranchised and helpless and start to suspect that local institutions are not working in their best interests. Fermanagh and Omagh would almost certainly see a similar situation to Lancashire.

Local people would have rights of redress to protect their human rights via the courts. UK courts would need to consider whether they agreed with European courts that the European Convention on Human Rights (ECHR)'s article 8 rights extended to environmental protection. Even if UK courts rejected this approach local people would still have the right to appeal to European courts. However, civil legal action at high court level is costly and time consuming. If this is only right to redress left open to local people, then it is difficult to see how this delivers procedural justice.

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# 2.

# I N T R O D U C T I O N

## 2 Introduction

### 2.1 Background

Unconventional drilling for oil and gas (UOG), commonly known as “fracking”, has been one of the most controversial issues in global energy supply over the last 15 years.

There has been extensive UOG activity in the USA and Australia. In the USA alone, there are 45,000 wells, which have produced over 600 trillion cubic feet of gas. To put that in context Northern Ireland’s Department for the Economy believes that the maximum recoverable reserves from the Bundoran shale area in Northern Ireland is 3.2 trillion cubic feet. North America’s UOG industry has revitalised its domestic gas production over the past 20 years.

By contrast many countries in Europe have enacted complete bans or moratoriums on UOG activity. As of April 2022, there are moratoriums or bans in every legal jurisdiction in the United Kingdom and the Republic of Ireland, except for Northern Ireland. Even in Northern Ireland, planning guidelines have a planning bias against supporting allowing UOG sites, whilst the current Minister for the Economy told the Northern Ireland Assembly on 8<sup>th</sup> February 2022 that he would support a legislative ban.

Fermanagh and Omagh consists of well-established communities with a population of over 117,000 (2020) covering nearly 3,000 km<sup>2</sup> and an economy worth about £1.6 billion per annum. Any significant introduction of UOG activity will affect the dynamics of both the community, the land, and the economy.

The Fermanagh and Omagh reserves are worth between £13 billion and £66 billion depending on the market price for gas (the lower figure uses 40p per therm, whilst the higher figure assumes £2.00). This seems to represent a significant opportunity.

And yet there is considerable local opposition to UOG activity in Fermanagh and Omagh, as evidenced by groups such as Fermanagh Fracking Awareness Network (FFAN) and Belcoo Frack Free. Opposition to UOG activity in Fermanagh centres on the experiences of UOG in communities in North America.

There are well documented concerns about the environmental damage caused by UOG activity and its subsequent negative effects on the public health, economy and society of communities living in or near UOG areas.

Kroepsch et al (2019) noted that UOG activity would impact on the environmental justice of an area. They asked 3 pertinent questions that are worthy of note here.

- Does UOG activity deliver distributive justice (that the environmental burdens of development are not disproportionately borne by vulnerable populations)?
- Does UOG activity share its benefits with those who take on the burden of development?
- Does UOG activity deliver procedural justice, in that decisions about development are made in an inclusive and representative manner?

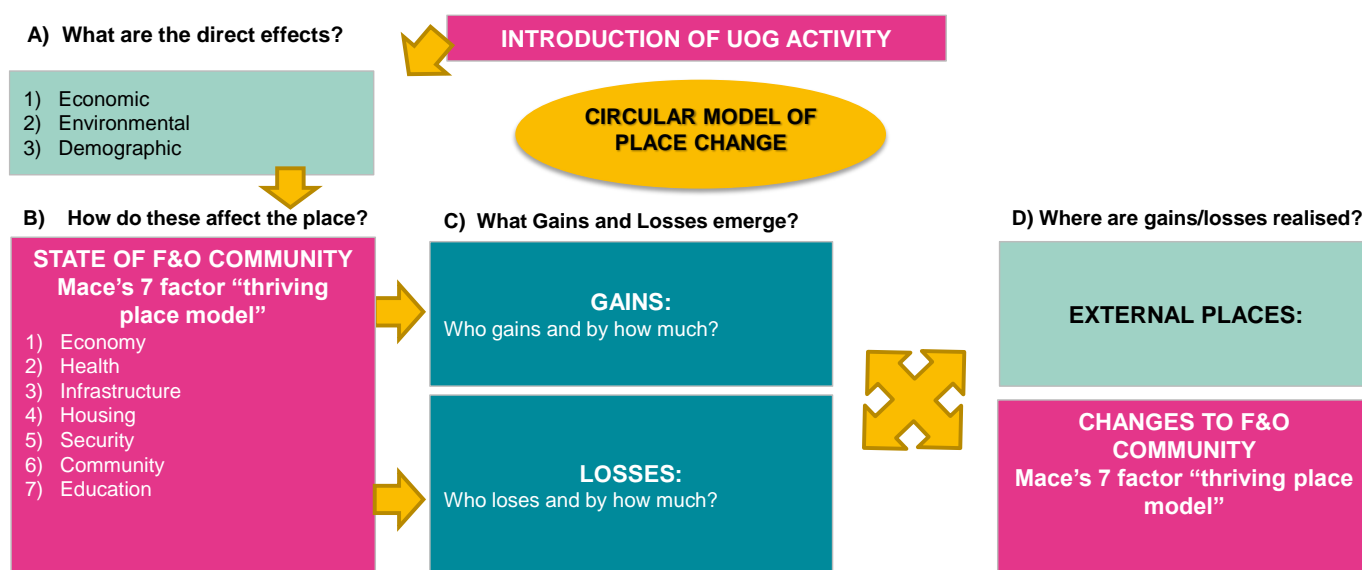
This study will attempt to answer these questions.



## 2.2 Model of Local Change

The introduction of UOG activity into an area is likely to bring significant change. It is important to develop an analytical framework to help understand how this change may affect an area. Figure 2.1 presents a schematic model of how UOG activity may impact Fermanagh and Omagh.

**Figure 2.1: Model of local change**



The model has a number of phases.

1. What is the nature of the change taking place?
2. How does this change the local environment, society, and economy?
3. How does this affect the people and place?
4. Who wins and loses from these changes and by how much?
5. Where are the gains and losses realised? – Are the gains and/or losses leaking out to another area. An activity's cost benefit analysis can look very different depend on which area is being analysed.

This report will use this model to analyse the possible impact of introducing UOG activity into Fermanagh and Omagh.

## 2.3 Objectives

Fermanagh and Omagh Council set the remit for this study.

Its objectives, as published in the Terms Of Reference, were as followed:

*“Fermanagh and Omagh District Council wishes to commission a study of published articles in scientific journals/peer reviewed articles and scientific evidence to inform the submission of a Council response to a future public consultation on the NI Executive’s preferred policy option in respect of future onshore petroleum exploration*

*and production, including Unconventional Oil and Gas (UOG), in Northern Ireland. The study should consider and reflect the potential adverse:*

- (i) societal, including public health and human rights impacts;*
- (ii) environmental impacts, including in respect of protected habitats and of climate change; and*
- (iii) economic impacts, including the impacts on the agriculture and tourism sectors locally, displacement of jobs and other investment.”*

*on the Fermanagh and Omagh district in the event of a policy option to support UOG development in both the exploration and commercial extraction phases.”*

## 2.4 Methodology

The report is essentially a desk top analysis of the situation. No field work, other than interviews, took place. The main methodological approach consists of

- 1 A review of over 50 academic papers on UOG.

These papers mainly consider issues in the USA given that this has had by far the most UOG activity in the world. At least 4 papers consider events in England, especially Lancashire. These studies cover many themes, including the environment, public health, community cohesion, economics, implications for agriculture, and implications for tourism.

The review covered all the main areas of the report and prioritised papers which discussed issues in England and also papers which served as “literature” reviews, such as Krupnick and Echarte (2017) for economics and Gorski, and Schwarz (2019) for public health.

Within the USA, the state of Pennsylvania is perhaps the most appropriate comparator for Northern Ireland for several reasons. UOG activity in the state has concentrated in Northern and Western counties, which are mainly rural areas based on dairy farming. As the analysis in section 4 indicates Fermanagh and Omagh is also a rural area, specialising in livestock farming. In addition, many of the counties in Northern and Western Pennsylvania are of a broadly similar size to Fermanagh and Omagh, meaning that the scale of activity in a county, such as Bradford County, which occupies a similar land area as Fermanagh and Omagh, could translate to Fermanagh and Omagh. Finally, UOG activity in Pennsylvania started later than in other areas of the USA, such as Texas or California, and the state is not close to the centre of the US energy sector in Texas. As such Pennsylvania has neither 1<sup>st</sup> mover nor key location status, which is similar to Fermanagh and Omagh.

The report references academic papers by quoting the author’s name and year of publication. If several people wrote the paper, then the report will refer to the authors by the lead author’s name with “et al” afterwards to indicate multiple authors.

These references are then reproduced in the reference section at the end with the full title of the report. Where possible, there is a link to help the reader find the report online.

- 2 A review of key economic, agricultural, demographic and health data for Fermanagh and Omagh.

This study also included figures for relevant comparator geographies, such as Northern Ireland, the Republic of Ireland, the United Kingdom, and England. This review provided the background for understanding the area of Fermanagh and Omagh and what the implications for UOG may be in the district.

- 3 A series of 10 interviews with representatives of key departments and institution. The organisations represented were.
  - Lead Planner, Fermanagh, and Omagh Council
  - Head of Regulatory Services, Fermanagh and Omagh Council.
  - Lead Climate Change Officer, Fermanagh and Omagh Council.
  - Data Science and Intelligence Lead, Fermanagh and Omagh Council.
  - NI Department of Agriculture, Environment and Rural Affairs (DAERA).
  - NI Department for the Economy.
  - Local campaigners against UOG activity in Fermanagh and Omagh.
  - Waterways Ireland.
  - Tourism NI.
  - The Shared Environmental Services (SES)

All the interviews took place via Microsoft Teams.

## 2.5 Structure

The report's structure follows the council's criteria. There are sections on the economic, environmental, social, public health and human rights implications of UOG activity in the Fermanagh and Omagh district. These sections follow a background section which explains what is meant by UOG, the history of UOG activity in England and Northern Ireland and an attempt to quantify how much UOG activity may take place in Fermanagh and Omagh if it was ever allowed to take place.

Finally, there is a conclusion which summarises the findings in the report.

# 3 .

## U N C O N V E N T I O N A L O I L   A N D   G A S B A C K G R O U N D

## 3 Unconventional Oil and Gas Background

### 3.1 Overview of UOG Processes

Hydraulic fracturing, otherwise known as “fracking”, is one of the methods used within the broader process of unconventional development of oil and natural gas (UOG). The local development plan defines fracking as “This process means the generation of mechanical fractures in rock below the surfaces by means of the physical process of pumping fluid at high pressure into the rock via a petroleum wellbore for the purpose of enhancing the flow of all hydrocarbons between the rock and the wellbore.” Fracking is typically a large scale operation, requiring 40,000 horsepower diesel pumps for injecting fluid into the rock, the construction of miles of pipelines, production of large quantities of contaminated wastewater, compressor stations and requirements for huge numbers of heavy goods vehicles.

Shale is a common type of sedimentary rock. Shale gas is a natural gas mostly composed of methane, which can be found trapped in shale with very low permeability. It is referred to as an ‘unconventional’ gas. It does not readily flow into a well without additional intervention, such as fracking.

Hydraulic Fracturing is not a new technique. In the US, fracking is now a proven drilling technology used for extracting oil, natural gas, geothermal energy, or water from deep underground. Since then, more than 1.7 million wells have been completed using the fracking process, producing more than seven billion barrels of oil and 600 trillion cubic feet of natural gas.

Broadly speaking the fracking process for shale gas can be divided into the following stages:

1. **Exploration** (approx. 2-6 months): a pad is built, and a drilling rig installed to carry out exploratory drilling to identify if shale gas/oil can be produced profitably. Typically, a small number of vertical wells are drilled (perhaps two or three). This stage can involve activities such as seismic surveys, transport of equipment, water, and chemicals in and out of the site, and one or more fracks. Fracking for shale gas in the UK is at exploration stage.
2. **Moving into production** (approx. 6 months-2 years): if the site is found suitable for production, more wells may be drilled and fracked.
3. **Production** (approx. 20 years): this involves the commercial production of shale gas. Horizontal wells are likely to be drilled and fractured. However, overall level of activity likely to decline. Some maintenance activities and possibly some further wells may be drilled.
4. **Decommissioning and restoration**: Similarly, to any other well, once a shale gas well reaches the end of viable production life, the site is abandoned and restored to its original condition. This can involve filling sections of the well with cement to prevent gas flowing up, and covering wells with a cap. This can happen at any stage, depending how the site develops

As well as the overview given above the technical Breakdown of the Fracking Process is as follows:

- 1) First, a "wellbore" or hole, is drilled down to the layer of gas-rich shale. The shale layer can commonly be up to 2km below ground level with drilling taking up to a month to be completed. The well is then lined with a steel casing to prevent the contamination of nearby groundwater.
- 2) Once the drill reaches down to the shale layer, it turns and begins to drill horizontally, again, for up to 2Km or more along the rock.
- 3) A "perforating gun" loaded with explosive charges is then lowered into the well and punctures holes to open up fissures in the shale throughout the horizontal section of the well.
- 4) The next stages consist of the actual fracking, or "completion" stage. A mixture of water, sand, and chemicals is pumped into the well at extremely high pressures which permeates through the tiny holes in the casing, opening the fissures in the shale rock. The sand is used to hold the cracks open, and the chemicals help the natural gas seep out.
- 5) The "flowback" stage: The water and chemicals flow back out of the well and are taken for disposal or treatment.
- 6) Finally, natural gas begins flowing from the shale and up out of the well, where it is normally shipped to consumers via pipeline. A typical well can produce gas for 20 to 40 years, pumping out thousands of cubic metres of gas each day.

**Figure 3.1 – Table Representing the Key Components of UOG activity**



Figure 1 Fracking Drill Bit



Figure 2 Typical Fracking Rig



Figure 3 Typical piping and pad site setup



Figure 4 Typical piping and pad site setup

Fracking the Bakken Formation in North Dakota

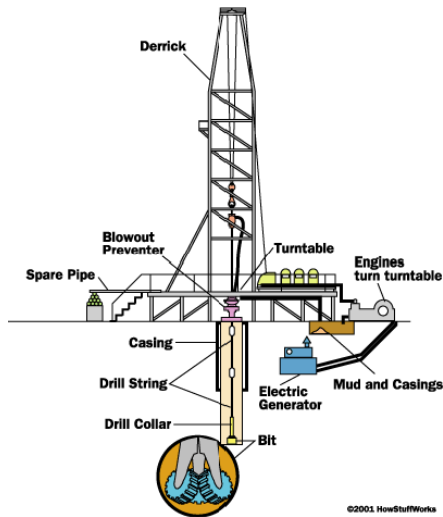


Figure 5 Fracking Setup

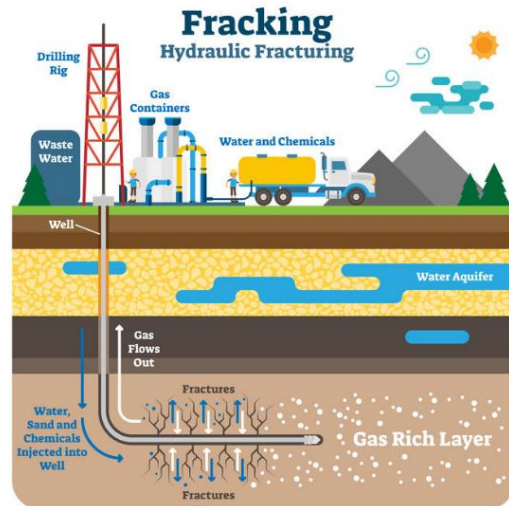
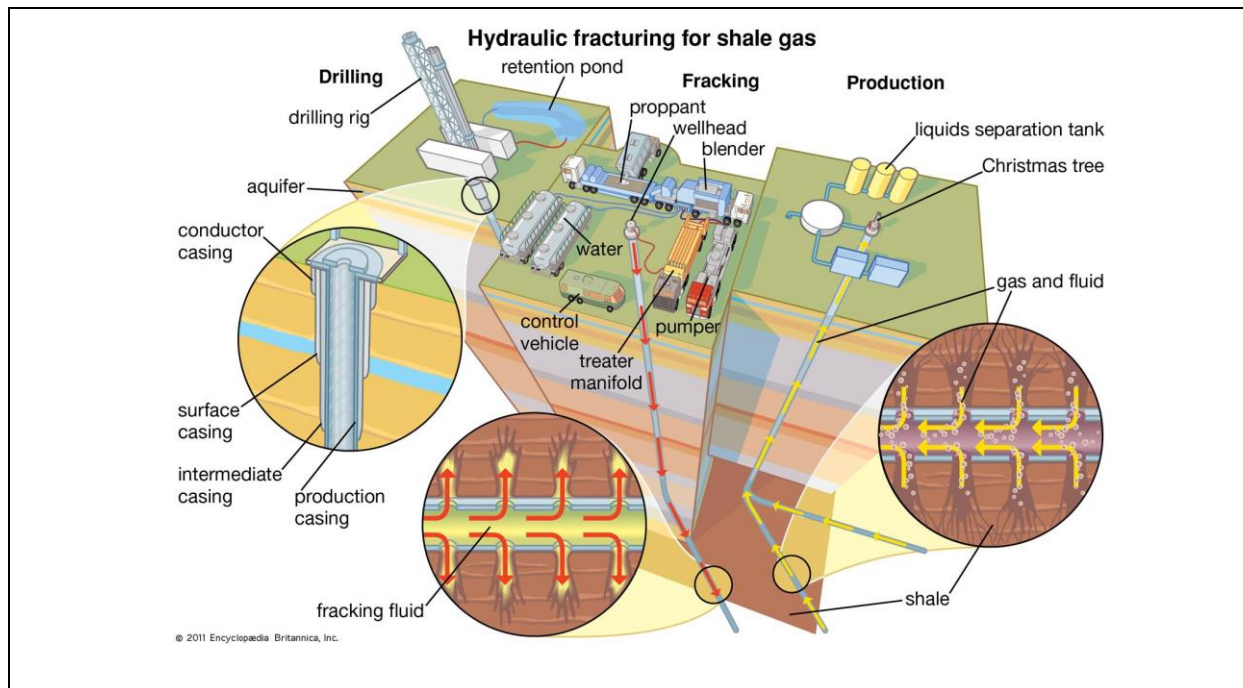


Figure 6 Fracking Setup



### 3.2 Water Requirements of UOG activity

UOG development is a water-intensive industry. The process requires water to be pumped into wells to extract the gas. Therefore, a major concern for locating wells is the proximity to appropriate water sources.

The amount of water required to drill a well depends on the geology of the area and the type of shale rock. A study undertaken by the Department for Energy and Climate Change indicates that fracking water requirements will consume between 10 and 25 million litres per well over its lifetime. This is the equivalent to the annual consumption of around 160 average UK homes.

### 3.3 History of UOG development in Northern Ireland and England

#### 3.3.1 General UK context

The UK has experience of hydraulic fracturing and directional drilling for non-shale gas applications. The first UK well to encounter shale gas was drilled in West Sussex in 1875 and in 1895 the nearby Heathfield well produced enough gas to light the local railway station until well into the 20th century. Since then, hydraulic fracturing has grown in the United Kingdom since the 1970's, where fracturing took place offshore in the oil and gas fields of the North Sea and used in around 200 oil and gas wells since. However, UOG development only recently gained mass public attention since the requirements for licences were introduced for onshore shale gas exploration in 2008.

In 2008, Cuadrilla Resources were permitted the first petroleum and exploration development licence to access to shale and gas exploration along the coast of Lancashire. Hydraulic fracturing was performed in March 2011 but then halted by



May 2011 due to seismic activity damaging the casing of the well. Damage to well casings is one of the main ways in which toxins used in the fracking process can leech out into the wider environment and so damage the ecology of the area. A major issue with seismic risk is that it is impossible to accurately predict its effects in the real world. A small change to the magnitude and location of the tremor can result in significantly different effects at ground level. The same month, another shale gas exploration well was halted at Preese Hall at Weeton in Lancashire after the process triggered two minor earthquakes.

This instigated a report by the Royal Society and Royal Academy of Engineering to investigate the earthquake risk of UOG activity. The report indicated that the earthquake risk was minimal and recommended that UOG development be given nationwide clearance.

On 2 November 2019, the UK Government announced that it would take a presumption against issuing any further Hydraulic Fracturing Consents in England, effectively creating a moratorium. The Government decision was taken on the basis of an interim report by the Oil and Gas Authority which found that it is not currently possible to accurately predict the probability or magnitude of earthquakes linked to UOG operations, and so the presumption must be that the industry cannot guarantee the maximum extent of induced seismic activity. This led to the government making a statement that more exploratory work would need to be undertaken to determine whether shale could be a viable energy source and until then shale exploration would be paused. Alongside this the government has since been undertaking crucial work on communication surrounding shale gas extraction to increase public acceptability.

The topic received considerable public debate on environmental grounds, with a 2019 high court ruling ultimately banning the process. The licensing of onshore oil and gas has been devolved to Scotland and Wales. The Scottish Government confirmed its final policy position of no support for unconventional oil and gas in October 2019; the Welsh government confirmed that UOG development would not be supported in Wales in December 2018.

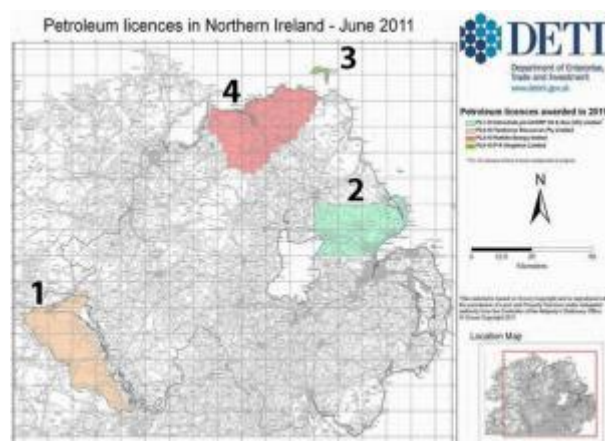
The two remaining high-volume fracturing wells were supposed to be plugged and decommissioned in 2022, but this has yet to happen. In April 2022, the High Court extended the deadline to decommission the wells to June 2023.

In April 2022 there were some notable developments concerning the future of UOG development in England. The UK Government published its energy strategy for the next 10 to 15 years. Whilst this focussed on new nuclear and renewable developments, it was silent about the possibility of a resumption of UOG activity in England. Two days before the publication of the strategy, the UK business secretary, Kwasi Kwarteng MP, had set up a desk top study to look into the possibility of resuming UOG development in England. He commented that “unless the latest scientific evidence demonstrates that shale gas extraction is safe, sustainable and of minimal disturbance to those living and working nearby, the pause in England will remain in place.”

### 3.3.2 Northern Ireland Context

The majority of Northern Ireland's energy comes from fossil fuels. Coalfields have not been mined since the 1970's. The two main power stations are powered by natural gas and Northern Ireland is served by large gas pipelines from Scotland. This gas originates mainly from the North Sea reserves, which are now approaching depletion.

In 2011, four hydrocarbon licenses were awarded in Northern Ireland by the then Department of Enterprise, Trade, and Investment (DETI).



1. Fermanagh (Tamboran Resources)
2. Larne Basin: Infrastrata
3. Rathlin Island (Providence plc)
4. Rathlin Basin: Rathlin Energy

The Department of Economy has since replaced DETI.

Since 2011, these licenses have either been cancelled, aborted or unsuccessful.

UOG development remains a highly controversial subject in Northern Ireland. The Department for Economy is responsible for granting petroleum licences in Northern Ireland under powers granted by the Petroleum (Production) Act (Northern Ireland) 1964. The Strategic Planning Policy Statement for Northern Ireland creates a "presumption against" the extraction of unconventional hydrocarbons "until there is sufficient and robust evidence on all environmental impacts". Fermanagh and Omagh District Council's Local Development Plan (LDP) states in policy MIN04 that "the Council will not permit exploitation of unconventional hydrocarbon extraction until it is proved there are no adverse effects on the environment or public health."

Onshore petroleum exploration, on a relatively small scale, has taken place over several decades across Northern Ireland. Only sixteen exploration wells have been drilled and although several wells have recorded gas and oil shows none of these have led to field development.

In November 2019, a spokesperson for the Department for Economy in Northern Ireland said that the future of UOG development in Northern Ireland was for a future minister to decide as exploration for onshore oil and gas is a devolved issue. The report also highlighted a consultation on an application for a licence to test a large area in the Southwest of Co Fermanagh for natural gas, with more than 3,000 responses being analysed by the Department.

In 2021 the Department for the Economy in Northern Ireland commissioned the Hatch report to investigate the issues surrounding onshore drilling for gas and

minerals in Northern Ireland. Local communities in Fermanagh and Omagh made representations to this report. Hatch delivered their draft of the report to the Department in December 2021, though this has not (at the time of writing) been made public.

On 4<sup>th</sup> February 2022 Paul Given MLA resigned from his position as First Minister of the Northern Ireland executive. This decision collapsed the executive, and a new executive will only be formed after fresh elections on 5<sup>th</sup> May 2022 and an agreement is reached with the political parties to resume power sharing. As such there is no NI Executive in place to discuss the Hatch report or to implement a new policy regarding UOG development.

On 8<sup>th</sup> February 2022, the Northern Ireland Assembly debated a private member's bill that would ban UOG activity in Northern Ireland. The then Minister for the Economy participated in this debate. His major contribution is worthy of note here and is reproduced in full.

*Mr Lyons: I welcome the opportunity to respond to the debate on the private Member's Bill. I value the interest shown by the House in this important and current issue.*

*I note with interest the Member's desire to prohibit onshore hydraulic fracturing. However, that is only one element of the much broader and more complex policy area of petroleum licensing. As Members debate the Bill today, I ask that they reflect on the steps taken and the progress made by my Department in formulating policy proposals on the future of all onshore petroleum activities in Northern Ireland.*

*Recognising the changing strategic policy context for energy supply, carbon emissions and climate change, my Department has recently undertaken a review of our petroleum licensing regime. An important step in that review was the completion of independent, Northern Ireland-specific research on the economic, environmental, and social impacts of petroleum exploration and development activity. My officials have fully considered the research findings, along with other international studies, and I can confirm that my Department's policy review has now concluded.*

*I have also considered this complex policy area carefully and given due consideration to the expert advice received. As it is a cross-cutting and controversial policy area, on 31 January, I circulated a paper to Executive colleagues outlining the position not just on fracking but on all onshore petroleum licensing activity. My paper recommended that the Executive agree a preferred policy option of a moratorium on all forms of exploration and extraction of oil and gas, to be followed by the introduction of a legislative ban. That would not only bring Northern Ireland in line with the rest of the United Kingdom on the issue of fracking but go further by legislating for all other types of petroleum exploration or extraction.*

*The position of my party is, therefore, clear, now and in any future Executive.*

*Of course, my proposed way forward will now require the agreement of a future Executive, and, following that, the preferred option will be subject to public consultation. It is important, therefore, for Members to consider the Bill before them in the context of those developments, as well as with an understanding of the context of petroleum licensing in Northern Ireland, presuming, of course, that the other parties in the Executive share my view. To date, only the Finance Minister has responded to my paper. The Ministers from the SDLP, the Alliance Party and the UUP have not responded. The question for those other parties to answer is why they did not respond.*

*It may be useful to provide some general context for this evening's debate. Onshore exploration for petroleum in Northern Ireland has been taking place on a small scale since the Petroleum (Production) Act (Northern Ireland) 1964 was introduced. Over that time, although small amounts of oil and gas have been found, no commercial extraction has taken place. Companies explore for and seek to extract both conventional and unconventional hydrocarbons. Conventional hydrocarbons are found in porous rocks and are easily accessed by vertical wells and standard production techniques. Unconventional hydrocarbons, by contrast, are found in less porous rocks such as shale and are less easy to access. That is when techniques such as long horizontal drilling combined with high-volume hydraulic fracturing are used.*

*This Bill is focused solely on one testing and production technique: the use of fracking to access hydrocarbons in shale. There are currently no petroleum licences in Northern Ireland. The last active licence was relinquished on 28 April 2020. Members will also be aware that my Department is considering two petroleum licence applications. Both applications were subject to a public consultation process that closed in July 2019. My Department received over 5,700 responses, which were published at the end of October 2019. PLA1/16 by EHA Exploration Limited proposes exploring for oil and gas in the porous sandstones in the area to the south and east of Lough Neagh using conventional drilling techniques. PLA2/16 by Tamboran Resources (UK) Limited proposes exploring for gas in County Fermanagh. Initially, the application sought approval for the use of high-volume hydraulic fracturing. However, Tamboran subsequently made a request to revise its application in March 2020. The proposed revision will remove the need for fracking.*

*In summary, therefore, across Northern Ireland at this time, we have no petroleum licences in place, and neither of the two existing applications currently propose the application of high-volume hydraulic fracturing. I have repeatedly stated that decisions on both licence applications will be made by an Executive as a whole following the agreement of Northern Ireland's future petroleum licensing policy, informed by my Department's policy review. I reiterate that commitment today and sincerely hope that those responsible for the misinformation on social media are listening.*

*The number and range of concerns raised in the responses to my Department's consultations on the two applications brought into sharp focus the urgent need to review and update Northern Ireland's petroleum licensing policy. On that basis, my officials commenced a review in late 2019, in accordance with the Executive's policy development toolkit, of Northern Ireland's current onshore petroleum licensing system. The aim was to establish a robust evidence base from which to develop policy options for any future licensing regime. Initial considerations highlighted the lack of Northern Ireland-specific information on the impacts of petroleum licensing and the need for independent research. In October 2020, my Department commissioned Hatch Regeneris to undertake independent research on the economic, societal, and environmental impacts of onshore petroleum exploration and production in Northern Ireland. In addition to analysing up-to-date peer-reviewed research and considering the policy context in Northern Ireland and further afield, Hatch engaged extensively with stakeholders, including government, councils, industry, environmental organisations, and community groups.*

*The final Hatch report was delivered to my Department in July last year. My officials have given careful consideration to its findings as well as other relevant international studies in order to develop evidence-based policy options. That report was circulated to my Executive colleagues, but I am now prepared to publish it so that all interested parties can read it. As I have already set out, my January paper to Executive colleagues presented the outputs of the research and the options for the future of not just fracking but all petroleum licensing in Northern Ireland.”*

It should also be noted that in Republic of Ireland, UOG development has been completely banned since 2017. A bill proposing its prohibition was introduced in 2016 and 62% of the Dáil voted in favour of it.

### **3.4 How UOG Development Will Likely Work in Fermanagh and Omagh**

Onshore petroleum exploration, on a relatively small scale, has taken place over a number of decades across Northern Ireland. Only sixteen exploration wells have been drilled and although several wells have recorded gas and oil shows none of these shows have led to field development.

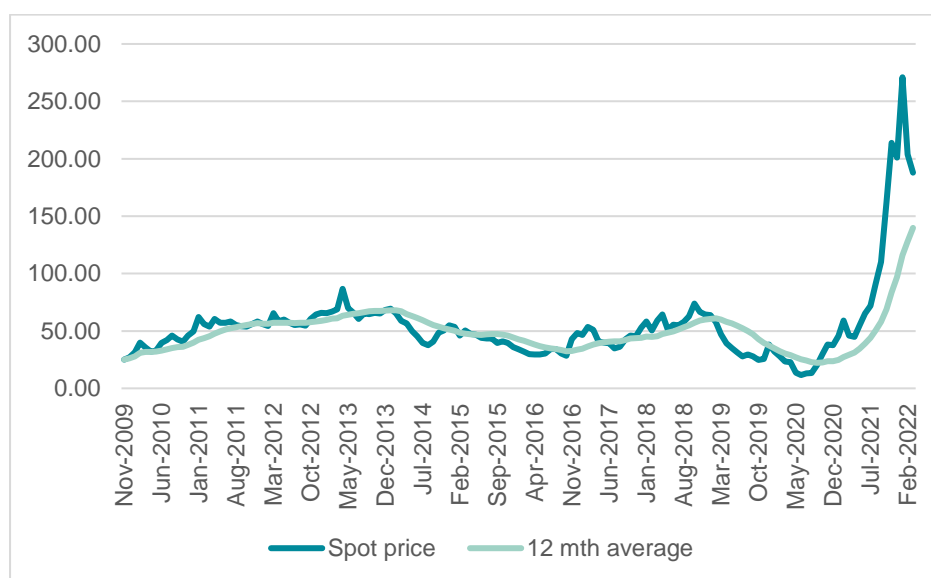
The Northern Ireland Department for the economy notes the following about the potential for UOG development in Fermanagh and Omagh,

*“Tamboran Resources Pty Ltd, who previously held a licence looking for shale gas, estimated the gas reserves in place in the Bundoran Shale [which covers Fermanagh] in both Northern Ireland and the Republic of Ireland at between 10.7 and 21.3 tcf (trillion cubic feet), with recoverable gas volumes of 1.6 to 3.2 tcf. This is a large potential resource but, as outlined above, there are still significant uncertainties around these figures at this early stage of exploration.”*

Source: [Specification for research into the economic, societal and environmental impacts of onshore petroleum exploration and production in Northern Ireland | Department for the Economy \(economy-ni.gov.uk\)](#)

There is 96.7 cubic feet of gas in a gas therm. A therm is the international standard unit of gas for energy markets. This suggests the field contains about 33 billion therms of energy. The price of a therm on UK markets was remarkably stable at about 40p from 2009 until May 2021. Since then, a combination of supply problems and Russia's invasion of Ukraine has seen the price become more volatile and significantly higher. The average price in March 2022 was £1.8777. This implies that the reserves have a market value between £13bn and £61bn using the range of 40p to £1.88 per therm.

**Figure 3.2: Price per gas therm in the UK 2010-22**



Source: <https://www.ofgem.gov.uk/energy-data-and-research/data-portal/wholesale-market-indicators>

Simultaneously, the importance of agricultural land has also become more prominent since Russia's invasion of Ukraine, with a desire for the UK to become more self-sufficient in the production of food and related items, such as fertiliser.

A commentary on how output from wells in the USA declines over time used an initial production value of 2 million cubic feet (mcf) as their standard well. They commented that very productive wells easily exceed that figure.

Using the 2 mcf figure, they estimated that over the 1<sup>st</sup> 5 years of production their standard well would produce nearly 1 billion cubic feet (bcf) of gas. They also noted that wells typically have production lives of about 20 years and produce about half of their capacity in the 1<sup>st</sup> 5 years. This suggests a total productive capacity of a standard well as being about 2 bcf.

Simple arithmetic suggests that that it may require 1,600 wells to extract the full amount of gas from the Bundoran Shale area.

The precise number of wells depends on how much of the gas reserves a UOG company wants to extract and the average capacity of the wells. However, 1,600

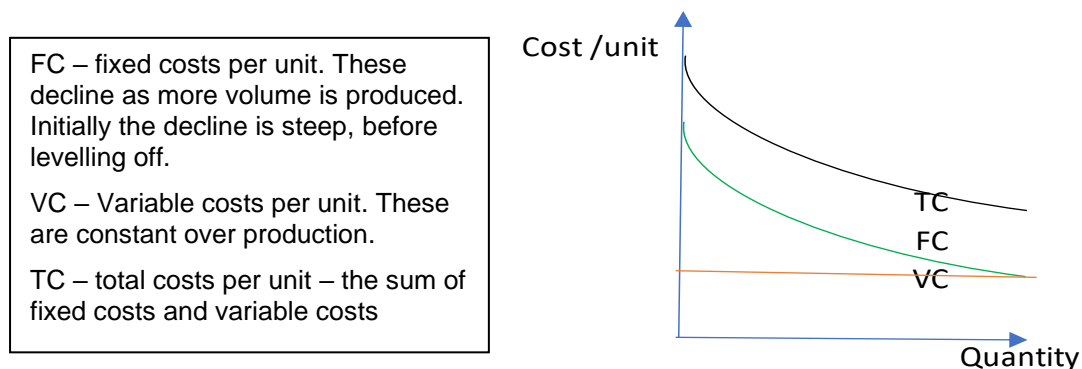
probably represents the upper limit of the number of wells that UOG companies would require in the Bundoran Shale area.

This number of wells is consistent with several counties in Pennsylvania. Hughes (2021) notes that in 2021 Bradford county had 1,399 wells, Green county had 1,205, Susquehanna county had 1,721 and Washington county contained 1,829 wells. At 2,220 km<sup>2</sup> Washington county is about 20% smaller than Fermanagh and Omagh, indicating that it is perfectly possible for there to be up to 1,600 wells in the district.

If 1,600 wells represent the maximum number, there must also be a minimum number of wells possible. So far Tamboran has only drilled 1 site in the district, but a viable UOG industry would need to operate at a much larger scale than 1 site. As Hughes (2021) notes only about 20% of wells hit the “sweet spot” in a shale formation where gas extraction is highest. Given this figure, UOG companies tend to want to drill a multitude of wells in an area to ensure they have enough “sweet spot” wells.

In addition, setting up a new industry in an area often requires the industry to achieve a certain scale of operations to be economically viable. For example, UOG operations will require skilled operational, maintenance and management staff who can work on several wells at once. UOG operations in the USA also usually incur high fixed costs to install pipe networks to either pipe in water or, more usually, to transport gas out of the area. When an industry involves significant fixed costs, there is always a minimum scale of operations needed to ensure that the unit production cost is commercially viable, as the following diagram shows.

**Figure 3.3: Variable costs, fixed costs, and total costs per unit**



It is possible that the industry chooses to operate at a lower level because of either geological difficulty in extracting gas or to navigate political difficulties in obtaining licences. It is, though, difficult to envisage there being fewer than at least 300 or 400 wells in order to make the industry commercially viable.

The industry usually locates multiple wells onto a single site called a well pad. Grouping wells onto pads facilitates the construction, maintenance, and logistics around drilling.

In a 2011 presentation to investors Tamboran Resources published some indicative numbers for how a potential UOG operation in Northern Ireland may operate. They assumed that they would drill 1,440 wells on 60 well pads, with each well pad

occupying 2.6 hectares (Tamboran 2011). They expected that the well pads would occupy 162 hectares in total.

Such an operation would though not conform to industry standards seen in the USA. The Shale Gas Information Platform states that typically UOG companies construct pads which contain 4 to 6 wells. It also states that a pad is typically 3.5 acres/1.41 hectares in area. [[The Basics: SHIP - Shale Gas Information Platform \(shale-gas-information-platform.org\)](https://www.shale-gas-information-platform.org/)]

This implies that a full scale UOG operation in Fermanagh and Omagh would require about 270 pads, covering 370 hectares. For context, the average size of a farm in Fermanagh and Omagh is about 33 hectares. The construction of these pads will take place over at most 5 years and will represent an industrial revolution for the landscape, which will quickly change from a rural one to an industrial one.

Assuming each well pad borders 4 farms this suggests that between 200 and 1080 farms will be in very close proximity to a pad. The latter figure represents more than 20% of all farms in Fermanagh and Omagh.

The US Department for Energy in 2010 estimated that in the USA on average 65 people lived within a mile of a well pad. Getting to a comparison for Fermanagh and Omagh requires some calculations from 3 key assumptions.

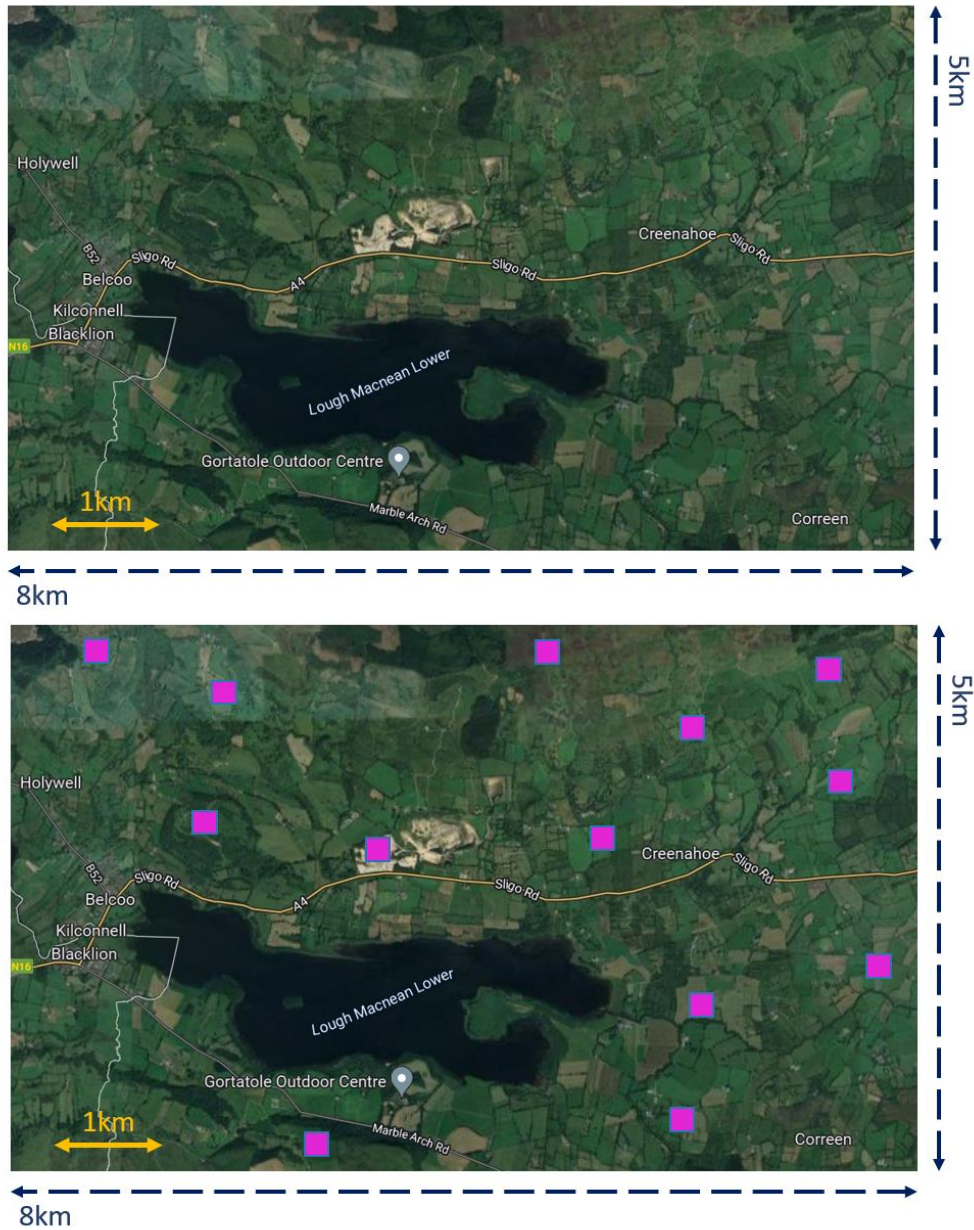
1. All the UOG activity would take place in the Erne West area, which occupies about 500km<sup>2</sup> or 193 square miles (mi<sup>2</sup>).
2. Erne West has a population of about 15,000 in 2020 according to NISRA mid-year estimates. This implies a population density of 77.7 people per 1 mi<sup>2</sup>, or 244 people in an area of 3.14 mi<sup>2</sup>. This is the area covered by a circle with a radius of 1 mile, using the  $A = \pi r^2$  formula.
3. If the industry requires 1,600 wells, then using assumptions from the USA, it will probably build 270 well pads. This implies 1 well pad for every 0.7 mi<sup>2</sup>, or just over 2 well pads per 3.14 mi<sup>2</sup>.

This calculates 244 people living in the same area as 2 well pads or about 488 people within a 1 mile radius of a well pad, which is well above the US figure.

The maps below show a 40km<sup>2</sup> area of South West Fermanagh, which contains the Tamboran test site at Belcoo. This area would need to accommodate about 13 well pads in order for the industry to be able to site 270 well pads in an area of 850km<sup>2</sup>. The 1<sup>st</sup> map shows the area as it currently is, whilst the 2<sup>nd</sup> map contains 13 well pads (measuring 1.41 hectares each). The impact would be dramatic – well pads will need to be located every 2 or 3 km from each other and will utterly change the landscape from a rural one to an industrial one within 5 years. This would represent a significant industrial revolution for the area.



**Figure 3.4: SW Fermanagh – before and after the construction of 13 well pads in a 40km<sup>2</sup> area.**



This report assumes that a UOG operation in Fermanagh and Omagh aims to extract the full 3.2 trillion cubic feet of gas in the Bundoran shale area using 1,600 wells on 270 pads. This is in line with the experience in the USA.

Figure 3.5 Artist's impression of a typical rural landscape in Fermanagh and Omagh



Figure 3.6 Artist's impression of the industrialisation of this landscape due to UOG activity



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# 4.

## ENVIRONMENT IMPACT

## 4. Environmental impact

### 4.1. Introduction

Fermanagh and Omagh is well known for the beauty of landscapes and countryside. The Cuilcagh Lakelands Geopark covers most of the Erne West area of Fermanagh and also extends into County Cavan in the Republic of Ireland. In addition, the Fermanagh and Omagh District Council's Local Development Plan included proposals for 3 Special Countryside Areas (SCA) within the district. These SCAs were The High Summits of the Sperrins, Cuilcagh Mountain and the Islands of Lough Erne, Lough Macnean and Lough Melvin. The 2015 Regional Development Strategy requires district councils to adopt "appropriate policies...to ensure their [SCAs] protection from unnecessary and inappropriate development." Northern Ireland's Shared Environmental Services team support the Councils to meet their statutory responsibilities as competent authorities when assessing planning applications to ensure they meet the requirements of the Conservation (Natural Habitats, etc) Regulations (Northern Ireland) 1995 (as amended), known as the Habitat Regulations. They would assess the impact of any development where that development is likely to have a significant impact on a designated European site. Planning policy makes it clear that planning permission should be granted only for projects that will not have an adverse effect on European protected sites. The Habitats Regulations require councils to take a precautionary approach, with the legal test being that it is beyond reasonable scientific doubt that the proposal will not have a lasting adverse effect. There are a number of these sites that may be affected including Cuilcagh Mountain and Lough Melvin Special Area of Conservation.

UOG development will create up to 270 1.4-hectare industrial sites across this landscape. These facilities create wide ranging potential environmental hazards and externalities stressors that adversely impact the local environment. The environmental effects of hydraulic fracturing are well documented. UOG activity requires huge volumes of water, runs the risk of spilling chemicals at the ground's surface, which in turn poses risk to surface water and ground water quality degradation from waste fluid disposal. The high-pressure injection of fluids into the wells induce seismicity which can disturb residents and wildlife.

Any kind of oil and gas drilling can additionally cause reduced air quality, noise pollution in the region of 90db, night sky light pollution and landscape changes such as forest fragmentation and disruption to wildlife corridors and habitats. Road damage from the increased use of HGV from the deliveries of drilling equipment to each site is also a major concern. Section 5 gives an overview of each of these areas focussing on the local context of Fermanagh and Omagh.

### 4.2. Road Damage and Increased Carbon Emissions

To set up a typical well, drilling, and fracturing equipment must be delivered to site by lorry. Some wells may also require water to be delivered via lorry instead of via a pipeline from the Lough. This requires a huge number of lorries to bring wells into

production. An assessment of road damage undertaken in a survey by the Texas State Department of Transport in 2012 indicated that it requires 1,190 loaded lorries to bring one well into production, with 350 for annual maintenance and 1000 every 4 to 5 years to re-frac a well. The same study recalibrated the number of lorry journeys into car journeys and calculated that the equivalent of 8 million car journeys was required for its development and a further 2 million cars per annum for maintenance. Another study from the US shows that in every state where UOG activity occurs, the life cycle of the roads is reduced by 70-80%, or from 20 years to five years. This would therefore likely have a devastating impact on the roads in Fermanagh and Omagh.

### **4.3. Development of UOG Infrastructure**

UOG facilities create wide ranging potential environmental hazards and externalities stressors that adversely impact the local economy. Fracking requires a large network of pipes to the well pads from local water sources. The natural gas produced from the wells will also need to be distributed to a central pipeline. This will require a network of pipes and compressor stations, an integral part of the natural gas pipeline network, to move the natural gas from the individual producing well sites to end users. This will cause further blighting of the natural landscape and increase risk of contamination from transporting methane and other high-pressure equipment.

### **4.4. Increase in Methane Emissions**

Methane has been rising rapidly in the atmosphere over the past decade, contributing to global climate change. However, it has been debated whether this is due to biogenic sources such as rearing cattle or whether there may be other causes. Many research studies are now beginning to paint a clearer picture that shows that the commercialisation of shale gas and oil in the 21<sup>st</sup> century has dramatically increased global methane emissions. (Meng, 2014) A study undertaken by Cornell concludes that “emissions from shale gas production in North America over the past decade may well be the leading cause of the increased flux of methane to the atmosphere, likely exceeding those from biogenic sources over the past decade. The study also points out that increased fluxes from biogenic sources such as animal agriculture and wetlands are far less important than indicated by some other recent papers.” (Howarth, R, 2019).

In another study by Ma and Hill (2017), researchers found considerably high levels of methane in well drinking water collected in close proximity to hydraulic UOG sites. In 85 percent of the samples, methane levels were 17 times higher on average in wells located within one kilometre of active UOG sites. The study looked at 424 water systems which were within 10km of a well pad in Pennsylvania.

## 4.5. Large Water Requirements

Large water requirements to frack each well have the potential to significantly lower water levels in local rivers and loughs. The water requirements could be between 10 to 25 million litres of water per well over its life. This has the potential to impact on boat safety, fishing and increases the risk of eutrophication. Given that around 3,000 angling licenses are sold to visitors annually in Fermanagh, this could have a huge impact on tourism.

Impacts on water levels on the region's lakes and rivers will likely have 3 implications for tourism. Firstly, representatives of Waterways Ireland, the body responsible for managing boats on the inland waterways of both Northern Ireland and the Republic of Ireland, have highlighted that Lough Erne is already shallow in some places, and so lowering the water level will increase the risk of boats grounding during dry spells. This may lead to Waterways Ireland issuing fewer boating permits and closing areas to larger vessels. Both of these will reduce the amount of boating traffic in the area, which will undermine the tourist trade.

Secondly, lower water levels will encourage the growth of more aquatic plants as sunlight will penetrate more of the waterways. More aquatic plants present 3 possible problems. They will limit the areas that boats can pass and so either cause Waterways Ireland to increase its plant clearing activities with obvious implications for taxpayers, or there will be more restrictions on boat traffic as rivers and loughs have reduced capacity. In addition, more aquatic plants in the area will affect the biodiversity of the loughs and rivers. This may inhibit the numbers of some species and encourage the growth in numbers of others. If these changes reduce the numbers of trout and salmon in the loughs and rivers it may have significant implications for fly fishing in the area, which centres around these 2 species.

Finally, lower water levels will encourage the growth of blue green algae, which is toxic to consume for both farm animals and domestic animals. The nearby hydroelectric plant at Cathleen's Fall hydroelectric power station, in Ballyshannon, County Donegal would need to spend increased sums on filtration technology to avoid algae being used in the generation of power, if algae formed on either Lough Erne. This may create a claim for damages against Northern Ireland's authorities for allowing UOG activity.

## 4.6. Production of Toxic Water

UOG activity usually produces wastewater, as the water/sand/chemical mix that is used in drilling comes back up to the surface. This flowback, contains not only the original additives but also salty subsurface brines and minerals from the shale formation, which is required to be transported to treatment facilities that first must be built to handle any toxic waste present. These facilities, along with the well pads, must be regulated by public authorities.

Local water quality may be compromised at several stages of shale gas extraction as gas wells are often drilled through or near to aquifers. (Smith, 2012). Fracking fluids injected down the wells under high pressure to fracture the shale consist mainly of

water, usually around 90%, sand to keep the fractures open and additives, which could include lubricants, biocides, rust inhibitors, solvents, foaming agents, and emulsifiers (Smith, 2012). These chemicals could be a variety of acids and alcohols, and/or compounds containing benzene, ammonia, and/or sodium. Considering the upper bounds of water requirements needed to frack a single well given above, the volume of the 1% of chemicals in the fracking fluid could equate to 40,000 gallons of chemicals per well. (Royte, 2012; Smith, 2012)

A study was completed by the British Columbia Medical Journal which analysed over 350 of these chemicals, finding that more than 75% could have, respiratory, gastrointestinal, dermatological, and ocular effects whilst 40 to 50% could be neuro-, immune-, and nephrotoxic; whilst 35% percent could be endocrine disruptors; and 25 percent could be carcinogenic. The contamination of these additives is somewhat dependent on the occurrence of leaky well casings. The oil industry's disclosed casing failure rate was averaging 6 to 10 percent (Aiello, 2013). As mentioned, uncertainty over the risk of seismic activity exacerbates this issue, as seismic activity is one cause of cases failing.

#### 4.7. Surface Contamination & Radioactive Elements

As well as the possibility of water contamination below the surface, another potential water contamination is when fracking fluids flow back up to the surface (Royte, 2012). Once a well has been fracked, the pressure in the well is reduced to collect the gas or oil to flow to the surface. However, before this happens, the fracturing fluids and other substances held in the rocks must flow back up to the surface (Lafrance, 2011). The flowback liquid is often contaminated with wide ranging toxic deep-earth elements which occur naturally. These include elements such as bromide, barium, radon, radium, sodium, uranium, chloride, arsenic. Many studies have now proven radioactivity around UOG sites to be considerably higher than background levels, with samples detected in soil, air, and water at or near gas drilling sites (Royte, 2012).

These used fracking fluids have the potential to contaminate groundwater through improper disposal of the wastewater and because of surface spillages. In the US, this has occurred on multiple occasions.

*The Central Valley Regional Water Quality Control Board investigated the discharge of fracking waste to an oilfield sump near almond orchards in Shafter, California. The petroleum subsidiary company had permission to discharge drilling mud and boring waste to the sump, but the Regional Board found the fluid laced with boron, benzene, salts, and a cocktail of notorious chemicals related to gasoline and diesel. With the chemicals appearing to have been used in hydraulic fracturing for oil (Grossi, 2013).*

Another problem occurring in the US is the incorrect disposal of wastewater to municipal sewage plants which are not designed to treat/remove toxic chemicals in the fluids. Removing dissolved salts from the high salt content in the fluids requires expensive distillation or reverse-osmosis (Schmidt, 2013). The treated wastewater is likely to then be discharged into rivers, irrigation systems with the potential to

become drinking water for communities downstream. This may present a problem in Erne West, as there is very limited capacity in the current Wastewater treatment works (WwTW) network to process more wastewater. A report by Northern Ireland Water in March 2022 stated that 3 Erne West WwTW plants were already at full capacity whilst another 5 were close to full capacity.

#### **4.8. Noise Pollution**

UOG activities can regularly produce noise levels in the 85 to 95 decibel range. A value of 90 decibels is categorised as a high noise level, equivalent to the noise generated by a leaf blower or the sound level of a concert. Compared to 80 dB, 90 dB is 10 times more intense and twice as loud. People with homes near UOG operations often describe vibrations that can make sleeping difficult and disturbance to their pets. Noise from UOG operations has also been proven to contribute to adverse health outcomes in three categories, including anxiety, sleep disturbance and cardiovascular disease or other conditions, all negatively impacted by stress (Mrdjen, I. & Lee, J.Y. 2016).

#### **4.9. Impact on Agriculture and Food Sector**

Fermanagh's economy is highly dependent on agricultural production, and it is a focus of economic innovation in the area. In recent times, niche agri-food and organic food production is emerging as a value-added sector to the economy. However, 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 impact of pollution on the agricultural sector across the island of Ireland would have devastating consequences on demand for exports. It is worth pointing out that the NI economy is more dependent upon agriculture than any other region in the UK, and Fermanagh and Omagh is more dependent on agriculture than most other districts within Northern Ireland.

#### **4.10. Air Quality**

Due to the nature of UOG procedure and its association with natural gas and oil, harmful chemicals, such as benzenes and xylenes, are discharged into the air (Mrdjen & Lee, 2016). Mrdjen and Lee also mention that chronic exposure to these toxic chemicals can cause an increased risk of cancer, particularly within 0.5 miles of wells.

A study conducted in 2019 titled the "Effects of 'pre-fracking' operations on ambient air quality at a shale gas exploration site in rural North Yorkshire, England". Found that during "pre-operational phase" Nitrogen Oxide levels increased 3-fold from combination of increased vehicle activity and site operations. Based on this study, changes to ambient NOx are the most significant issue for air quality. However, in rural locations, concentrations at individual sites are expected to be below ambient



air quality limit thresholds. A large source for the excess Nitrogen Oxide Levels was due to emissions from Idling Trucks and increased HGV journeys.

#### **4.11. Industrialisation of the landscape**

Fermanagh is well known for the beauty of its landscapes and countryside. As well as the UNESCO recognised Cuilcagh Lakelands Geopark, and 3 (as above) Special Countryside Areas, which have special status within the Local Development Plan. The area has benefited from considerable SEUPB (Special EU Programmes Body) and Northern Ireland Executive funding for a range of rural tourism investments. The industrialisation of the landscape would be extremely damaging to the reputation of the area as a place for tourism and farming, destabilising the long-term sustainability of the many local business and jobs that rely on the inflow of tourists.

The scale of the proposed development is extensive. As discussed above the UOG industry would probably need up to 1,600 wells, located on up to 270 well pads occupying 1.41 hectares each, or 370 hectares in total. These well pads would primarily be in the Southern and Western parts of County Fermanagh. This has a rough area of about 850 km<sup>2</sup>. This would suggest 1 well pad in every 3.2km<sup>2</sup> of land. This is roughly equivalent to 1 well pad per 1 square mile. This scale of development would utterly transform a peaceful rural area into a noisy, dirty industrial landscape in no more than 5 years.

#### **4.12. Effects on Biodiversity**

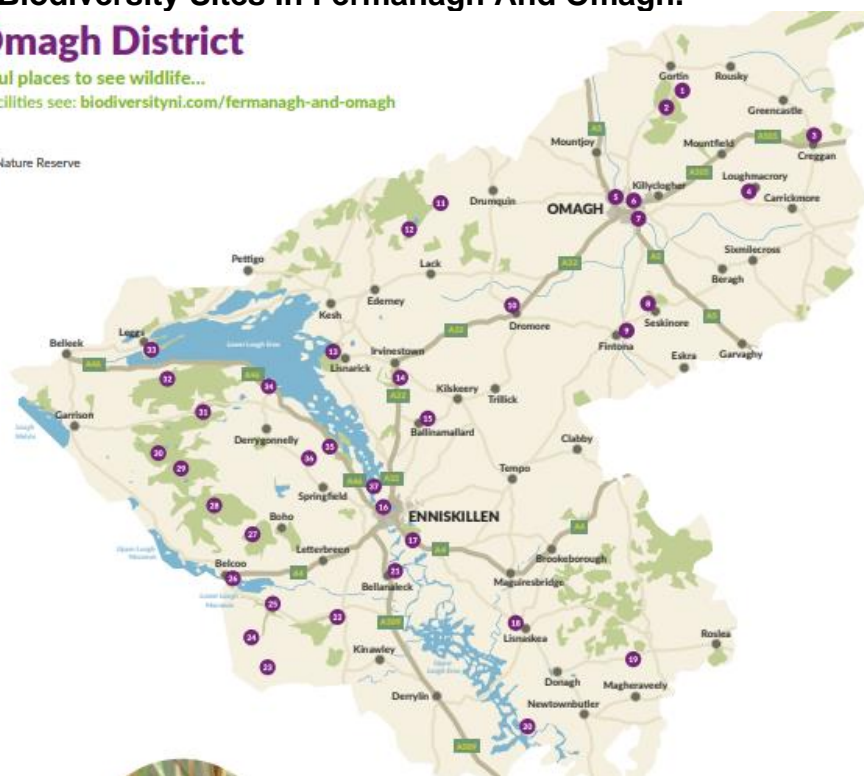
Fermanagh and Omagh District Council has completed a consultation period on the draft Fermanagh and Omagh District Council Biodiversity Strategy and Action Plan 2022-2027. The Council's draft Biodiversity Strategy and Action Plan (2022-2027) explores the unique biodiversity of the district from the rare boglands to the common garden bird as well as encompassing that biodiversity across the area. An overview of the biodiversity of Fermanagh and Omagh is given below.

**Figure 4.1: A Map Of Biodiversity Sites In Fermanagh And Omagh.****Fermanagh and Omagh District**

Why not visit some of these wonderful places to see wildlife...

For more information on directions and facilities see: [biodiversityni.com/fermanagh-and-omagh](http://biodiversityni.com/fermanagh-and-omagh)

1. Gortin Lakes
2. Gortin Glen Forest Park
3. An Creagan Visitor Centre and Creggan Bog Local Nature Reserve
4. Loughmacrory
5. Grange Park, Omagh
6. McCauley Park, Omagh
7. Riverside Walk, Omagh
8. Seskinore Forest
9. Ecclesville Demesne
10. Dromore Riverside Walk
11. Sloughan Glen
12. Lough Bradan
13. Castle Archdale Country Park
14. Necame Estate
15. Ballinamallard Mill Walk
16. Forthill Park, Enniskillen
17. Castle Coole NT
18. Lough Head Park and Wildfowl Centre
19. Killyfole Lough Local Nature Reserve
20. Crom Estates NT
21. Bellanaleck Moorings Walk
22. Florence Court NT
23. Cuilcagh Mountain Park
24. Killykeaghan and Crossmurrin Nature Reserves
25. Cladagh Glen Nature Reserve
26. Cottage Lawn, Belcoo
27. Belmore Forest
28. Ballintempo Forest
29. Carrigan Forest
30. Big Dog Forest
31. Correl Glen Nature Reserve
32. Lough Navar Forest
33. Castle Caldwell Forest
34. Tully Castle
35. Ely Lodge Forest
36. Monea Castle
37. Devenish Island



A key element of Fermanagh and Omagh's effort to maintain biodiversity occurs within the boundaries of the Cuilcagh Lakelands Geopark, which covers most of the Erne West area of Fermanagh and extends into parts of County Cavan in the Republic of Ireland.

To understand the likely impacts of UOG development, it is important to first consider the fracking life cycle with the associated activities and the impact that poses on the vulnerabilities of the receiving environment. Therefore, it is important to consider the major sources and distribution of disturbance on the environment posed by the impacts of UOG activity. The major impacts associated with UOG activity are likely to be impacted across the landscape due to processes such as loss of landscape connectivity, dispersal, fragmentation of populations and decreased provision of ecosystem services (E. Branoski, 2012). In this section, the likely impacts on biodiversity have been explored in the context of Fermanagh and Omagh.

UOG activity will generate noise pollution to some degree throughout the fracking life cycle. Sources of noise would include seismic surveys, operation of drilling rigs, well pad preparation, construction, and haul vehicles, and well pad operational activities (JK Barber 2009). Many forms of fauna that rely on acoustic communications may also be negatively impacted in terms of abundance, species richness and breeding success. Impacts of foraging have been documented in species such as deer, which allocated more time to vigilance at the cost of foraging, near to roads (D. Gavin 2006). This is similar across bat species, of which Fermanagh and Omagh is known to have 8 different species, which avoid foraging in noise areas as this affects their ability to detect sounds produced by their prey (MD Tuttle 1982). Heavy vehicles,

drilling machinery and seismic exploration generate vibration in the ground which is also likely to impact subterranean fauna as many have highly sensitive ears which makes them ultra-sensitive to vibrations within the ground soils. They also use this to navigate and detect prey (ER Lewis 2006).

It is common for well pads to be lit at night during operations, in an area with little usual light pollution, these light sources can generate significant ecological impact. Artificial light can affect the population and behavioural ecology of a wide variety of organisms and can lead to changes in the ecological behaviour of animals associated with foraging, reproduction, migration, and communication. This can lead to a change in organisms' abundance and can lead to a change of the concentration of animals, especially insects (T Longcore, 2004). This can in turn create patches of overabundance of prey, causing the long-term change of relative species levels.

Bats have a complex interaction with artificial light. Some species avoid areas of artificial light as it interferes with their hunting regimes, whilst others will seek out places with an overabundance of prey, such as artificial lights. The same effect occurs with spiders that prefer to increase their prey catch where large amounts of insects congregate (T. Polak 2011). Fermanagh and Omagh are also known to have rare species of butterfly which may also be impacted due to this effect.

Another characteristic of UOG activities is the large quantities of materials which are required to be brought to site. The associated impact of increased traffic volumes has widespread impacts on fauna, which can be argued to be the greatest ecological impact of UOG activity on the area. With well pads being constructed every 3.4km<sup>2</sup>, many new temporary roads will be required, and increased traffic volumes will occur on local roads. This is likely to increase roadkill and affect the routes that prey use to hunt. This is further exacerbated by the vegetation clearing and direct habitat loss caused by road and well pad construction. The associated clearing of 1.4 hectares per well pad is likely to drastically increase the threat to biodiversity patterns where this coincides with rare and unique habitats such as localised populations of rare or endemic plant species. Another element of this is the clearing of hedgerows which bats use to navigate.

The transportation of machinery and chemicals required by the UOG activity process is likely to pose a significant threat to spills of petrochemicals and other toxic liquids. This is likely to severely impact sensitive species such as fish and amphibians when they enter drainage lines and waterways (D MacKay 2013). This contamination is also likely to have an impact where it occurs close to the roots of trees in the local area which are important to the structure of habitat diversity.

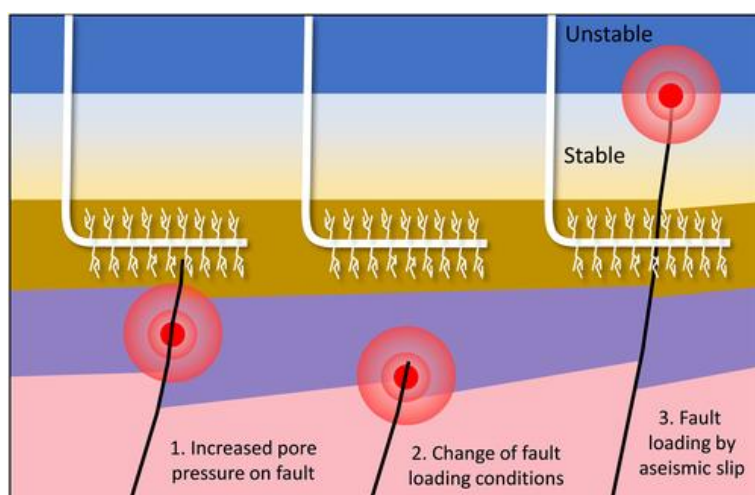
The storage of toxic water produced by the fracking process is also likely to pose a series of threats. Spills, blowouts, and failure of wastewater holding ponds are a common pathway for contamination of ground and surface water and pose further threats to the mortality of fauna (D MacKay 2013). In addition to this, animals tend to drown or be poisoned by the wastewater storage ponds as they can often be attracted to them for drinking. Therefore, these storage ponds can act as an ecological trap for a wide range of species (E Kivit 2013). It is possible to use fencing to prevent larger animals from accessing the ponds, however this is unlikely to stop smaller animals or invertebrates.

UOG activity will require huge amounts of water which will likely be sourced from the local loughs and rivers leading to the decrease of water levels. Fermanagh and Omagh is known to have rare species of trout and salmon which will be impacted. During breeding season, salmon and trout migrate up the rivers, altered water levels can impact their breeding patterns which will have knock on effects to future generations. Fermanagh and Omagh District Council is actively involved with the North Atlantic Salmon Conservation Organisation to mitigate the effects of human activity on the salmon population within Northern Ireland.

#### 4.14 Induced Seismicity

In order to understand the impacts of induced seismicity it is helpful to introduce the potential mechanisms that allow earthquakes to nucleate in response to UOG activity. In general, induced seismicity is far more likely to occur in areas which are prone to faults. Of these faults, the occurrence of earthquakes is directly proportional to the number of faults which are close to failure, otherwise known as the pre-stimulation tectonic stress field. The mechanism by which seismicity is induced is shown in figure 4.2 below (Ryan Schultz, Robert J 2020).

**Figure 4.2: Induced Seismicity Diagram**



*Figure 4.2 - Conceptual diagram of fracking earthquake triggering mechanisms. Three proposed mechanisms are displayed from left to right: direct pore pressure communication, poroelastic stress transmission, and pore pressure causing aseismic slip. (Ryan Schultz, Robert J. 2020)*

In Great Britain, where hydraulic fracturing is planned, the Oil and Gas Association requires the operator to produce a 'Hydraulic Fracturing Plan', detailing how the risks of any potential induced seismicity will be managed. This ensures that the risk of felt seismicity is very low and within existing background levels. A traffic light system has been put in place to manage the risk of induced seismic activity during hydraulic fracturing. The 0.5ML 'red light' Richter Scale (Local Magnitude) level for use during operations has been set by Government. If a 0.5ML is detected, the operator must pause for a period dictated by the hydraulic fracture plan, which is approved and regulated by the Oil and Gas Authority, and consequently consent must be given by the regulator to proceed. This requires the operator to do several checks, which include verifying well integrity as well as consider any modification that is required for operations to continue.

Therefore, a major regulatory issue posed by fracking is related to the allowable threshold of acceptable seismicity of 0.5ML. Due to the nature of the faults within Great Britain it is likely that earthquakes of magnitude 5.7ML could occur, representing significant risks to the surrounding area and far surpassing the limits set, likely to cause serious implications for future fracking processes and structural damage to structures of the nearby area.

To explore why this poses such a problem in the UK it is important to understand the geology and its relationship to induced seismicity. A case study undertaken by Solid Earth Discuss (2016) of Hydraulic fracturing in the Bowland and Weald Basins regions in England identified several key problems relating to hydraulic fracking. These are:

- UK shale exploration to date is characterised by a low degree of technical competence
- Regulation, which is divided between four separate authorities, is not up to the task.
- The English shale basins are two to one hundred times smaller in area than their US counterparts but hold a shale target two to one hundred times thicker and are cut or bounded by normal faults penetrating from the shale to the surface.

The study concludes the following arguments.

- There is a far greater inherent risk of groundwater resource contamination via the types found in the UK during or after unconventional resource development.
- The USA experience of UOG activity in shale basins cannot be applied to the UK shale basins because the geometry of the basins is completely different.
- The complex faulted geology of the UK shale basins does not favour exploitation by unconventional means. This would likely require a minimum of 5 years to permit advances in fault understanding and imaging to take place.
- Far more rigorous regulation of the operators is required than is current practice if UOG development is to proceed.

To conclude, there is overwhelming evidence pointing towards the risk and additional complexities presented by the geology in Fermanagh and Omagh and how this will impact the likelihood of both induced seismicity and risk of groundwater contamination compared to fracking operations in the USA.

## 4.15 Conclusions

If UOG activity takes place in the district, there are likely to be wide ranging environmental and ecological implications for the area. Firstly, the increased HGV movements are likely to devastate the natural tranquillity of the area, damaging roads and leading to hazardous lorry movements through rural communities as well as increasing the levels of hazardous emissions realised by the HGVs. UOG development is likely to severely scar the landscape, impacting local tourism and destabilising the long-term sustainability of the many local business.

Gas released from the wells is likely to increase background levels of methane in the local area as well as creating consistent noise pollution from fracking processes disturbing residents in the area. Added to this is the risk posed from the deep-earth radioactive elements such as bromide, barium, radon, radium, sodium, uranium, chloride, arsenic which are brought back up to the surface and increase background radiation.

The main environmental impact of UOG activity, however, stems from the use of toxic chemicals used to drill the well. This causes wide ranging implications, from the contamination of drinking water to the surface contamination of farmland. Of these chemicals, 75% could have, respiratory, gastrointestinal, dermatological, and ocular effects whilst 40 to 50% could be neuro-, immune-, and nephrotoxic; whilst 35% percent could be endocrine disruptors; and 25 percent could be carcinogenic.

# 5.

## E C O N O M I C I M P A C T



## 5 Economic Impact

### 5.1 Introduction

UOG companies usually emphasise the potential economic gains that an area may make if UOG activity commences. These potential gains were the focal point of Tamboran's pitch to the community in 2011. Studies in the USA (Christopherson 2017) have though queried the benefits claimed by UOG companies.

Fermanagh and Omagh has a mature economy and so introducing a significant new activity into the district is likely to upset the balance of economic activity already taking place. This change may stimulate some sectors but may also lead other sectors into decline. This study focusses on calculating a cost benefit analysis for the local area. The classic economic dilemma concerning a resource boom is that it then causes a resource curse. Krupnick and Echarte (2017) define this as:

*“Resource-based economic development creates the potential for a “resource curse,” or decreased long-term economic growth as a result of natural resource development, and a local “Dutch disease” effect, in which certain sectors may become less competitive as a result of oil and gas development.”*

They note that the extent to which UOG development has created a resource curse in the USA is disputed by academics. However, whether a resource curse would develop in Fermanagh and Omagh is a key question.

The study starts though with a brief analysis of the economy of the district, before discussing the likely economics of any UOG activity. It then focusses on the potential benefits from UOG activity, before discussing the potential impact on key sectors of the economy such as agriculture, tourism, and manufacturing. The study makes indicative attempts to calculate the present value of the costs and benefits in order to arrive at an economic cost benefit analysis.

### 5.2 Economic Analysis

As a small district, Fermanagh and Omagh's total Gross Value Added (GVA) depends on its performance in certain sectors. Agriculture, distribution/transport/accommodation and food, manufacturing and construction are all more important to the district than to most other geographical areas under consideration. Service activities are generally more important to the United Kingdom and Republic of Ireland than to Fermanagh and Omagh.

**Table 5.1: Share of recent GVA by economic activity**

Share of recent GVA by economic activity	Fermanagh and Omagh	Northern Ireland	United Kingdom	Rol
Agriculture, forestry, and fishing	4.3%	1.5%	0.7%	1.1%
mining, electricity, gas, water, and waste	6.4%	3.7%	3.9%	7.9%
Manufacturing	17.3%	15.0%	10.1%	32.3%
Construction	10.9%	6.4%	6.1%	2.3%



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V3.0 June 2022

Distribution; transport; accommodation & food	21.1%	19.1%	17.7%	9.3%
Information and communication	1.7%	3.3%	6.4%	15.8%
Financial and insurance activities	1.6%	3.8%	7.1%	5.8%
Real estate activities	12.8%	11.1%	13.6%	6.0%
Business service activities	4.0%	7.1%	12.4%	8.9%
Public administration; education; health	16.8%	25.7%	17.6%	10.1%
Other services and household activities	3.2%	3.4%	4.2%	0.6%
	100.0%	100.0%	100.0%	100.0%

Source: UK ONS for F&O, NI and UK. Central Statistical Office (data.cso.ie) for RoI.

This suggests that Fermanagh and Omagh is a rural economy, with a good tourist sector supported by local manufacturing and construction activity. The US does not publish data in the same way as the UK and the Republic of Ireland, but agriculture represents about 0.5% of the economy in Pennsylvania (source: statista) probably as the state's economy is dominated by Philadelphia and Pittsburgh. However, a development website for Bradford county (a key area of UOG activity) lists natural gas extraction and cattle farming as the 2 key sectors for the county.

(<https://bradfordcountypa.org/key-industries/>)

Whilst not the largest sector, farming has a key place in forging local identity in Fermanagh and Omagh. Within the context of Northern Ireland, the United Kingdom, and the Republic of Ireland, this is undoubtedly an agricultural district. Fermanagh and Omagh's economy was approximately £1.6bn in 2019 (source [https://niopa.qub.ac.uk/bitstream/NIOPA/10793/1/Annex-7-Fermanagh-and-Omagh-District-Council-Council-Area-Profile\\_0%281%29.pdf](https://niopa.qub.ac.uk/bitstream/NIOPA/10793/1/Annex-7-Fermanagh-and-Omagh-District-Council-Council-Area-Profile_0%281%29.pdf)). This implies that the farming sector was worth about £68m in 2019, or approximately £71.4m in 2021 applying standard UK GDP growth rates.

Farming in the district closely follows the pattern of farming across both Northern Ireland and the Republic of Ireland. It consists of relatively small farms living off cattle, sheep and, to a lesser extent, poultry farming on open pasture fields. There is very little cereal farming anywhere in Northern Ireland or the Republic of Ireland. These factors ensure that farming looks very different in Fermanagh and Omagh compared to England. The table below summarises the situation.

**Table 5.2: Farm data across the geographies**

	Fermanagh and Omagh	Northern Ireland	Rep. of Ireland	England
Avg Farm size (HA)	35	33	33	87
Arable	0.4%	4.5%	8.0%	52.0%
Perm Pasture	84.7%	79.0%	80.0%	36.0%
Other	14.9%	16.5%	12.0%	12.0%
Avg Cattle per farm	56	65	54	48
Avg sheep per farm	54	78	41	145
Avg poultry per farm	414	938	122	1,312
Farm Business Income	NA	£34,402	£20,456	£46,000

Source: 2021 farm census for F&O and NI; Source Defra Statistics: Agricultural Facts for 2019 for England (pub 2021); Source: CSO - census of Agriculture 2020 for RoI

Most farms in Fermanagh and Omagh are family farms where the farmer, and his/her spouse provide most of the farm labour, as table 5.3 highlights. Even so some 17.5% of the agricultural labour force in the district comes from “other workers”.

**TABLE 5.3 Agricultural labour force, June 2021**

	Farmers, partners, directors & spouses*		Other workers			Total
	Full time	Parttime	Fulltime	Parttime	Casual	
Fermanagh and Omagh	4,006	3,820	315	609	744	9,494
Total for Northern Ireland	20,294	20,073	2,902	4,018	4,908	52,195

Source: 2021 farm census for F&O and NI

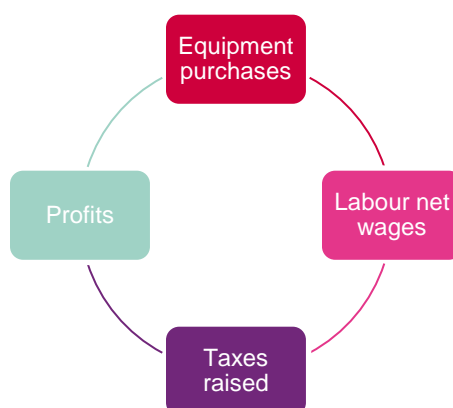
### 5.3 The Economics of UOG Development

A University of Manchester study in 2018 (Cooper, Stamford, & Azapagic 2018) highlighted that the cost of undertaking UOG activities were likely to be different in the UK compared to the USA. The paper estimated that total production costs per KWH were likely to be more than twice as expensive as US Shale gas. The difference was due to both higher set up costs as the UK would need to import both equipment and set up engineers, lower expected realisable volumes, and a lower number of wells per play.

This study is important as it highlights that UOG development in the UK is likely to be a very different proposition than in the USA.

If UOG development ever took place in Fermanagh and Omagh, then it is likely that very little of the direct benefit of the activity would accrue in the district. Figure 5.1 shows the main direct economic benefits that develop as a result of the introduction of UOG activity into a district.

**Figure 5.1: Direct economic benefits from UOG activity**



The companies involved in UOG development, such as Tamboran, are likely to be either US or Australian owned so any profits will go to overseas shareholders. In

addition, most of the specialist equipment associated is manufactured in the USA and would need to be imported into Northern Ireland. There are likely to be no specialist oil and gas extraction engineers based in Fermanagh and Omagh. Any UOG company will probably use a mix of UOG specialists from the USA or Australia, and specialists in conventional oil and gas extraction, based in the UK's North Sea oil and gas fields.

The USA experience suggests that a well-paid itinerant engineering workforce has developed that occupies these positions. This work force moves around the UOG sites as opportunities develop. In a study of job creation in Pennsylvania, Susan Christopherson, Professor of City and Regional Planning at Cornell University, noted in a 2017 article (Christopherson 2017)

*“During the 2007-2012 shale boom, Pennsylvania gained 15,114 jobs in the drilling, extraction and support industries, but Texas gained 64,515 – over four times as many jobs. Texas not only has much of the skilled drilling workforce, but the majority of the industry’s managers, scientists, and experts, who staff the global firms headquartered in Houston.” (emphasis from the original author)*

One respondent to a focus group in West Virginia commented about out of state workers that “they travel, they follow the industry, they’re out of state, and those pay checks are going home.” (Sangaramoorthy et al 2016).

Most likely, local people would fill site management, site security, site labouring and lorry driving positions. As such these salaries are more likely to be near the average annual salary for jobs in Fermanagh and Omagh which was £25,194 in 2021, according to data published by the Northern Ireland Statistics and Research Agency.

UOG development will raise tax revenues, especially income tax and national insurance associated with employment and corporation tax from the profits generated by UK based subsidiaries. However, these revenues will go to the UK treasury for general expenditure across the UK and there is no reason to think that any of these revenues will be earmarked for the local area.

As such most of the direct benefits will not accrue in the district.

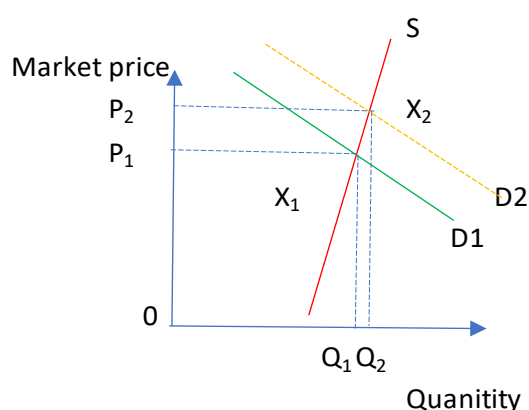
UOG development will though have some potential indirect benefits as UOG companies place contracts with local people and companies. The main beneficiaries are likely to be haulage companies, employees, and landowners.

UOG activities use a lot of lorry journeys. It uses lorries to transport the equipment to the site, bringing in materials and potentially transporting gas to network node points.

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 redrill a well.

These additional lorry movements will increase demand for local hauliers and will put up local prices. Figure 5.2 shows the likely impact on the local haulage industry.

### **Figure 5.2: Impact of UOG activity on hauliers**



Before UOG activity starts the local haulage industry has a supply curve of  $S$  and a demand curve of  $D1$ . The market is in equilibrium with a quantity of lorry journeys of  $Q_1$  at an average price of  $P_1$ . This assumes that in the short term haulage supply is relatively inelastic, as local haulage companies cannot easily add new lorries or drivers. This seems to be the current situation in Northern Ireland. In November 2021, John Martin of the Road Haulage Association said there is a shortage of between 4,000 and 5,000 HGV drivers in Northern Ireland in a statement to the Northern Ireland Legislative Assembly (Irish Times, November 2021).

UOG activity will move the demand curve from  $D1$  to  $D2$ , in that a new major customer will increase demand for services at all price points. With an inelastic supply curve, the major impact of the higher demand will be on an increase in average prices from  $P_1$  to  $P_2$ . This price rise will obviously benefit local hauliers, but all local customers will also pay the new higher rate.

## 5.4 Potential Economic Benefits of UOG Activity

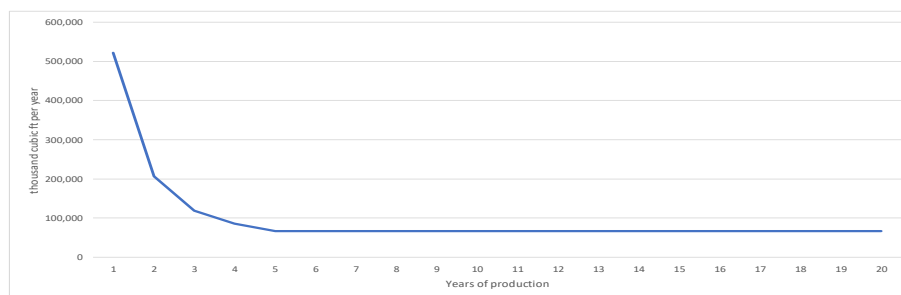
There is likely to be 2 main economic benefits for Fermanagh and Omagh. These are royalty payments made by the industry to the local area and the benefits from employing local people.

### 5.4.1 Royalty Payments

The shale gas industry, via its trade body “UK Onshore Oil and Gas (UKOOG)” has set its commitment to community engagement in its Charter (<https://www.ukoog.org.uk/community/charter>). This Charter sets out what communities can expect from companies developing shale in their areas. Operators will engage communities in advance of any application for planning permission and then again at each stage of development. Financially the charter includes a commitment to make contributions into a local development fund. The contributions include £100,000 per site developed and to pay 1% of revenues. It is not clear what UKOOG mean by site as this could refer to either a well or a well pad. This study assumes “site” refers to a well pad. At present these royalties would be a voluntary payment by the industry rather than a legal or planning requirement.

Using information from Geology.com it is possible to chart the likely production from a well, as figure 5.3 shows below. The general pattern is for high production initially that then falls significantly over the 1<sup>st</sup> 5 years until output plateaus for the remaining 15 years of the well's productive life. This pattern means that a well that produces 2 million cubic feet of gas on day 1 will probably produce about 2 billion cubic feet over its life. Importantly, it will produce about half of that total in the first 5 years.

**Figure 5.3: Expected output from a well over its life.**



SOURCE : ([Decline of Natural Gas Well Production and Royalties Over Time \(geology.com\)](https://www.geology.com/decline-of-natural-gas-well-production-and-royalties-over-time))

Over 1,600 wells this produces just over 33 billion therms of output. If we assume a long term market rate of 60p per therm and apply the 1% community payment suggested by the UKOOG charter, this generates total payments of £198.7m over 20 years. In addition, the charter says the industry will pay an initial fee of £100,000 per site drilled. Assuming 270 well pads, this will generate £27.0m in fees. In total therefore the industry will pay a nominal fee of £225.7m into a Fermanagh and Omagh community fund.

The 1% royalty fee is payable over 20 years and so the present value of this payment will be lower than the nominal value due to the need to discount future cash flows at an appropriate rate. This study uses the standard guidance for discount rates supplied by the UK Government via its investment guidelines (usually called the "Green Book"), which is 3.5%. Using this rate, the £198.7m of nominal fees generates a present value of £157.2m. Adding this to the site fee of £27.0m, produces a total present value of benefits of £184.2m.

This investment should also generate further economic benefits in the area due to the workings of the economic multiplier effect. This simply states that any investment into a local economy will generate 2<sup>nd</sup> order benefits as companies will spend part of that investment on suppliers and subcontractors (indirect benefits) and consumer demand may grow in the area (induced benefits) as the investment supports higher employment levels and/or higher income levels (mainly wages but also dividends).

In 2017 Northern Ireland's Statistical agency estimated the total GVA multiplier for various sectors across the province. Their assumption for mining and quarrying is the total GVA multiplier is 1.6. This estimates that an increase in economic activity within an area is likely to generate further benefits within that area of 1.6 times the original increase, through indirect and induced benefits. Using this suggests that the total present value of benefits is **£294.7m** (£184.2m \* 1.6).

**Table 5.4: Present value of industry royalties**

	Unit	Variable	TOTAL	1	2	3	4	5	6
Output per well	kcf		<b>2,001,478</b>	522,315,000.00	206,992	119,118	85,921	66,394	66,716
Output per well	Kilo therms	96.7	<b>20,698</b>	5,401	2,141	1,232	889	687	690
Output: 1600 wells	Kilo therms	1,600	<b>33,116,484</b>	8,642,234	3,424,885	1,970,925	1,421,650	1,098,548	1,103,883
Royalty payments £m	1% £	0.60	<b>£198.7</b>	£51.9	£20.5	£11.8	£8.5	£6.6	£6.6
			<b>Nominal</b>	<b>Present Value</b>					
PV of payments £m		3.5%	£198.7	£157.2					
1st payments £m	270.00	£0.1	£27.0	£27.0					
<b>TOTAL PAYMENT £m</b>			<b>£225.7</b>	<b>£184.2</b>					
Multiplier				<b>1.6</b>					
<b>Total after multiplier</b>				<b>£294.7</b>					

years 7  
to 20 are  
same as  
year 6

### 5.4.2 Employment Benefits

In addition, the industry would create some additional jobs in the area. Tamboran Resources predicted in 2011 that there would be 600 local additional jobs created in the area at the point of maximum production. As discussed above, these roles will likely be site management, site security, lorry driving roles and site labouring roles, rather than senior management and technical roles. As such these roles are likely to be at the current average salary in 2021 for Fermanagh and Omagh of £25,194 per annum.

The number of jobs would probably peak at 600 in line with maximum production and then decline over time in line with production. A local study (O’Roarty 2014b) noted that Tamboran had reduced their forecast of employment gains several times since 2011.

These jobs would generate an indirect economic multiplier mainly through the use of local subcontractors, such as haulage drivers. The report uses 1.6 for this multiplier in line with Northern Ireland Statistical Agency assumptions.

These assumptions produce a total benefit from increased local employment of £92.7m over 20 years. This discounts to a present value of £73.3m.

**Table 5.5: Present value of local employment benefits**

ITEM	UNIT	TOTAL	1	2	3	4	5	6
Output	Kilo therms	<b>33,116,484</b>	8,642,234	3,424,885	1,970,925	1,421,650	1,098,548	1,103,883
Jobs	Person Years	<b>2,299</b>	600	238	137	99	76	77
Salary	£m	<b>£57.9</b>	£15.1	£6.0	£3.4	£2.5	£1.9	£1.9
Indirect multiplier	£m	<b>£34.8</b>	£9.1	£3.6	£2.1	£1.5	£1.2	£1.2
<b>Total benefit</b>	£m	<b>£92.7</b>	£24.2	£9.6	£5.5	£4.0	£3.1	£3.1
<b>PV</b>	£m		<b>£73.3</b>					

years 7 to  
20 are  
same as  
year 6

#### Assumptions

Avg salary pa	£	25,194	From: <a href="https://www.nisra.gov.uk/publications/ni-geographies-by-place-work-and-place-residence">https://www.nisra.gov.uk/publications/ni-geographies-by-place-work-and-place-residence</a> : for 2021
Multiplier		1.6	From NIRSA 2017 research.
Discount factor		3.50%	From UK Green Book

### 5.4.3 Summary Benefits

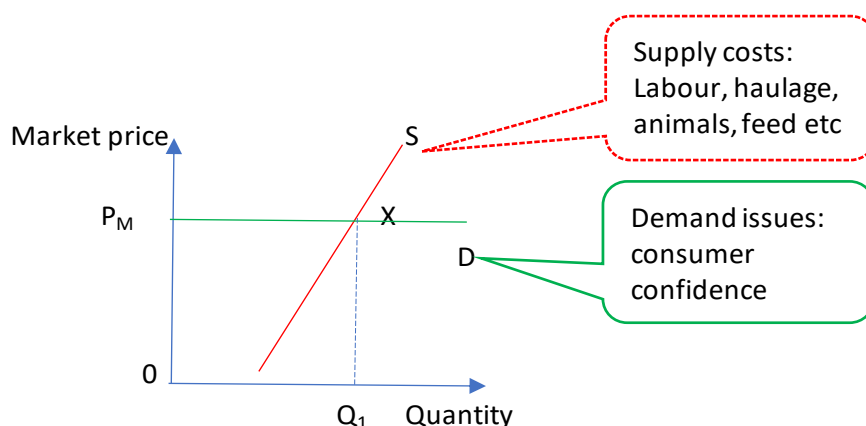
Summing these benefits together produces a present value of **£368m** for the local economy.

## 5.5 Economic Implications on Agriculture

Fermanagh and Omagh's farmers compete in both national and international markets to sell their produce. In 2020 Northern Ireland exported £1.791bn of food products to Great Britain (ranked 1<sup>st</sup> for NI to GB exports) and £0.727bn of food products to the Republic of Ireland (ranked 2<sup>nd</sup> for NI to RoI exports). This indicates the integrated nature of food markets across the United Kingdom and Republic of Ireland.

Assuming these markets are in broad long term equilibrium (that long term supply equals long term demand, and that prices and quantities are broadly stable), it is possible to use simple economic analysis to understand the possible economic impacts of UOG activity on Fermanagh and Omagh.

**Figure 5.4: Current market dynamics**



In the above diagram, Fermanagh and Omagh's farmers have a supply curve, S, and face a demand curve, D. The demand curve for local farmers is likely to be highly elastic as they are part of a wider British and Irish agricultural market rather than constituting a separate market. This means that local farmers will be price takers of the market price,  $P_M$ , and will have little ability to set or influence the price. The market equilibrium point will see an average market price of  $P_M$  at a quantity of  $Q_1$ . The rectangle  $XQ_1OP_M$  represents the size of the agricultural sector for the district.

UOG activity may affect this equilibrium by either affecting the supply curve and/or the demand curve for Fermanagh and Omagh farmers.

### 5.5.1 Supply Curve Analysis

If UOG activity were to develop on any significant scale in Fermanagh and Omagh, then the new industry would put significant pressure on the area's farmers' supply curve through increased competition for scarce economic resources.

Farmers purchase both hired labourers and haulage contractors to help run their businesses and deliver their products to market. UOG companies would compete with local farmers for haulage capacity and labourers. A study into the impact of UOG activity in the counties in Northern Pennsylvania (Christopherson and Rightor 2011) highlighted UOG activities require considerable lorry movements in order to set up the site, transport in the raw materials (sand and chemicals) and to transport out the stored gas). This usually bids up the local labour costs of lorry drivers, as there is significant increase in demand for those services. This higher rate then becomes the new market rate for all lorry customers, including farmers.

UOG development as a “boom” industry is likely to provide significant competition to the farming sector in the labour market. As table 3 noted farms rely on non-family members to provide 17.5% of their labour force. The UOG industry may offer these individuals roles as security guards, site managers, general labourers, and lorry drivers. The effect again will be drive up wage rates for these people and so make farming more expensive.

These changes obviously increase local costs compared to other livestock farmers throughout Britain and Ireland, and places Fermanagh and Omagh’s farmers at a disadvantage. As figure 4.5 below indicates basic economic theory suggests these changes will reduce farming activity in the area.

**Figure 5.5: Likely impact of higher resource prices on farming activity.**



In figure 4.5, Fermanagh and Omagh’s farming sector is currently in market equilibrium with a supply curve S1, interacting with a demand curve of D, to produce farming activity  $Q_1$  at an average market price of  $P_M$ . However, the impact of UOG activity moves the local supply curve from S1 to S2 due to increased labour and transport costs. Unfortunately, as Fermanagh and Omagh is part of the Britain and Ireland farming market it cannot easily raise prices above the  $P_M$  level as it is effectively a price taker in this market. Other farming regions of Britain and Ireland will probably expand production to take advantage of their increased competitiveness compared to Fermanagh and Omagh. As local competitiveness falls the new equilibrium position moves from  $Q_1$  to  $Q_2$ . The result is that Fermanagh and Omagh is left with a smaller farming base as the less profitable farms in the area close due to higher costs. The farm sector shrinks from  $X_1Q_1OP_M$  to  $X_2Q_2OP_M$ , with the rectangle  $X_1Q_1Q_2X_2$  representing the loss in output for the local sector. As noted below the line  $0Q_2$  could well be only 70% of the line  $0Q_1$ .



A landmark study by the University of Pennsylvania (Finkel et al 2013) demonstrated a clear negative correlation between increases in UOG activity within a county and changes to milk production in that county between 2007 and 2011. The 5 counties with the most wells (an average of 620 per county), saw an average reduction in the dairy herd of 30.3% over the period. By contrast 5 adjacent counties with an average of 46 wells each, saw a decline in their dairy herd of only 3.4% on average. Whilst the study did not offer an explanation, a previous study in the same area of Pennsylvania (Christopherson and Rightor 2011) suggested that competition for scarce labour resources had been a factor in increasing farmers' costs. This is a classic example of a "resource curse".

Fermanagh and Omagh is not the same as Pennsylvania and so it is impossible to accurately predict the exact size of the reduction in farming that would result if UOG activity commenced. However, the 30.3% has at least been observed in a real world setting in an area known for its livestock farming and so has some credibility. Applying the 30.3% decline to Fermanagh and Omagh and there is a risk that the farming sector will decline from £71.4m GVA in 2021 (see above) to under £50m.

There is, therefore, a clear risk that UOG companies outcompete farmers for key resources, and so force up the price of those resources for farmers, *ceteris paribus*. Economic theory predicts this will reduce profitability of local farms and probably force the least profitable out of business.

### 5.5.2 Demand Curve Analysis

UOG activity may affect Fermanagh and Omagh farmers' demand curve if consumers perceive that food produced in the district is less safe than food produced in other regions. In this case some consumers actively seek out alternative sources.

The recent history of food production though suggests that farmers and agri-businesses rely heavily on their general reputation for producing good quality safe food in order to trade. When consumers perceive a type of food as being less safe than its rivals they can move quickly and decisively to boycott the affected product. Recent examples of consumers losing confidence in food products include the Genetically modified food debate at the start of the century and the Chinese baby formula scandal in 2008.

Whilst the actual risk of a water contamination incident may be very low, a study (Williams et al 2017) into the perceptions of UOG activity amongst various focus groups in England highlighted that the 2 main known risks were water contamination and increased seismicity.

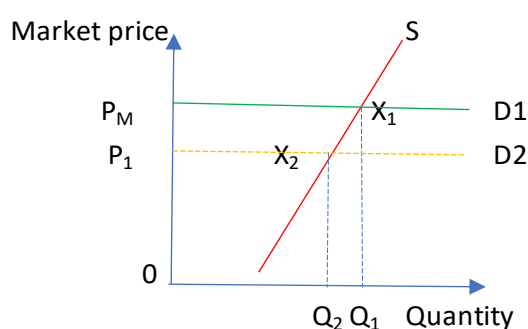
Assessing how British and Irish consumers may react to eating food produced in a UOG environment is nearly impossible to ascertain at this stage as there has never been any commercial UOG development in Britain and Ireland. As Williams et al (2017) noted participants in their studies tended to take a worst case scenario, precautionary principle approach. A study in the USA (Zhang, Rupp, and Graham 2021) found a similar response. Many people in their study wanted to adopt a precautionary approach to UOG activity, regarding environmental and water safety issues.

Ong (2014) noted that farmers in the Marcellus shale formation in Pennsylvania were struggling to attract premium customers for their products, such as organic produce.

At this stage there is no way of knowing how consumer perceptions play out for sure. It seems likely that any significant UOG activity in the area will adversely affect premium agriculture. More general agriculture will also be affected if a safety incident takes place.

If, however, consumers do perceive food from a UOG region as being of lower standard than other food then figure 5.6 explains how that will impact on the economy of local farmers.

**Figure 5.6: Likely impact of lower commodity prices on farming activity.**



The perceived risks of UOG activity will move the demand curve for local farmers from D1 to D2. This will, *ceteris paribus*, reduce the agricultural sector from  $X_1Q_1P_M$  to  $X_2Q_2P_1$ . This would imply that only the most efficient or niche farms would survive.

These farm losses would potentially occur at a time when the importance of agricultural land has also become more prominent since Russia's invasion of Ukraine, with a desire for the UK to become more self-sufficient in the production of food whilst also seeking to keep food costs down to mitigate the impact to the population of the significant increases in the cost of living.

## 5.6 Economic Implications on Tourism

Significant UOG activity in Fermanagh and Omagh is likely to have implications for the tourist sector in the local area.

Tourism is an important element for the local economy. In 2019 overnight trips contributed over £79m to the local economy (source NISRA). This puts Fermanagh and Omagh as the 4<sup>th</sup> out of 11 Northern Ireland districts for overnight spend. Fermanagh issued nearly 3,000 angling licences to tourists in 2019, representing 85% of all tourist angling licences issued in Northern Ireland.

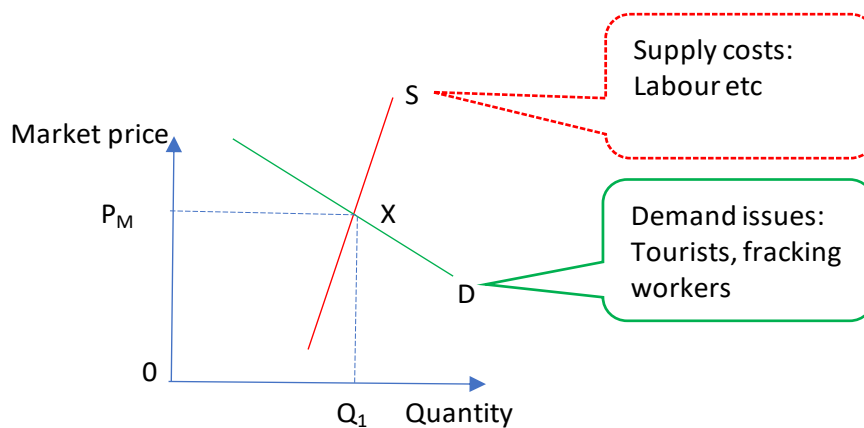
The cornerstone of the area's tourism offer is the UNESCO recognised Cuilcagh Lakelands Geopark, which covers most of the Erne West area of Fermanagh and extends into parts of County Cavan in the Republic of Ireland. The park became the world's 1<sup>st</sup> cross border geopark in 2008 and was in the 1<sup>st</sup> wave of UNESCO

geoparks in 2015. There are now nearly 200 UNESCO geoparks around the world (mainly in Europe and Asia). UNESCO reassesses every geopark every 4 years to ensure it is still meeting the acceptance criteria.

The Geopark has significant attractions, such as the Marble Arch caves, the Cuilcagh mountain park, and the stairway to heaven walkway. It is a hub for outdoor leisure activities, such as hiking, mountain biking, angling, and kayaking. In 2019 the park's management estimated 474,000 people had visited key attractions (where the park's management counts numbers). This was an increase from 300,000 in 2016.

The figure below shows the likely equilibrium point for tourist services in Fermanagh and Omagh.

**Figure 5.7: Basic economics of tourism in Fermanagh and Omagh.**



In this model, the local industry has a supply curve,  $S$ , and faces a demand curve of  $D$ . In a market equilibrium situation, the sector's value is  $XQ_1OP_M$ . In this case the supply curve is likely to be highly inelastic in the short term as tourist sectors (accommodation, restaurants, attractions) have relatively high fixed costs.

If UOG activity were to become significant in the district, then it would impact on both the supply curve and the demand curve. Its impact on the demand curve would probably be more dramatic in the short run.

### 5.6.1 Demand Curve Analysis

There is likely to be little if any capability in the local area to supply goods and labour for a nascent UOG industry. There is no prior experience of UOG activity in Northern Ireland. As such UOG companies are likely to rely on imported equipment and labour to set up and initially at least operate sites. Evidence from the USA has been that companies have generally preferred to create newer shale gas plays with experienced staff from elsewhere. This has had a notable impact on local hotels and restaurants.

In effect several hundred people descending on a town at once has a dramatic impact on the demand for hotels and restaurants. Staff soon book out hotels and restaurants. Importantly they easily outcompete more price sensitive tourists for fixed resources such as hotel rooms and restaurant tables. In the short term this is

beneficial for local hotels and restaurants who see a rise in demand for their services. Mount, Kelsey, Brasier (2014) argued that the shale producing counties of Pennsylvania had seen hotel revenues grow by 36% between 2007 and 2011 due to the increased demand from transient workers

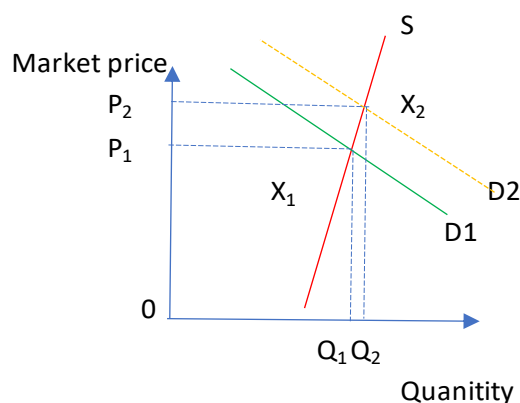
However large scale UOG activity is likely to be a blight on the landscape. The landscape will become increasingly industrialised. There are usually up to 8 wells per square mile. There is a constant hum (up to 95 decibels) from the compressor and there are several lorry trips per day per well. All this will undermine the peace and tranquillity of the area and make it less attractive to outdoor activities (cycling, hiking etc). A study (Kelliman 2015) into users of US parklands indicates that a plurality of respondents believed that UOG activity would negatively impact their ability to access parkland. A majority of respondents to the same survey said they would consider visiting another parkland area if it was unaffected by UOG activity. Therefore, whilst UOG development will bring in new demand for hotels and restaurants it is also likely to chase away some of the existing demand from tourists.

Each well will require 10-11.5m litres of water. This is likely to come from local water sources. Significant UOG activity may permanently lower the water levels in the lough, which may affect the water environment and affect the number of fish in the rivers and loughs. Fermanagh issues nearly 3,000 angling licences to tourists (about 85% of Northern Ireland's total). This number may fall if either the local environment becomes industrialised and/or the water quality/quantity changes in local lakes.

The major threat of UOG activities is to the Cuilcagh Lakelands Geopark's UNESCO status. UNESCO reviews this status every 4 years, and it is difficult to see how the park retains its status if there is any significant UOG activity in the area, given it would significantly change the character of the area. Estimating the impact of losing UNESCO status is near impossible as every park and site is unique. Generally, places which were already well known will withstand the loss of a UNESCO designation. For example, Liverpool City Council does not expect the loss of UNESCO world heritage for the waterfront in 2021 to affect tourism much (see the Guardian article 2021 link in the references). Lee and Ramasamy (2021) however note that for lesser-known sites UNESCO status is important for branding purposes and is crucial for attracting visitors from outside the region, especially foreign visitors. In the same paper the authors note how a museum in the Itoigawa UNESCO geopark in Japan saw a doubling of visitors between 2008 and 2019. It achieved UNESCO geopark status in 2015. Flipping this around, implies that a loss of UNESCO status could reduce tourism by up to 50%.

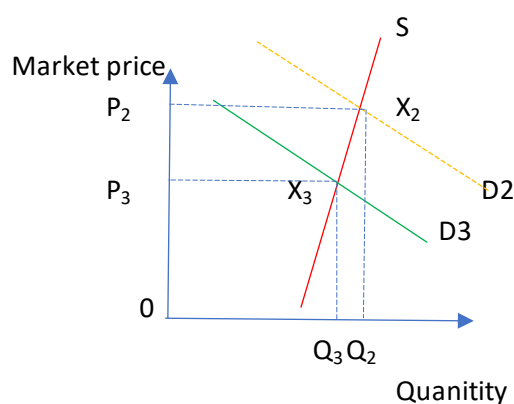
How these forces play out will be complex and will probably change over time. Initially during the set up phase the influx of engineers into the area will represent a net increase in demand for hotel and restaurant services. However even from the 1<sup>st</sup> well, tourist numbers are likely to decline, mainly as price sensitive tourists move to cheaper regions. Over time however as the initial burst of UOG activity dies away, the region's tourist services will be left with only a reduced demand for their services.

As such we expect the demand curve to move differently in the short term and the long term.

**Figure 5.8: Short term Impact of UOG activity on tourism's economics.**

In the short term, demand rises from D1 to D2. This results in higher prices as the price rises from P1 to P2, and a small increase in quantity. Overall, the market expands from  $X_1Q_1P_1$  to  $X_2Q_2P_2$ .

However, in the long term, demand will fall back from D1 to D3, as fewer tourists come to the region.

**Figure 5.9: Long term Impact of UOG activity on tourism's economics.**

This leads to a reduced sector of  $X_3Q_3P_3$ , which is both smaller and less profitable than the initial position.

The long-term impact on tourism in Fermanagh and Omagh could be potentially at least as severe. If there are 1,600 wells in the area on 270 well pads, then the industry could devastate the tourism sector. However, using a figure of a 50% decline (as discussed above) suggests that local GVA may fall by £39.5m from £79.0m to £39.5m.

### 5.6.2 Supply Curve Analysis

The impact of UOG activities on the tourist sector's supply curve is probably less pronounced than on its demand curve. Generally, the only area where the tourist sector competes for resources with UOG companies is over the employment of staff.

However, as UOG activity usually requires very different skills to tourism, there is unlikely to be much competition.

The supply of good new tourist businesses will also likely fall on any announcement of extensive UOG activity in the area, as tourism business entrepreneurs seek opportunities in other tourist locations, due to changing expectations of future tourist numbers in different locations.

## 5.7 Economic Implications of Manufacturing

As table 1 shows manufacturing is the 2<sup>nd</sup> largest contributor to Fermanagh and Omagh's GVA. If UOG activity were to commence in the district it is unlikely to have much direct impact on local manufacturing companies. It will though have an indirect impact as UOG companies will compete for scarce local resources, especially haulage, with local manufacturers.

This implies that local manufacturers will see an increase in their cost base as they have to pay more for some key resources.

**Figure 5.10: Impact of UOG activity on manufacturing's supply curve.**

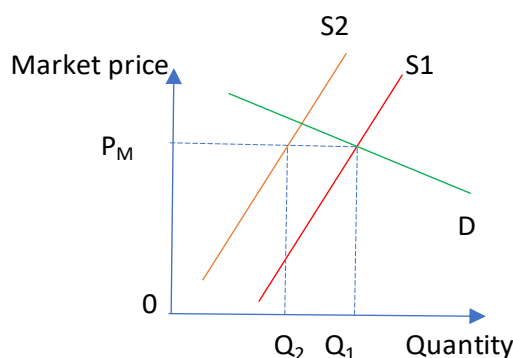


Figure 5.10 explains this impact. Before UOG development, local manufacturers have a supply curve of S1 and a demand curve of D. They produce a quantity of output of  $Q_1$  at an average price of  $P_M$ . UOG development increases the cost base of these companies and so the supply curve moves to S1. Generally local manufacturers will compete with integrated markets that cross the boundaries of Fermanagh and Omagh to include Northern Ireland, the Republic of Ireland, Great Britain and perhaps further afield. As such local manufacturers are likely to have limited ability to pass on increased costs to customers as increased prices. This implies that the main impact of higher costs will be a reduction in manufacturing activity from  $Q_1$  to  $Q_2$ .

Assuming that these increased costs reduce manufacturing activity by 5%, would see local GVA fall by £13.7m.

## 5.8 Cost Benefit Analysis

Cost benefit analyses allow for the comparison of an initiative's costs to its benefits to see if it is economically viable. These are never complete as they usually ignore external costs, such as environmental damage, and health issues.

Given there is no history of significant and sustained UOG development in the United Kingdom or the Republic of Ireland, it is impossible to develop a definitive cost benefit statement, as there is no valid comparator to refer to. However, it is possible to devise a rudimentary cost benefit statement based on the above analysis.

This analysis will assume that UOG development takes place to its maximum potential in Fermanagh and Omagh. That is UOG companies develop 270 well pads, with 1,600 wells and extract 3.2 tcf over a 20 year period. If UOG activity takes place on a smaller scale, then both the costs and benefits will be scaled back.

Section 5.3 calculated that the total benefits of UOG development using the UKOOG charter would have a present value of **£368m** for Fermanagh and Omagh.

The major economic costs for Fermanagh and Omagh are likely to be the contraction in the agriculture, tourism, and manufacturing sectors as a result of the introduction of UOG activity.

The analysis in section 4.5.1 suggested that the farming sector may contract by £21m per annum as a result of UOG activity.

Section 5.6 stated that overnight stays contributed £79m to the local economy in 2019. A fall of 50% (reversing the growth in numbers seen at Itoigawa UNESCO geopark in Japan) would reduce this by £39.5m per annum.

Section 5.7 estimated that a 5% fall in manufacturing would reduce local GVA by £13.7m.

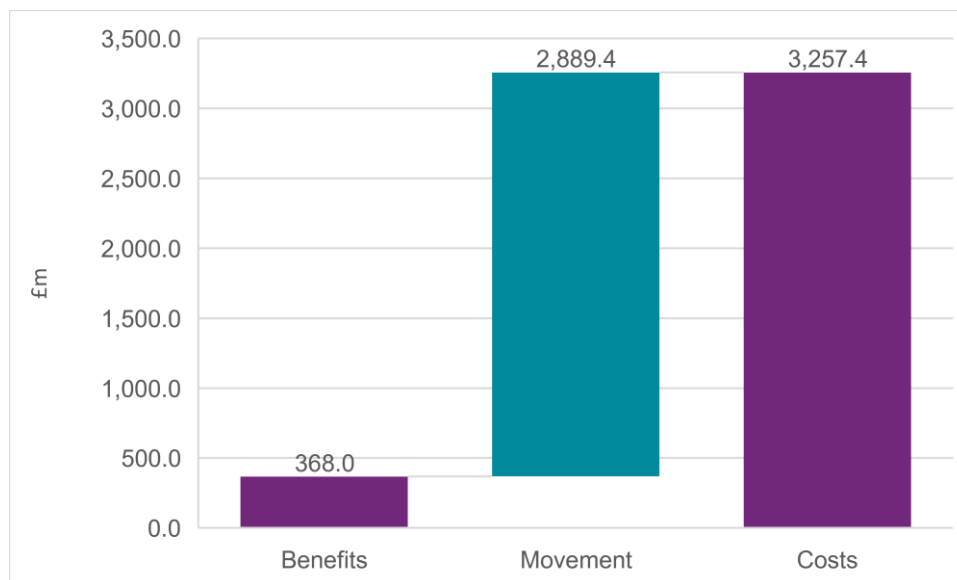
Adding these declines together, generates a reduction in annual GVA reduction of £74.3m. Reducing economic activity by this amount would cause the multiplier effect to go into reverse. The NISRA multipliers for 2017 for agriculture, tourism, and manufacturing were respectively 2.0, 1.3 (tourism covers accommodation and food services – 1.3 is the average of these 2) and 1.5. Using these, the likely decline in GVA would be more like £114.0m per annum. The lifetime value of the costs at the same discount rate of 3.5% produces a present value of **£3,257.4m**

**Table 5.6: Economic costs of UOG activity**

Reduction in GVA	£m						
	Current GVA (£m)	Reduction	Reduced GVA	GVA multiplier	Indirect effects	Total reduction in GVA	Life time value
Agriculture, forestry and fishing	£ 70	30%	£ 21.1	2.0	£ 21.1	£ 42.1	£ 1,203.1
Tourism*	£ 79	50%	£ 39.5	1.3	£ 11.9	£ 51.4	£ 1,467.1
Manufacturing	£ 274	5%	£ 13.7	1.5	£ 6.9	£ 20.6	£ 587.1
<b>TOTAL</b>	<b>£ 423</b>		<b>£ 74.3</b>		<b>£ 39.8</b>	<b>£ 114.0</b>	<b>£ 3,257.4</b>

Whilst the **£368m** in benefits is a lifetime benefit, the costs are over **£3,257m**, which is nearly 9 times the benefits.

**Figure 5.11: Cost benefit analysis summary**



This calculate is for illustrative purposes only and is dependent on many assumptions. A key one is obviously the price of a therm of gas. However, this would need to be in excess of £7.00 per therm to get close to generating the benefits needed to offset the costs. The highest price this has ever reached was £5.40 on 7 March 2022 – and this was in the midst of Russia’s invasion of Ukraine which sent prices spiralling from £1.74 on 21<sup>st</sup> February 2022.

## 5.9 Conclusions

Fermanagh and Omagh is an area that is steeped in farming, and increasingly has been successful at developing a tourist industry with a key product/experience being the beauty of the Cuilcagh Lakelands Geopark.

If UOG activity takes place in the district, there are likely to be implications for the area. Firstly, most of any benefits that accrue are likely to leak out of the area by way of import payments for equipment, wage payments to itinerant staff who do not reside in the area, profits to foreign owned companies and tax revenues to UK tax authorities.

UOG development is likely to damage the local farming, tourism, and manufacturing sectors. It will compete for scarce resources for labour and haulage, pushing up rates and so increasing key input costs for farming. It is likely these increases, relative to other regions in Britain and Ireland, will put the most marginal farms and manufacturing companies under pressure and may result in some farms and companies closing. This is a classic example of “crowding out” when one sector outcompetes other sectors for scarce resources and so leads to a decline in the other sectors.



In addition, public perceptions about the safety of UOG development are generally not good. If this perception crystallises around food safety (this point is debatable and may not occur), Fermanagh and Omagh farmers may struggle to sell farm produce if consumers have fears over food safety.

Initially the tourist industry may experience a mini boom as the influx of engineers fills up local hotels and local restaurants. However, the inevitable increase in prices this would cause will drive out existing tourists who will move to other cheaper destinations for their holidays. The danger for the local tourist sector is that simply when the engineers move on, will the tourists return? They may not do so anyway if the area has been despoiled by many wells and the local roads are choked with HGV lorries moving materials and product into and out of the wells.

Overall UOG activity is likely to bring only limited benefits to the area and the disruption to key sectors such as farming, tourism and housing will more than outweigh these.

As O’Roarty (2014a) concludes *“The environmental degradation, whether real or perceived, will obliterate tourism in Fermanagh and reduce demand for agricultural products and agri-foods...”*

This quote is important as it highlights that a resource curse is a very likely development in Fermanagh and Omagh precisely because the local needs of a nascent UOG industry are a direct threat to 2 well established local economic sectors (tourism and agriculture) which rely on a very different use of land to UOG activity.

As the cost benefit analysis suggests full scale UOG development in the district may easily generate economic costs that are 9 times the benefits. This analysis did not cover the huge potential external costs from a worse environment and worse public health.

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# 6.

## S O C I A L I M P A C T

## 6 Social Impact

### 6.1 Introduction

The introduction of a new major activity, such as UOG development, into a mature and stable society like Fermanagh and Omagh is likely to change the relationships that exist within that society. These changes will produce winners and losers in society. A group “wins” from a major social change when it becomes more powerful/prestigious, wealthier/receiving a higher income or feels that it is happier or healthier following the change. Conversely a group loses when they experience the opposite reactions to these as a result of the change.

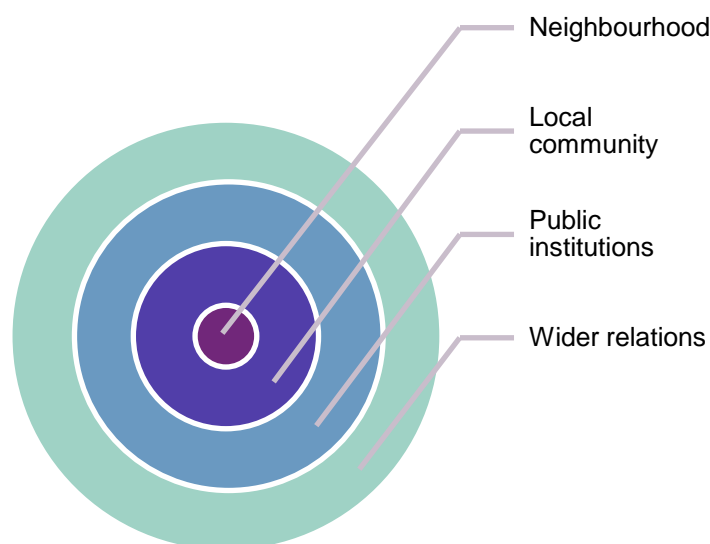
Mace uses a 7 factor model to analyse the social relations within the community to understand the dynamics within that community. This model assumes that the outcomes for a place depend on the strengths, weaknesses and interactions of its health, education, economy, housing, infrastructure, security, and community.

**Figure 6.1: Mace’s model of place**



In addition, these factors and relationships may take place at several different geographical levels ranging from the local to the international. Figure 6.2 identifies the 4 main geographical levels that a community may exist on.

**Figure 6.2: 4 levels of place**



In the context of possible UOG activity in the district, the neighbourhood would mean those residents who live next to or close by a UOG site or a main transportation route. The local community would cover the wider community of Fermanagh and Omagh as well as the immediate neighbours. Public institutions include the local council, schools, and health services provided by the Western Health and Social Care Trust (WHSCT). Wider relations would cover the community's links to other areas of Northern Ireland, the Republic of Ireland and the wider United Kingdom.

This section commences with a demographic analysis of Fermanagh and Omagh to understand who lives in the district and how this is changing over time. It then discusses each of the 7 factors, except for the economy which is discussed extensively in section 5. As a discussion of the public health implications of UOG activity forms the basis of section 7, the discussion on health focusses on the implications for the health care infrastructure in the district and is included in the infrastructure section.

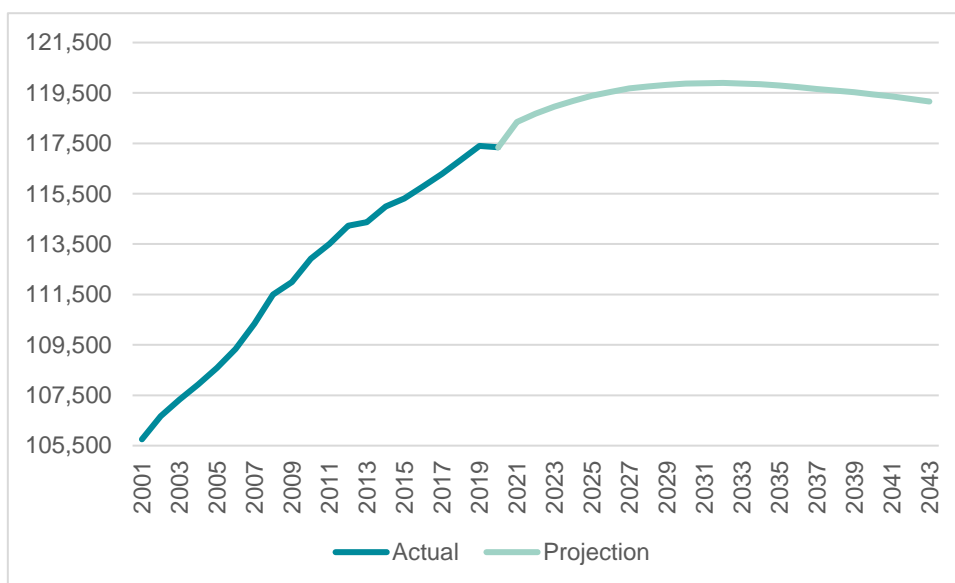
The key question is really “what impact will UOG activity have on the key factors that affect the people and place of Fermanagh and Omagh?”

## 6.2 Demographic Analysis

The demographic analysis of Fermanagh and Omagh presents a familiar picture for a Western European rural area. The general trend has been for population growth rates to slow this century until population figures either stagnate or decline from about 2030 onwards. Whilst numbers are forecast to stagnate, the age profile of the population though is becoming ever older. The proportion of older people (defined as 65 or older) will increase from 13% in 2001 to 32% by 2043.

The population has increased since 2001 at a compound annual growth rate of 0.52% to reach 117,337 in 2020. However official population projects expect growth to slow to only 0.20% compound growth per annum between 2020 and 2032. After 2032 official projections predict the district’s population will stagnate and fall slightly to 2043. By contract the proportion of the population under 15 will fall from 23% in 2001 to 17% in 2043.

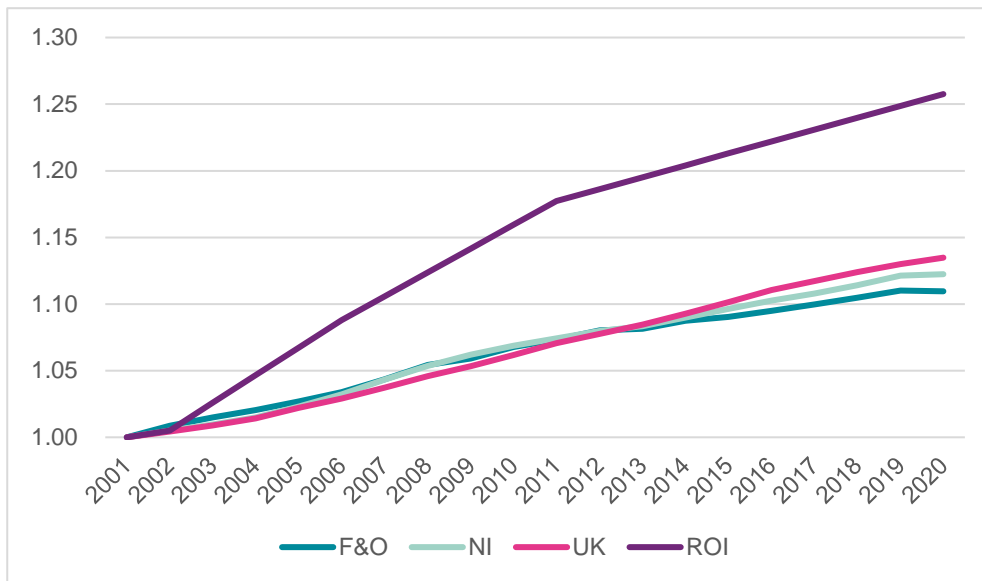
**Figure 6.3: Fermanagh and Omagh’s population 2001-43**



Source: NISRA Mid-Year Population Estimates and 2018 Based Sub National Population Projections

Figure 6.4 shows that Fermanagh and Omagh’s population growth was slightly lower than Northern Ireland’s and the UK’s. Figure 6.4 also shows that the Republic of Ireland’s growth rate was significantly higher than any other geographical area under consideration. For comparison, the UK’s compound annual growth rate was 0.67% between 2001 and 2020, whilst the Republic of Ireland’s compound annual growth rate was 1.21%.

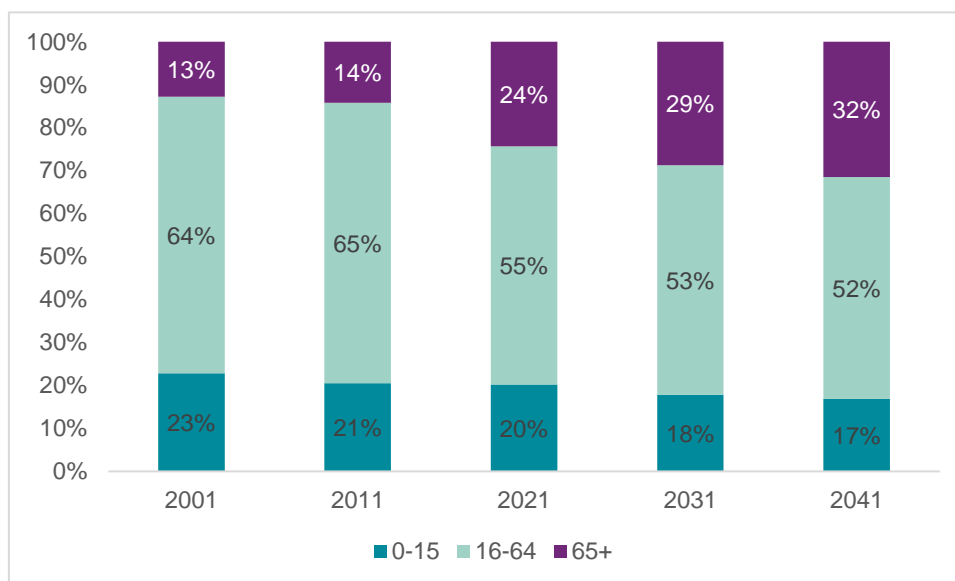
**Figure 6.4: Relative change in population: 2001-2020**



Source: UK NOMIS Database for F&O, NI and UK. Central Statistical Office (data.cso.ie) for ROI.

In common with most areas of Western Europe, Fermanagh and Omagh is experiencing an aging population, with the proportion of people aged 65 and over increasingly steadily over time.

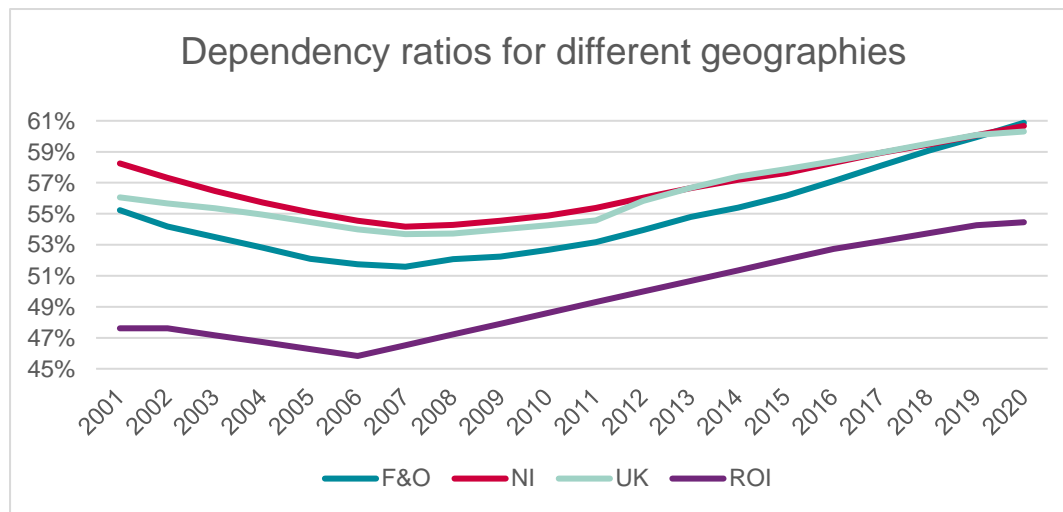
**Figure 6.5: Fermanagh and Omagh district's age profile over time**



Source: UK NOMIS Database for F&O.

This age profile means that Fermanagh and Omagh has a higher dependency ratio when compared to its comparator geographical areas. The dependency ratio compares the sum of children and older aged people to working aged people. It is a key measure in understanding the viability of key public services such as health and education as it measures the number of main users of these services to the main group of taxpayers.

Figure 6.6 shows the trends here. It is noticeable that the Republic of Ireland has a lower dependency ratio than the other geographical areas.

**Figure 6.6: Trends in the dependency ratio for different geographies.**

Source: UK NOMIS Database for F&O, NI and UK. Central Statistical Office (data.cso.ie) for ROI.

The demographic numbers suggest that in the long term the major challenge facing Fermanagh and Omagh will be to attract and retain younger people to the area. This will require the area developing a compelling offer for this segment.

### 6.3 Security

This factor's definition is more than a simple "crime and punishment" approach. It refers to a general sense of wellbeing, and an attachment to place.

As well as air pollution, wells create a number of unpleasant side effects that will make people less happy and so less secure. One of the main issues is the risk of increased seismic activity. Williams et al (2017) noted that in focus groups held in the UK, seismic activity came up as a key issue for participants. Exploratory UOG development in Lancashire in 2018 produced several seismic events up to 2.9 on the Richter scale. This is above the UK Oil and Gas Authority's guideline limit of 0.5. A tremor up to 2.9 on the Richter scale may cause minor cracks in buildings and will create a vibration that may be felt by people and animals. People who start to experience a significant number of tremors when previously they felt none are likely to feel less secure in their properties. It is worth noting that the island of Ireland is known for its very low level of seismic activity. It is much lower than Great Britain for example.

A strong tremor will be felt for several kilometres from the site of the well and so will have a community affect.

In 2014 Tamboran's proposed exploratory site in Belcoo was about 2-3km from the border with the Republic of Ireland. As such if UOG activity had taken place in Belcoo and it had led to increased seismic activity in the area, then the tremors would almost certainly have been felt in communities in County Cavan in the Republic of Ireland, close to the border. As such in this regard, the sense of place spans both Northern Ireland and the Republic of Ireland.

UOG activity also produces significant noise and light pollution for its neighbours. Sites usually have a gas compressor (to compress the captured gas, so it is easier to store and transport) which run constantly and generate a noise of 85-95 decibels. This is the equivalent of motorcycle engine running. In addition, once a well produces gas, it will produce gas continually until all the recoverable gas in that given fracture has been recovered. This can take weeks and months to take place. As such sites are 24 hour 7 days per week operations and require large industrial lights to maintain operations during darkness. This will create significant light pollution and day and night noise for anyone living nearby.

Sangaramoorthy et al (2016) conducted some focus groups in West Virginia to gauge how local people felt about the introduction of UOG activity in the area. One woman, a long-time resident of the area, gave a powerful answer.

*"I love where I live. I just love the area and I'm distressed. I'm grieving, grieving the loss of [my] environment. Grieving home when [I'm] still at home. It has been overwhelming. Lost the road. Living with the dust. Pipe yard within a 100 yards of my home that has since been converted to have a heavy equipment yard. Wood pallets. Trucks all hours. Gas well. Industrialized bottom line ..."*

## 6.4 Infrastructure

UOG development will place a burden on a place's public infrastructure. The most immediate problem concerns the impact on the roads. A 2012 study by the University of Texas estimated it took an average of 1,184 lorry movements to set up a well, 353 annual movements to maintain a site and 997 movements to redrill a site (about every 5 years). These movements assume that the gas is transported out by pipe, rather than by lorry. If transport is by lorry there will easily be a further 365 lorry movements per year.

These heavy lorries (weighing 30-40 tonnes when fully laden) will create significant wear and tear on the district's roads. The 2012 University of Texas study estimated that a road surface that should last 20 years with mainly car usage, could last only 5 years with this volume of lorries. Assuming a cost of £1200 per 1 metre of road. This implies that the Northern Ireland Department for Infrastructure could spend up to £36m more to maintain 10 km of roads over 20 years due to the increased wear and tear of lorry movements.

In addition, the health implications of poor air quality will put pressure on local health services. There will likely be more people with chronic breathing conditions such as asthma and bronchitis, and illnesses which affect breathing (such as covid 19) may be more severe than previously.

UOG activity will bring with it a large transient labour force of engineers. Many of these people will be temporary immigrants to the district. However, they will still put pressure on key public services, such as GP services and Accident and Emergency services during their stay in the district. This pressure may increase if some of the engineers decide to settle for a period of time in the district and so bring their families with them.



Fermanagh and Omagh in particular and Northern Ireland in general have some major issues with regard the state of its public infrastructure. As the Bengoa Report of 2016 highlighted, Northern Ireland's health care system is under huge pressure compared to other parts of Great Britain and Ireland. Table 6.1 shows the relative performance of Northern Ireland's health service compared to its English counterpart on 2 key health service measures (cancer treatment and A&E stays).

**Table 6.1: Health service outcomes in northern Ireland and England**

Key Health statistics	Northern Ireland (Dec 2021)	England (Jan 2022)
%age of cancer patients receiving 1 <sup>st</sup> definitive treatment within 62 days of referral.	43%	62%
%age of A&E patients being treated with 4 hours.	48%	75%

Source: NI Dept of Health for NI statistics. NHS England for English statistics.

Any influx of people into the area, whether iterant or people taking up residence, will put further pressure on an already stretched health service. Even if engineers do not intend to reside in the area, they will be staying in the district whilst they work and will presumably require Accident and Emergency services from time to time.

A Northern Ireland Water report in March 2022 identified that 16 (3 of these are in the Erne West area) out of 66 wastewater treatment works in Fermanagh and Omagh have no capacity at all to serve more developments in their catchment, whilst another 13 (5 in Erne West) have limited capacity for growth. This presents an interesting problem for any UOG activity in the area. Well pads, as places of work, will need to provide staff with adequate kitchen and bathroom facilities. Any well pad built in the areas that use wastewater treatment plans that are full or nearly full may well be refused due to the inability of the local wastewater treatment network to cope with any additional demands.

**Table 6.2: Wastewater treatment works in Erne West which are at or close to maximum capacity in March 2022**

Current status	Erne West Wastewater Treatment Works
Currently Full capacity	Garrison, Belleek, Florencecourt
Max 10% additional capacity	Church Hill
Max 17% additional capacity	Derrylin, Derrygonnelly, Arney, Springfield

Source: NI water report March 2022.

The transient nature of the engineers' work coupled with a centralised taxation system may result in difficulties for public institutions in responding to the needs of transient engineers and their families. Government may be reluctant to increase hospital capacity if its planners believe the increase is temporary. In addition, the additional taxes (income taxes on wages and VAT on local sales) raised from the transient engineers will not necessarily be earmarked for additional public infrastructure spending in Fermanagh and Omagh.

The likely result is that in short term a population of transient engineers will put pressure on key public services with little new investment to cover. Local residents may notice that their access to local services will worsen slightly. This will manifest itself in longer waiting times for health services and more competition for school places.

## 6.5 Housing

UOG development may have an impact on local housing markets due to the increased demand for housing that may result from a transient population of engineers wanting accommodation in the area.

Fermanagh and Omagh already has the most overstretched housing market of all the districts within Northern Ireland, as the table below indicates.

**Table 6.2: Housing price affordability in Northern Ireland**

NI District	Q4 2020	Q4 2021	Q1 2022	Change Q420-Q122	Mean wages	HP/MW
Antrim and Newtownabbey	£169,043	£159,751	£176,788	4.58%	£27,712	6.38
Ards and North Down	£220,538	£217,430	£213,553	-3.17%	£28,098	7.60
Armagh City, Banbridge & Craigavon	£163,864	£187,815	£176,916	7.97%	£27,556	6.42
Belfast	£182,311	£169,929	£176,774	-3.04%	£26,988	6.55
Causeway Coast and Glens	£203,106	£178,233	£200,467	-1.30%	£28,984	6.92
Derry City and Strabane	£149,085	£126,114	£147,657	-0.96%	£25,695	5.75
Fermanagh and Omagh	£192,571	£240,453	£207,658	7.83%	£23,302	8.91
Lisburn and Castlereagh	£212,386	£212,379	£218,288	2.78%	£25,257	8.64
Mid and East Antrim	£160,351	£166,319	£175,320	9.34%	£31,377	5.59
Mid Ulster	£175,561	£211,424	£194,301	10.67%	£26,065	7.45
Newry, Mourne and Down	£198,171	£214,123	£211,887	6.92%	£25,575	8.28

Source: Houses prices from Ulster University Q3 2021 Housing Market report; mean wages for 2021 from NISRA ASHE 2021.

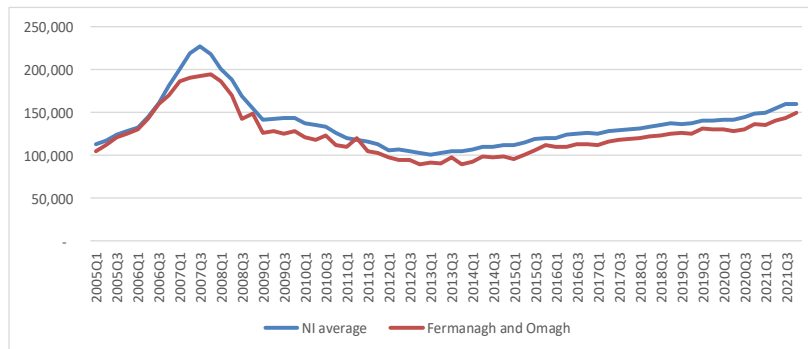
House prices have the highest ratio of house prices to mean annual wages of all the districts within Northern Ireland. Fermanagh and Omagh has consistently the smallest number of sales of any district in Northern Ireland. In 2021, NISRA estimated that only 4% of sales in the province took place in Fermanagh and Omagh. This low volume of sales may explain the volatility in house prices for the district as a small number of abnormally large or small transactions can affect the average.

NISRA statistics show that house prices in the district are consistently below the Northern Ireland average, which appears initially to contradict the Ulster University data. However, NISRA uses a “standardised housing unit” as its measure, which accounts for the different types of property available from small flats to large, detached houses. Fermanagh and Omagh’s raw average house price may be higher

than for Northern Ireland as its housing stock may be more weighted to larger properties than smaller.

Over time NISRA statistics show that Fermanagh’s standardised house prices are about 90-95% of the Northern Ireland figure and this has not changed significantly since 2005.

**Figure 6.7: Standardised house prices in Fermanagh & Omagh.**

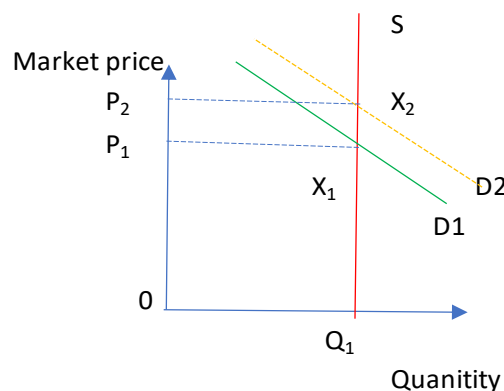


Source: NISRA – Northern Ireland House Price Index for 2021.

Any UOG activity within the district will put pressure on this already overstretched housing market. The extent of the pressure will depend on how many transient engineers work in Fermanagh and Omagh and what proportion of them seek to buy a house in the district. Generally, engineers working on setting up wells will seek to stay in hotel rooms, but those individuals involved in the operations and maintenance of wells may decide to rent or buy in the area. Generally experienced and qualified engineers are likely to earn above the mean wage for the area and so these individuals would be able to participate fully in the local housing market.

The figure below shows that any increase in the demand for houses will, in the short term, feed through to higher prices in the area as in the short term the supply of housing in Fermanagh and Omagh would be inelastic.

**Figure 6.8: Impact on the housing market**



In this diagram the market is assumed to be in equilibrium with a Supply of S and a Demand profile of D<sub>1</sub>. The equilibrium point is at Price P<sub>1</sub> and Quantity Q<sub>1</sub>. However, an influx of transient engineers seeking to purchase properties pushes the demand

curve from  $D_1$  to  $D_2$ . As supply cannot react to this increase in the short term, prices increase from  $P_1$  to  $P_2$ . This would increase prices in an already overstretched area and increase the house prices to mean wages figure ratio. This will inevitably price out some local residents from the housing market and restrict other people's ability to buy houses in the area. This will probably exacerbate the demographic problems in the district as young people will be most affected by a rise in house prices.

Given the proximity of the potential UOG sites to the Republic of Ireland, it is reasonable to expect some spill over demand into neighbouring counties in the Republic of Ireland, such as County Cavan.

## 6.6 Education

UOG activity in Fermanagh and Omagh is unlikely to significantly impact the education sector in the area. The most likely impact is if any transient engineers decide to bring their families to the district and then they seek places in local schools for their children. This will put pressure on school capacity, though it is difficult to quantify without knowing the number of children involved.

In 2014/15, the capacity across all primary schools has been approximated to be somewhere in the region of 7,914 with an enrolment figure of 5,622 resulting in 2,369 unfilled places (Fermanagh and Omagh district council 2015 position paper on Education, health, and community). This implies schools are operating at 71% of capacity, giving them plenty of scope to absorb new children. Given this, UOG activity is unlikely to have any significant impact on local schools.

## 6.7 Community

In this context, community means the relationships and networks that link individuals and groups in a place. A major change to a place, such as the introduction of a new economic activity such as UOG development is likely to disrupt the settled pattern of relationships and networks. It will inevitably create winners and losers. Whether this is beneficial to an area depends on the numbers of winners and losers and the degree to which groups and individuals feel they have won.

The interaction of these 2 factors means there is, theoretically, 4 potential outcomes of introducing a major change on a community. This depends on whether there are overall more winners than losers and the whether the net winners or losers think they have won or lost in a large or small way.

**Figure 6.9: Potential impact on a community of a major change**

Net Winners	<b>Status quo</b>	<b>Thriving</b>
Net losers	<b>Disengaged</b>	<b>Disenfranchised</b>
	Weak	Strong

If a change produces more winners than losers, but the overall change is seen as weak, then it is unlikely to have much impact on the community. If the change is seen as important, however, then the change will produce a thriving community. By contrast if a change produces more losers than winners and the losers perceive the overall change as being important then the community is likely to visibly weaken, and people may become disenfranchised. If there are net losers but the change is seen as unimportant, people are likely to become disengaged from local social, economic, and political forces that affect the place.

Introducing UOG activity into Fermanagh and Omagh produces a clear list of groups who may experience a deterioration in their quality of life. These groups include:

- Farmers who will pay more for labourers and haulage and may see a reduction in demand.
- Anglers and hikers.
- Tourist industries who see their key attraction, which is the natural beauty of the area, undermined.
- People with breathing difficulties.
- People seeking to purchase houses in the district.
- The roads authority seeing a deterioration in road quality due to truck movements.

The potential winners from introducing UOG development into the district include.

- Landowners who sell mineral rights.
- Haulage contractors
- Hoteliers (in the short term)
- People selling their houses and leaving the district.

Generally, there are more people in the loser groups than the winner groups and their losses are likely to be more important to them than the gains are for the winners. UOG development will lead to a disengaged and possibly disenfranchised community.

Short and Szolucha's (2017) study into the planning process regarding UOG development on the Fylde peninsula in Lancashire, England used the term "collective trauma" to describe a situation where many people in a community think a change will weaken their place, but they feel powerless to stop that change from occurring. Given the list of potential losers and the strength of feeling within Fermanagh and Omagh, the term "collective trauma" could apply to the district if UOG activities ever commenced in earnest in the district.

## 6.8 Conclusions

The introduction posed the following key question.

*"What impact will UOG development have on the key factors that affect the people and place of Fermanagh and Omagh?"*

The following table broadly summarises the discussion of the impact of UOG development on the 7 community factors that Mace use to analyse a place.

**Table 6.3: Summary of social impacts**

	Weakening	Strengthening
Health	Increase in breathing problems.	
Economy	Impact on farmers, tourism, manufacturing.	Higher demand for haulage, hotels
Infrastructure	Impact on roads, Impact on wastewater systems, Impact on health services.	
Security	Seismic events, noise, and light pollution	
Housing	Increase in house prices	
Education		
Community	Collective trauma	Land prices increases for owners

The table shows starkly that UOG development is likely to weaken the community and place of Fermanagh and Omagh and not strengthen it. This is probably to be expected given the way in which it would take place in the district. Most of the jobs, and certainly the skilled well paid jobs, would go to transient engineers with relevant experience who in the main are not resident in the district. Many of these engineers would come from the USA or Australia, whilst UK workers will probably have North Sea gas and oil experience. The main tax revenues raised will be income tax, corporation tax and VAT, which are all accounted for by UK central government. As such the main benefits of UOG development in terms of higher wages, higher tax revenues will not accrue to the residents and institutions of Fermanagh and Omagh. Any gas produced will probably be sold on UK and European markets and will therefore not benefit local consumers.

The only real benefits that will accrue locally are likely to be increased demand for certain local resources such as land, haulage, and labour. But even those benefits come with problems as increased rates for haulage will hurt existing customers, such as farmers.

The area, however, will be left to deal with the problems caused by UOG development. The area's rural beauty will be despoiled by the industrialisation caused by well pads; air pollution will worsen; farms may struggle due to increased pollution and increased costs; tourism will struggle as hikers and anglers seek alternative places; house prices may rise if engineers seek to buy houses to live in during their stay; and roads will worsen due to the increased wear and tear from heavy lorries.

Sangaramoorthy et al (2016) concluded their discussion of focus groups they had held in West Virginia by commenting:

*“Participants' lived experiences of fracking contribute to a heightened sense of fragmented individual and collective identities and increasing loss of control over lives and personal property.”*

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# 7.

P U B L I C   H E A L T H  
I M P A C T

## 7 Public Health Impact

### 7.1 Introduction

There have been several detailed studies undertaken in the USA on the possible effects of UOG activity on public health. Some of these studies focussed on the process by which it may affect public health whilst others focussed on the possible outcomes for public health from UOG activity. Both types of study are important and have implications for public health in Fermanagh and Omagh.

The following diagram shows the simple cause and effect relationship between how the introduction of UOG activities into an area may affect health outcomes in that area.

**Figure 7.1: Link between UOG activities and health outcomes.**

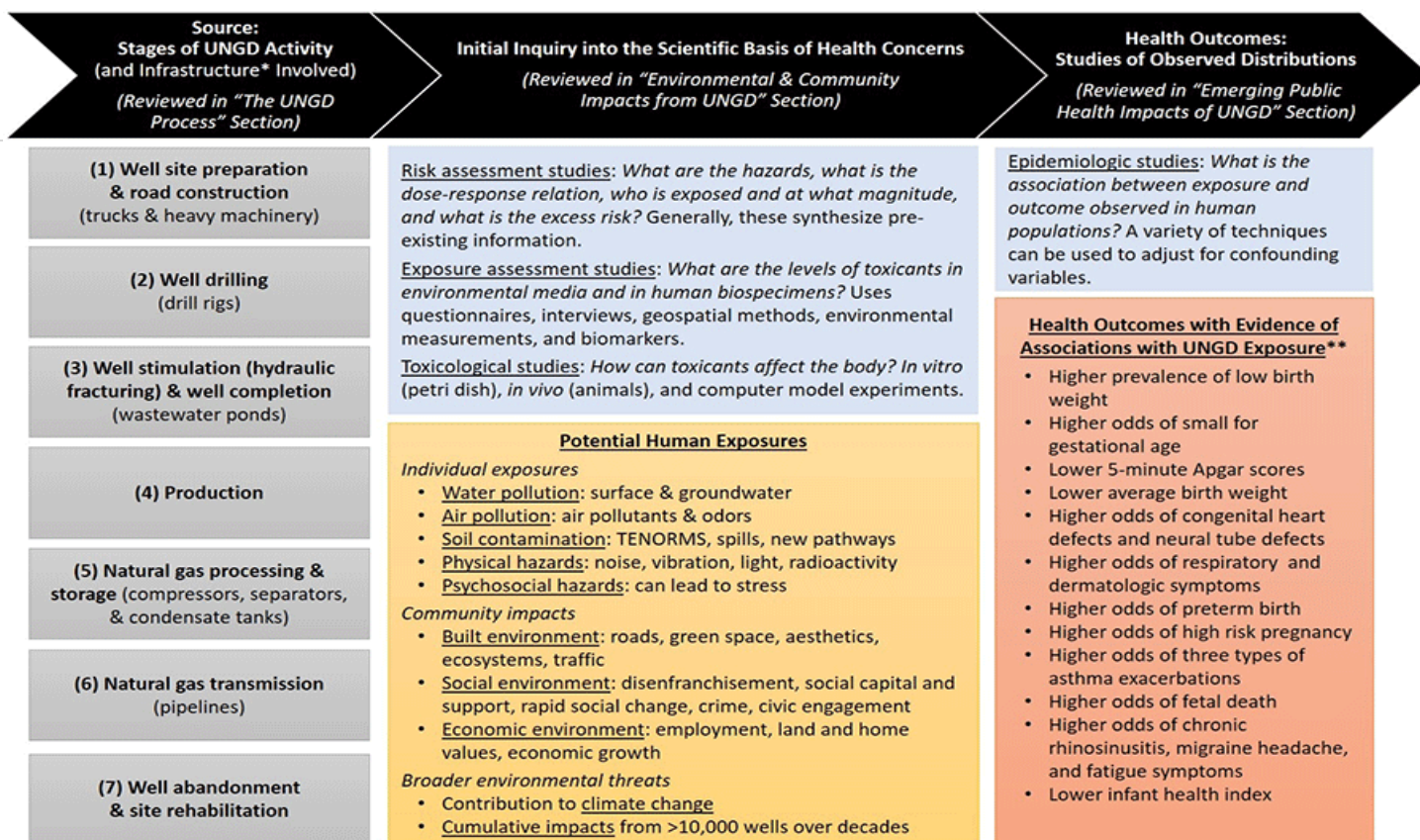


Significant UOG activity in an area will produce environmental changes for that area in the form of increased air pollution, water pollution, seismic activity, noise pollution and light pollution. The community, both individually and collectively is then exposed to these changes and this exposure may lead to changes in the health outcomes within that area. The main outcomes, studied so far by researchers are an increase in asthma cases and an increase in problems in newborn babies, such as premature birth and low birth weight.

In a comprehensive review of recent academic literature on the health effects of UOG activity, Gorski, and Schwarz (2019) produced a very useful schematic of the cause and effect nature of fracking on public health. They use the term Unconventional Natural Gas Development (UNGD).



**Figure 7.2: Gorski & Schwarz’s UOG/health schematic**



\*Infrastructure listed provide examples of sources of pollutants but are not comprehensive.

\*\*Only health outcomes with evidence from epidemiologic studies where both exposure and outcome were assessed on the individual level are included. Findings are organized in rough chronological order by study.

It is also worth noting that Fermanagh and Omagh is a different society to many of the UOG areas in the USA. As noted in section 3.4 there will possibly be 488 people and 2 well pads in an area of a circle of 1 mile radius in Erne West. In UOG areas of the USA, there would be 1 well pad and 65 people in the same area. This suggests that the processes by which UOG activity affect public health in the USA are likely to produce stronger negative outcomes in Erne West due to the higher population density near wells

In addition, Fermanagh and Omagh, as part of Northern Ireland, has a recent history due to “the Troubles” that impacted on, and still impacts on the mental health situation of the district. The implications of UOG activity on mental health outcomes are perhaps more important to a place like Fermanagh and Omagh than, say a rural county in Northern Pennsylvania.

## 7.2 Potential Individual Exposures

UOG activity can impact on individual health in a number of ways. Gorski and Schwarz listed water pollution, air pollution, physical hazards, and psychosocial hazards.

### 7.2.1 Water Pollution

UOG activity may cause water pollution in 2 main ways.

Firstly, UOG drilling typically uses a water/sand/chemical solution, which consists of about 90% water, 9% sand and 1% chemicals. If there are problems at the well this mixture may leak directly into local water sources such as aquifers, ground water and eventually into rivers and lakes.

Secondly UOG activity usually aims to bring the water/sand/chemical mix, usually called produced water, back to the surface once used, where it is stored in pits before being treated. Produced water can escape into the water network in numerous ways, such as faulty pipes from the well to the pits, poorly lined pits, storm overflow of the pits and sometimes human error to discharge the produced water into the local environment.

The 7<sup>th</sup> addition of the “Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking (Unconventional Gas and Oil Extraction)” published in 2020 by the Concerned Health Professionals of New York ([www.concernedhealthny.org](http://www.concernedhealthny.org)) and Physicians for Social Responsibility ([www.psr.org](http://www.psr.org)) noted that there were over 100 chemicals potentially used in UOG processes are known endocrine disruptors, acting as reproductive and developmental toxicants, and at least 48 are potentially carcinogenic (This source will be referred to as the “2020 US Compendium” hereafter). Specific contaminants of water include BTEX (butane, benzene, toluene, ethylbenzene, and xylene) and other volatile organic compounds (VOCs) (Drollette et al., 2015), and salts and metals (including mercury, bromide, iodide, and ammonium) (Grant et al., 2015; Harkness et al., 2015).

The 2020 US compendium noted the likelihood of water pollution from produced water. It said,

*“A 2017 study found that spills of fracking fluids and fracking wastewater are common, documenting 6,678 significant spills occurring over a period of nine years in four states alone. In these states, between 2 and 16 percent of wells report spills each year. About five percent of all fracking waste is lost to spills, often during transport.”*

Hill and Ma (2017) found evidence of contamination of drinking water in Pennsylvania where the water source was within 1km of a well. They noted that many people who lived near wells had switched to only drinking bottled water. This confirmed an earlier study by Wrenn, Klaiber, & Jaenicke (2016) that there had been a significant rise in bottled water purchases in counties in Pennsylvania that were affected by UOG development.

### 7.2.2 Air Pollution

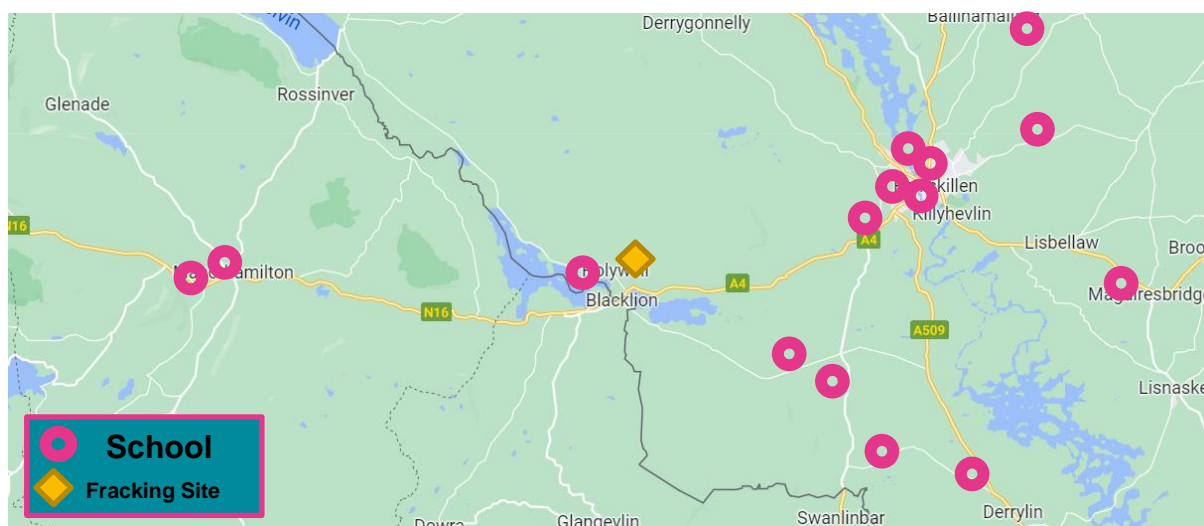
A 2014 literature review by the US Natural Resources Defense Council found that fifteen different UOG processes and sources—including the drilling process, wastewater, and condensate tanks—release air contaminants including

- particulate matter (diesel PM and PM), which is emitted during all stages of UOG activity including trucks and heavy machinery, as well as the drill rig and compressor stations;
- VOCs (including BTEX, polycyclic aromatic hydrocarbons, formaldehyde, ethylene glycol, and methanol), which are also emitted during all stages of UOG activity (Paulik et al., 2016);
- hydrogen sulphide (H<sub>2</sub>S, a toxic and explosive gas), which is emitted during hydraulic fracturing, well completion, production, and processing from flowback and produced waters as well as from gas venting; respirable crystalline silica (from sand), which re-emerges from the well during hydraulic fracturing;
- nitrogen oxides (NO<sub>x</sub>), which are emitted during all stages of UOG activity from trucks, heavy machinery, and compressor stations as well as from the processes of drilling, hydraulic fracturing, and gas venting (Zielinska, Campbell & Samburova, 2014); and
- greenhouse gases (including methane and carbon dioxide), which are emitted during all stages from the same sources as NO<sub>x</sub> as well as from separators, condensate tanks, and pipelines (Natural Resources Defense Council, 2014).

These air quality impacts are of concern because, in studies from related industries, exposure to these elevated levels of diesel PM, H<sub>2</sub>S, and VOCs has been linked to eye, nose, and throat irritation, respiratory illnesses, cardiovascular problems, central nervous system damage, birth defects, cancer, or premature death (Macey et al., 2014).

Northern Ireland's air quality is managed by 2 main mechanisms. These are the Northern Ireland air quality management regulations (2010) and the UK air quality strategy (2007). The Northern Ireland regulations established 21 air quality monitoring sites across Northern Ireland. Only 1 is in Fermanagh and Omagh, whilst 8 are in or near Belfast. District Councils must declare an air quality management area (AQMA) for any area where there is a risk that the regulation standards will not be achieved. Councils must then publish a plan for improving air quality in each AQMA. So far there are 19 AQMA zones across Northern Ireland. Fermanagh and Omagh is one of only 2 councils not to have any. One of the main legal triggers for poor air quality is the quantity of diesel particulates. It is difficult to envisage how wide scale UOG activity will not cause air quality to deteriorate to below the regulation standards and so trigger Fermanagh and Omagh Council to establish local AQMAs, with their own improvements. This is incompatible with the area's current reputation for scenic beauty and outdoor activities, and with the Council's declaration of a Climate Emergency as set out in its Climate Change and Sustainable Development Strategy.

Figure 7.3 shows the location of the schools within close proximity of Tamboran's 2014 test site at Belcoo. Any major traffic movements along roads close to the schools will worsen air quality for children attending those schools.

**Figure 7.3: Schools near the Belcoo test site**

### 7.2.3 Physical Hazards

UOG activity generates a lot of obvious physical hazards in a local community, including lorry movements, increased noise, increased light, and increased seismicity.

One obvious one is the noise and dirt produced by hundreds of lorry movements as equipment, and materials are transported to the well sites and (potentially) gas and wastewater are transported out. In the USA, most UOG areas generally use lorries to transport in fresh water to the well sites, but then use pipelines to transport the gas to the local gas terminals. Northern Ireland in general does not have a developed gas network, with many areas not being on the gas network. As such any UOG company would either have to build a relatively long pipeline over undeveloped areas or use tankers to transport the gas out. If the companies decide on the latter, this means that Fermanagh and Omagh would witness significantly more lorry movements than many UOG areas in the USA. Goodman et al (2016) estimated that every well would require nearly 6,500 lorry movements over its life. Their model assumed that gas was piped off site, rather than transported in tankers. Their model for 400 wells predicted that the lorry movements alone would produce up to 21.6 kilo tonnes (1 KT = 1,000,000kg) of carbon dioxide and up to 16 tonnes of nitrogen oxides. These chemicals are all going into the local atmosphere.

Fracking sites generate a lot of additional noise as well. Generally, most of the equipment on site uses diesel generators. These generators power the drilling equipment and the gas compressors and can easily reach volumes of 85-95 decibels (2020 US compendium). This is the equivalent to a motorcycle engine revving. The

equipment usually operates for 24 hours per day, 7 days per week. A densely populated well pad (with 8 wells on it) will therefore generate a lot of additional noise in rural areas that are usually very quiet.

The 24/7 nature of the operation also requires large “flood lights” to operate during the hours of darkness. These floodlights break the natural sense of darkness in rural areas and will affect any nearby houses.

Williams et al (2017) noted that the main perceived risk of fracking from various focus groups held in England was the threat of increased seismicity. The limited fracking that has taken place in Lancashire, England has been associated with tremors up to 2.9 on the Richter scale. At this level, animals and people can sense the tremors and they may cause minor structural damage to buildings (mainly cracks in wall plaster).

#### 7.2.4 Psychosocial Hazards

There are 3 main ways in which fracking can have an impact on the mental health of a society.

The sheer level of physical hazards, especially the noise and lorry movements can affect people’s mental health. Goodman et al (2016) highlight that the increased lorry movements are likely to lead to more road traffic accidents, which again will impact on the mental health of a community.

Short and Szolucha (2017) introduced the phrase collective trauma when discussing the community reaction to the potential introducing of UOG development in Lancashire, England. They argue that when a major change is introduced into an area, when most people oppose that change there is likely to be a sense of collective trauma in the area as a result.

This trauma tends to lead to a divided and stressed community. Powers et al (2014) analysed 215 letters to local newspapers in Pennsylvania. These letters show that people were concerned in four major areas: socioeconomic impacts, perceived threats to water, population growth and implications, and changes to the rural landscape.

Academic studies that have recorded the impact on community mental health of UOG development have taken place in very different communities to Fermanagh and Omagh. Northern Ireland is still recovering from the period known as “the Troubles”. This has left Northern Ireland with a complex community mental health situation. As a 2011 report by the Commission for Victims and Survivors notes

- An estimated 39% of the study population has experienced a conflict-related traumatic event.
- An estimated 8.8% of the Northern Ireland adult population met the criteria for PTSD at some point in their life while 5.1% met the criteria in the previous 12 months.
- The prevalence of PTSD in Northern Ireland is the highest of all countries that have produced comparable estimates including the USA, other Western European countries and countries that have experienced civil conflict in their

recent history. The prevalence of lifetime mental health disorders and 'post-conflict' disorders amongst those exposed to conflict-related events

- Individuals who experienced any conflict-related traumatic event were more likely to have had any lifetime anxiety, mood, substance, or impulse-control disorder compared to those who experienced a non-conflict related event and those who had not experienced a traumatic event.
- Overall, an estimated 53% of individuals who experienced a conflict-related traumatic event had a mental health disorder at some point in their life.

Given the impacts on community mental health noted in both Pennsylvania and Lancashire, then it is likely that Fermanagh and Omagh would see similar impacts if large scale UOG development were to commence in the district. These impacts, though, would take place in an already more fragile society than either Pennsylvania or Lancashire, so the mental health outcomes would likely to be similar or worse.

### 7.3 Potential community health outcomes

Academic research into the potential community health outcomes from UOG development have focussed on the impact on newborn babies and breathing problems.

#### 7.3.1 Birth weights of newborn babies.

There is significant evidence that premature babies and babies with low birth weight (defined as under 2.5kg or 5 ½ pounds) are more at risk of health and development problems, such as type 2 diabetes, heart problems and autism than other babies.

The general maternal environment, including air quality is known to be a key factor in influencing whether a mother will have a premature or low weight baby.

There have been 6 major studies in the USA into the correlation between proximity to wells and potential birth issues. The studies were generally retrospective analysis of birth data, looking for links between the proximity of the mother's residence to a well and the prevalence of suboptimal birth outcomes (premature births, low birth weight, low weight for gestational age). The studies used different methodologies, which may explain the differences in the results. The table below summarises these studies.

**Table 7.1: Summary of studies into link between UOG development and adverse outcomes in pregnancy.**

Author & Date	Area studied	Period	Births	Outcomes linked to mother's proximity to a well.		
				Premature Births	Low Birth weight (LBW)	LBW / gestational age
Hill 2012	Pennsylvania	2003-10	2,437	No findings	25% increase	17% increase
Stacy et al 2015	SW Pennsylvania	2007-10	15,451	No findings	Yes	Yes
Casey et al., 2016	Pennsylvania	2009-13	9,384	Yes	No	No
Whitworth, Marshall, & Symanski, 2018	Texas	2010-12	150,000	14%-56% increased risk based on distance and other risk factors.	Not covered	Not covered
Currie, Greenstone, & Meckel, 2017 & 2018	Pennsylvania	2004-13	1,125,748	25% increase in risk, living within 1km of a well.	Not covered	Not covered

Gorski and Schwarz (2019) conclude a survey of these studies by saying “the findings, while not conclusive, are strong preliminary evidence that UNGD [fracking] is associated with adverse birth outcomes from pregnancies in UNGD areas.”

### 7.3.2 Increased prevalence of Asthma

The prevalence and severity of cases of asthma has long been associated with local air quality. In addition, the lag time between changes in air quality and changes in the quantity and severity of cases is relatively short, meaning that studies should be able to detect what, if any, link there is between changes in air quality due to UOG activity and changes in local asthma rates.

Rasmussen and colleagues in 2016 conducted the major study into the links between UOG activity and asthma. This study reviewed 35,508 asthma patients treated at the Geisinger Clinic from 2005 to 2012. The study looked at the number and severity of cases (grouped into mild, moderate, and severe, depending on the medical intervention required), proximity to wells and the level of activity at the well (based on lifecycle stage and output of the well). This gave them 12 possible outcome pairs. They found increased prevalence of asthma in 11 of the 12 pairs, with increases over the control group of between 56% and 440%. The highest score was for the “mild” severity and production phase pair. The authors concluding remarks were “Residential UNGD activity metrics were statistically associated with

increased risk of mild, moderate, and severe asthma exacerbations. Whether these associations are causal awaits further investigation, including more detailed exposure assessment.”

## 7.4 Conclusion

UOG development is a new activity that introduces potentially significant changes into an area’s environment. The main change is the increase in air pollution caused by escaped gas, fumes from lorries and fumes from generators and drill parts, water pollution caused by wastewater, increased noise pollution, increased light pollution and seismic activity. Individuals in the community are then exposed to these changes which may impact then on health outcomes.

Social historians have long known that the 2 key general measures of a population’s general health are average height attained in adult and the proportion of problematic births, defined as either premature births or births with a low birth weight. Studies have shown consistently that there is a correlation between a mother living near a well and the chances of her having a problematic birth. UOG areas will therefore likely see a rise in other conditions in years to come as these babies move through childhood into adulthood.

In addition, the 1 major study into the links between UOG activity and asthma cases showed a clear link between proximity to a well and the likelihood of developing asthmatic symptoms.

There is evidence that UOG activities can impact on a community’s collective mental health. This arises from both the powerlessness to stop UOG activity in a community and the mental health strains caused by a deterioration in the physical environment. As stated, the mental health issues are important to Fermanagh and Omagh given its history of increased mental health problems.

There is therefore a clear theoretical model about how UOG development could contribute to worse health outcomes and so far, there is evidence to support this model at every stage. This implies that the introduction of UOG activity into Fermanagh and Omagh would, almost certainly, produce worse health outcomes for many people living in the area.



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# 8.

## HUMAN RIGHTS IMPACT

## 8 Human Rights Impact

### 8.1 Introduction

UOG development may have an impact on the human rights of people in Fermanagh and Omagh. The UK Human Rights Act 1998 covers traditional political and civil rights and focuses on the individuals' rights when dealing with the state.

However, the concept that human rights cover more than just traditional political and civil liberties is a new and emerging trend within the law. There are several treaties and court cases which explicitly seek to extend the concept of human rights to cover health, economic and environmental rights.

These rights exist in the UK due to the UK being a state party to several UN and European treaties which take this wider definition of human rights. The extent to which individual citizens could seek redress through the courts for a perceived breach of these rights is unclear and inconsistent. Generally, UN treaties are not enforceable through UK courts unless the UK Parliament has explicitly incorporated their provisions into UK primary legislation. UK citizens though have a right to seek redress to the European Court of Human Rights.

The major treaties and institutions that may be pertinent for human rights in this discussion include.

- The European Convention of Human Rights.
- The International Covenant on Economic, Social and Cultural Rights (ICESCR)

### 8.2 The European Convention on Human Rights

The European Convention on Human Rights (ECHR) was signed in 1950 and came into effect in 1953. The UK is a signatory body. The European Court on Human Rights decides on cases brought before it. It expects relevant member states to implement its rulings. Its most common remedy for a breach of human rights is compensation.

The ECHR is perhaps the key international treaty regarding international human rights for 3 reasons.

- The UK Human Rights Act is closely modelled on the ECHR. It adopts very similar wording.
- UK citizens have the right to seek redress from the European Court of Human Rights if they think their rights as set out in ECHR are being breached.
- The UK Supreme Court expects UK courts to acknowledge the legal reasoning that the European Court of Human Rights uses in deciding judgements. However, the Supreme Court has said UK courts may not follow the European court's reasoning if they do not think it is appropriate for the case they are considering.

These 3 reasons mean crucially that the ECHR is incorporated into UK law, is enforceable in the UK and that European court rulings are considered by UK courts. These factors mean that the ECHR is a practical document for citizens seeking to protect their human rights.

This relationship is important as in several cases the European Court has taken a wider interpretation of article 8 of the convention compared to the interpretation typically used in UK courts.

Article 8 covers the individual's right to a private and family life. Traditionally this meant that the state could not unreasonably interrupt an individual's private life (through surveillance) or family life, by keeping family members apart without justification. However, as the Irish Centre for Human Rights (ICHR) has explained the European Court has expanded this interpretation to cover the right to a healthy and clean environment in several cases. In April 2021, the ICHR published a useful summary of recent cases where the European Court of Human Rights had ruled on these matters.

*"In Lopez Ostra v Spain, the Court was clear that environmental pollution can be severe enough to constitute a violation of Article 8 due to its effect on individual wellbeing without having to seriously endanger the health of the individual. The Court's finding emphasizes the importance of individual well-being, and such well-being is not limited to the physical wellbeing, it can include enjoyment of private and family life.*

*This position was elaborated upon in Fadayeveva v Russia, in which the applicant alleged that the operation of a steel plant in close proximity to the applicant's home endangered the health and well-being of her and her family. In this case the Court held that there had been a violation of Article 8 as the environmental impact of the steel plant amounted to interference in the life of the applicant and that Russia had 'failed to strike a fair balance between the interests of the community and the applicant's effective enjoyment of her right to respect for her home and her private life'. The applicant's claim succeeded because 'Even assuming that the pollution did not cause any quantifiable harm to her health, it inevitably made the applicant more vulnerable to various illnesses'. The applicant's increased vulnerability to disease was held sufficient adversely to affect the applicant's quality of life in her home, engaging Article 8 protection. Accordingly, 'deleterious consequences or serious impacts, including the posing of serious risk, and increased vulnerability to disease, will attract a protective interpretation of Article 8.'*

*Another aspect of the interpretation of Article 8 which is relevant to fracking is the recognition of an obligation on the part of the State to inform the public about environmental risks, as seen in Guerra and Others v Italy. In this case, residents of Manfredonia brought an action against the Italian government for failing to provide them with information about the health risks posed by a nearby chemical factory. The factory in question produced fertilisers and caprolactam and was classified as 'high risk'. The local authorities were obligated to inform the local population of the risks and draw up emergency plans, however there was still no emergency plan in 1995, nor were there*

*procedures to inform the public in case of an accident. The Court held that the State did not fulfil its obligation to secure the applicants' right to respect for their private and family life, in breach of Article 8 on the basis that the applicants had not been provided with the necessary information for them to be able to assess the risks of living in the vicinity of the factory.*

*In Bacila v Romania, the applicant lived close to a large industrial plant which was a major long-term source of pollution. The Court found that the State had violated the applicant's Article 8 rights due to the State's inaction in addressing the plant's emissions which were negatively impacting the applicant's health. Further, the Court stated that economic arguments should not have been allowed to prevail over the locals' 'right to enjoy a healthy environment'.*

All these cases seek to extend the traditional definition of the Article 8 rights to a private and family rights. What is clear is that the European Court will listen to arguments where economic activity impinges on others' health and local environment. This would suggest that the citizens of Fermanagh and Omagh may be able to bring a case under the ECHR article 8 if they can show that UOG development breached their health and environment in similar ways to those set out in the cases above.

At present there is a very little relevant case law in the UK regarding similar issues, so it is not clear how UK courts would react, other than they have a duty to acknowledge European Court rulings in their deliberations.

### 8.3 The United Nations

Since its inception in 1945, the United Nations (UN) has been at the forefront for setting the global agenda on human rights. There is no direct enforcement of UN human rights treaties, reports, and mandates in the UK (or any other country) and so rights derived from the work of the UN are definitely less important to ordinary UK citizens than rights enshrined in both the UK Human Rights Act and the ECHR.

Nevertheless, the UN is an important body which has considerable moral authority around the world. This authority derives from 4 main sources.

Firstly, the UN has a clear authority through its standing Office of the High Commissioner for Human Rights (OHCHR) . The current High Commissioner is the former President of Chile, Michelle Bachelet, whilst the former President of the Republic of Ireland, Mary Robinson served as the High Commissioner between 1997 and 2002. The OHCHR is well staffed and writes several reports per annum into perceived human rights abuses and human rights issues.

Secondly, the UN has written several treaties on Human Rights. The UK is a State Party to many of these treaties. This means that the UK has formally agreed to implement the treaty.

Perhaps the key treaty is the International Covenant on Economic, Social and Cultural Rights (ICESCR), which came into effect in 1976. Article 12 covers the right to health. States must protect this right by ensuring that everyone within their

jurisdiction has access to the underlying determinants of health, such as clean water, sanitation, food, nutrition, and housing, and through a comprehensive system of healthcare, which is available to everyone without discrimination, and economically accessible to all.

Other key UN treaties, that the UK is a state party to include

- The Convention on the Rights of the Child (ICRC);
- The Convention on the Elimination of All Forms of Discrimination against Women (ICEDAW);
- The Convention on the Rights of Persons with Disabilities (ICRPD); and
- The Convention on the Elimination of Racial Discrimination (ICERD)

Thirdly, in 2012 the UN Human Rights Commission appointed a Special Rapporteur to advise on human rights and the environment. This role has the objective of developing UN policy and best practice in this area.

The UN Special Rapporteur on Human Rights and the Environment released the 'Framework Principles on Human Rights and the Environment' in 2018, wherein the basic obligations of States under human rights law as they relate to the enjoyment of a safe, clean, healthy, and sustainable environment are set out. These include

- States should ensure a safe, clean, healthy, and sustainable environment in order to respect, protect and fulfil human rights';
- 'States should require prior assessment of possible environmental impacts and potential effects on human rights of proposed projects and policies to avoid authorising actions with environmental implications that interfere with the enjoyment of human rights; and
- 'States should provide for and facilitate public participation in decision making related to the environment and take the views of the public into account in the decision-making process'

Fourthly, the International Court of Justice can rule on civil disputes between states. Given that the proposed UOG site in Northern Ireland is close to the border with the Republic of Ireland, then the Republic of Ireland authorities may be able to bring a case to the court if they can show that there are any adverse effects from UOG development in Northern Ireland on their territory. Argentina successfully brought a case against its neighbour Uruguay where it alleged that pollution in Argentinian rivers was caused by new pulp mills built upstream in Uruguay.

Whilst UN treaties do not have the force of law in the UK, the growing corpus of work undertaken by the UN and its agencies on health, the environment and human rights would probably influence UK courts (if only as an expert witness on the matter).

## 8.4 Conclusion

Whilst human rights are traditionally conceived as political and civil rights, both the ECHR and especially the UN has been leading the debate to extend the definition of human rights to cover economic, social, health and environmental rights.

UOG development has significant adverse public health and environmental impacts. As such it may infringe citizens' health and environmental rights. The growing body of cases before the European Courts indicates that the Court is willing and able to extend Article 8 rights to cover these matters.

This does not guarantee of course that the Court would seek to either ban UOG development or impose compensation on the Northern Ireland Executive if it ever allowed it to commence. However, it probably does mean that the Court would look to see if the decision to allow UOG activity had considered the health and environmental issues, had sought to mitigate them, and had allowed full community participation in the decision making process.

As stated, the position of UK courts is unclear at this point. They would have to acknowledge and recognise any judgements from the European Court, but they do not have to follow the legal reasoning laid down by the European Court.

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# 9.

## C O N C L U S I O N S

## 9 Conclusion

### 9.1 Introduction

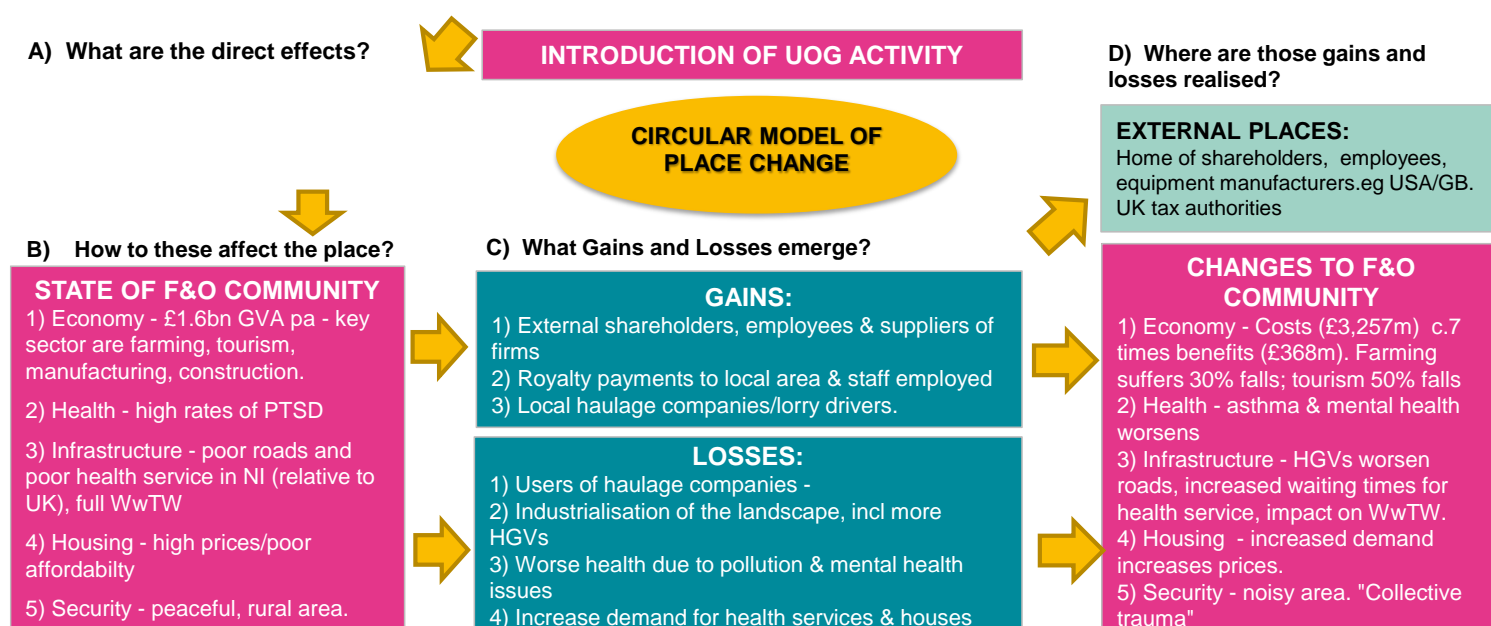
This study set out to analyse the possible impacts on Fermanagh and Omagh if UOG was ever permitted in the district. As requested by the Council this study has drawn heavily on academic papers on the impact of UOG activity on communities where it has already taken place, especially Lancashire, England, and Pennsylvania.

The study has covered the potential scale of the industry, and its potential adverse impact on the economy, environment, and society of Fermanagh and Omagh.

### 9.2 Revisiting The Model Of Change

Section 2.2 introduces a model of change that acts as an analytical framework for understanding how the UOG activity may impact on Fermanagh and Omagh. Figure 9.1 shows the results of this model based on the analysis undertaken in this report.

**Figure 9.1: Model of Change**



The main conclusions from this model are:

- The introduction of UOG activity on a significant scale into Fermanagh and Omagh will represent an industrial revolution at light speed for the area. Large tracts of land will be transformed from agricultural to industrial use in the space of 5 years.
- The speed and scale of change will produce significant winners and losers due to new investment and jobs, balanced by increased competition for resources and significant increases in pollution levels.



- The issue for Fermanagh and Omagh is that it will be left with all the losses but most of the major gains will leak outside the district to external shareholders, external employees, and external equipment manufacturers.
- This produces a significant economic cost relative to the local benefits for the area, as well as a despoiled landscape, adverse impacts on public infrastructure and worsening public health outcomes.
- After 20-25 years the UOG industry will wind down in the area, leaving no long term gains but plenty of long term losses including the cost of decommissioning the well pads. The losers will be unlikely to be able to recover once UOG activity ceases.

### 9.3 Discussing The Environmental Justice Questions

This study opened by listing Kroepsch et al's (2019) 3 questions concerning environmental justice. The analysis in this study provides some possible answers to those questions.

#### 9.3.1 Does UOG Activity Deliver Distributive Justice?

A key principle of environmental justice is that a change does not make a disadvantaged group weaker. Any UOG activity within Fermanagh and Omagh will have major adverse implications for at least 4 disadvantaged groups – children, young people, farmers, and those with mental health issues, such as Post Traumatic Stress Disorder (PTSD)

Children will suffer from the despoilation of the landscape and the deterioration in air quality, which will probably increase the cases of asthma in the district. In addition, the work from the USA suggests a consistent if weak correlation between the rate of birth problems, such as low birth weight, premature delivery, and the mother's proximity to a well during pregnancy. Therefore, local children may be disadvantaged from UOG activity before they are even born.

Young people will mainly suffer from the pressure that UOG employees may exert on the local housing market. Fermanagh and Omagh already has the highest house prices and the lowest affordability of any district in Northern Ireland, so any tightening of the housing market will make houses even more unaffordable for many young people and affect their life decisions.

Farmers will suffer dramatically. If the experience from Pennsylvania holds true for Fermanagh and Omagh, then the farming sector may contract by up to 30% as farmers face a double effect of higher costs due to competition from UOG for key resources and lower demand as consumers become nervous about consuming food produced in a UOG area.

Northern Ireland already has high rates for PTSD sufferers due to the effects of the recent history of the Troubles. UOG activity is only likely to exacerbate this situation for 2 reasons. Firstly, the physical effects of UOG activity, such as air pollution, light pollution, and noise pollution, will make the area less attractive to live in, which will affect mental health. In addition, if UOG activity ever commenced in the district, it

would do so in spite of significant local opposition. In this case, many people may suffer from “collective trauma”, as an unwanted change is “forced” upon them.

Given these factors then the introduction of UOG activity is likely to worsen distributive justice in the district.

### 9.3.2 Does UOG Activity Share Its Benefits?

The industry has usually claimed that UOG activity creates a significant economic benefit for the area affected.

However, as the economic analysis suggests, the economic costs of UOG activity are likely to be significantly higher to Fermanagh and Omagh than the benefits it provides. As the experience of Pennsylvania highlights, a lot of the economic benefits may not accrue to the district at all. Foreign shareholders, foreign equipment manufacturers, and foreign senior and technical staff will take the majority of the benefits, leaving the local area with just royalty payments and some site based roles. In 2011 in the wake of the financial crash of 2007/8 unemployment was higher than in 2022 and these jobs may have been desirable. In 2022 however, with a tight local labour market, UOG companies may struggle to fill positions on average salaries, in remote locations requiring anti-social working hours. Against that this study suggests significant economic damage to farming (through higher costs and lower demand), tourism (through lower demand), and manufacturing (through higher costs).

This analysis did not factor in the environmental, health or public infrastructure costs which will be significant but will be harder to quantify.

In short, the benefits from UOG activity in Fermanagh and Omagh will accrue outside the district and almost certainly outside of Northern Ireland, whilst the costs of development will fall on the area. This is likely to represent a significant imbalance.

### 9.3.3 Does UOG activity deliver procedural justice?

Short and Szolucha (2017)'s analysis of the introduction of UOG activity in Lancashire shows the impact of introducing a new activity into an area without local support. People feel disenfranchised and helpless and start to suspect that local institutions are not working in their best interests. Fermanagh and Omagh would almost certainly see a similar situation to Lancashire.

Local people would have rights of redress to protect their human rights via the courts. UK courts would need to consider whether they agreed with European courts that the European Convention on Human Rights (ECHR)'s article 8 rights extended to environmental protection. Even if UK courts rejected this approach local people would still have the right to appeal to European courts. However, civil legal action at high court level is costly and time consuming. If this is the only right to redress left open to local people, then it is difficult to see how this delivers procedural justice.

This review highlights that introducing UOG activity into Fermanagh and Omagh will not deliver environmental justice on any level and will actively cause harm to the local community.

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# 10.

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- 

**Mace**

155 Moorgate  
London EC2M 6XB

T +44 (0) 20 3522 3000