The Perceived Impact of Fracking on Energy Security and Property Values in the United Kingdom: An Analysis of Interviews with Key-Informants

Abstract

A considerable body of academic research has emerged in the last decade identifying many environmental consequences of unconventional hydraulic fracturing ('fracking' or 'UHF') in the U.K. (for example, on climate change, air pollution, wastewater disposal and water contamination). However, there is much less research on the economic implications of fracking, particularly regarding property values and contributions toward energy security. This article will draw upon primary data collected through twenty semi-structured interviews with key-informants to the fracking industry in the U.K. (including a variety of interviewees from regulatory bodies, academia, the oil and gas industry, and anti-fracking campaigners, giving a reasonable breadth of knowledge, experience and opinion). Qualitative analysis of interview data concludes that fracking will contribute only minimally to energy security, whilst having a perceived negative impact for the value of property, particularly those located within close proximity to extraction sites.

Key Words: Fracking; energy security; property values.

Word Count: 7,919.

Introduction

Regarding fossil fuel production, the United Kingdom (U.K.) has relied almost exclusively on oil from the North Sea, a policy that was reinforced by consecutive governments following World War II. This is significant because extensive production of North Sea oil can be seen as an attempt to make the use of such energy as secure as possible following difficult international relations proceeding that time period. However, since 2001 North Sea oil production has declined due to oil being a non-renewable resource (Aleklett et al. 2010).

Although the U.K. has historically produced masses of oil, there has been much less natural gas extraction. This is due to geological make-up whereby shale forms in different ways and at varying depths. Shale gas in the U.K. resides very deep below the Earth's surface (1-3 kilometres)[i] and, originally, the technology did not exist to make the production of this resource profitable. In the 1980's, *Mitchell Energy* of the United States (U.S.) engineered a way to combine traditional (low-volume) drilling techniques with unconventional (high-volume), horizontal drilling (Prud'homme, 2014). Doing so enabled the profitability of gas wells to increase exponentially, creating a shale gas boom in the U.S. Subsequently, oil and gas companies became interested in the shale gas potential of the U.K. and whether applying unconventional, horizontal drilling would increase the profitability of the extraction process in that market. This led *Cuadrilla Resources* to conduct the first unconventional hydraulic fracturing at Preston New Road (PNR) (Lancashire, U.K.) in 2011 (Green et al. 2012).

Events at PNR triggered a number of minor earthquakes resulting in the U.K. government implementing a one-year fracking moratorium (Hawkins, 2015). Consequently, the industry attracted an enormous degree of media attention and criticism (Jaspal and Nerlich, 2014). Such reproval was reignited in 2019 following the government's decision to impose a second

moratorium on fracking. Whilst the reasoning behind the prohibition is open to conjecture, it is likely that it was either a political manoeuvre on the run-up to the 2019 General Election (Vaughan, 2019), or a candid response to hundreds of instances of seismic activity generated by recommenced UHF operations at PNR in 2018 and 2019 (Hayhurst, 2019). Either way, public support for shale gas production in the U.K. reached a record low in March 2020 of just 8% according to a government public attitudes tracker for energy generation (Department of Business, Energy and Industrial Strategy (DBEIS), 2020). Such support has gradually declined from 27% since the start of government data collection in December 2013 (DBEIS, 2020).

Such operations have sparked heated debate over the necessity of undertaking UHF in the U.K. In particular, discussion has revolved around the perceived impact of UHF on two key issues: property values in areas proximate to fracking operations (Gibbons et al. 2016); and the potential contribution to the U.K.'s energy security (Acquah-Andoh et al. 2019; Institute of Directors, 2013). Whilst these issues have been discussed in isolation, the following analysis seeks to contribute a more nuanced understanding. This will be done by combining existing academic literature with interview data collected from a range of actors concerned and involved with UHF operations in the U.K.

Methodology

The interview data drawn upon within this article was collected between May 2016 and September 2017 where twenty semi-structured interviews[ii] were conducted with key-informants[iii] to the UHF industry in the U.K., as part of doctoral research at the University of XXX, U.K. (XXX, XXX). The results of these interviews are not intended to be generalizable to a population, as in much social science research. Instead, interviews reflect a snapshot of

views on a variety of topics at a given moment in time. Similar studies have found different results (Ochieng et al. 2015) and future studies will undoubtedly do the same.

What this article will do is address, debate and analyse two key areas. The perceived impact of UHF on energy security and on property values. These topics have been selected for this paper as they were two of five key economic issues identified within a doctoral literature review (XXX, XXX) and were therefore discussed by participants within interviews. This extensive literature review originally identified twelve key research topics which were split into seven environmental issues[iv] and five economic issues[v]. These made up the 12 semi-structured interview questions asked of all participants. Whilst several research questions were developed to reflect these issues, there are two that are relevant to this discussion:

1. What do key-informants understand to be the impact of UHF in the U.K. on energy security?
2. What do key-informants understand to be the impact of UHF in the U.K. on property values?

Economic issues included the (perceived) impact of UHF processes in the U.K. on: jobs; property values; energy security; the economy; and community financial incentives (CFI's)[vi]. These topics areas were kept broad in order to allow the range of participants to answer in their own way, according to their own knowledge, opinions and experience of the UHF process.

The qualitative data analysis for this research included transcribing interview recordings, coding interview transcripts[vii] and conducting thematic analysis of the coded data. The PhD

thesis itself focused only on the seven environmental themes due in part to institutional word count restrictions, and also to a slightly over-ambitious project. As a result, the economic themes have never been reported on until now.

The thematic analysis regarding the main economic themes resulted in the development of a number of key areas of discussion, referred to hereafter as *sub-themes* (ST). The remainder of this paper will follow the structure of this thematic analysis as identified in Table One, focussing on the perceived impact of fracking on both property values and energy security:

Table One: *Sub-Themes*

Main Theme	**Sub-Themes**
Perceived Impact on Property Values	ST1: Perceived Positive Impacts on Property Values Based on Existing Oil and Gas Activity in the U.K. ST2: Perceived Negative Impact on Property Values
Perceived Impact on Energy Security	ST3: The Perceived Effect on Energy Security Depends on the Success of the Technology ST4: Low-Storage Capability ST5: Domestically Produced Gas is Preferable to Imported Gas

Participants were selected using *purposive* sampling, whereby the researcher has an intimate knowledge of the research area and uses this knowledge to specifically select ideal[viii] participants. This involved the researcher using online networks and platforms (such as *LinkedIn*) and meeting people at relevant conferences and events (e.g. by attending anti-fracking meetings and public debates) on UHF issues in the U.K. The sampling technique employed can also be considered an *opportunity* or *convenience* sample as the researcher selected prospective participants from a variety of different backgrounds and occupations in

order to achieve a diverse sample (see Table Two). Eleven of these interviews were conducted face-to-face and nine over the telephone. Participant information and interview durations are displayed in Table Two (adapted from XXX, XXX: 105):

Table Two: *Participant Characteristics and Interview Durations* (Adapted from XXX, XXX: 105)

Participant Number	**Gender**	**Employment Type**	**Interview Duration (Hours, Minutes, Seconds)**	**Face-to-Face (F2F) or Telephone (T) Interview**
PN01	Male	Retired Consultant Geologist	00:42:21	T
PN02	Male	Anti-fracking Campaigner	01:05:21	F2F
PN03	Female	Anti-fracking Campaigner	01:26:12	T
PN04	Female	Journalist	01:19:24	T
PN05	Male	Academic Geologist	00:57:57	T
PN06	Male	Academic Social Scientist	00:55:10	T
PN07	Female	Parish Councillor	01:11:47	F2F
PN08	Female	Law Academic	00:31:07	F2F
PN09	Male	Regulatory Body	00:45:51	T
PN10	Female	Oil and Gas Consultant	00:37:03	T
PN11	Male	Anti-fracking Campaigner	01:11:26	F2F
PN12	Male	Anti-fracking Campaigner	00:35:28	F2F
PN13	Female	Consultant Geologist	00:53:04	F2F
PN14	Female	Water Consultant	00:48:50	T
PN15	Male	Gas Company Director	00:43:22	T

PN16	Male	Oil and Gas Professional	00:39:49	F2F
PN17	Male	Regulatory Body	00:57:29	F2F
PN18	Male	Regulatory Body	00:57:29	F2F
PN19	Male	Anti-fracking Campaigner	00:45:53	F2F
PN20	Male	District Councillor	00:40:04	F2F
Total	**7 Female, 13 Male**	N/A	**Total: 17:45:07 Mean: 00:53:15**	**9T, 11 F2F**

Interviews were standardized in that the researcher asked the same twelve questions (relating to the twelve key themes) to all participants. However, interviews were semi-structured in that the researcher asked additional questions depending on responses given by individual participants. This enabled the participant to reveal their own thoughts and experiences leading to richer data, and also ensured rapport was maintained, allowing participants to feel comfortable in speaking at length about UHF issues. Interviews were discontinued when a sample of twenty respondents was reached as the researcher felt that data saturation was occurring (where little new information is gleaned from further interviews). Each interview was recorded and then transcribed by the researcher. Coding was conducted using Microsoft Excel and following Miles et al.'s (2014) simple coding strategy where codes are self-generated and assigned to participant responses that entertain the same (or similar) topics, issues or viewpoints. Coding and analysis were not conducted or quantified in any way with the stakeholders employment category, gender (or any other characteristics) in mind. This is mainly due to the diversity of the sample and uneven clusters of different participant types (i.e. there was only one gas company director interviewed, but five anti-fracking campaigners interviewed). Therefore, the quotations that follow in the remainder of this article include a

mix of responses from a range of different participants, representing a variety of different perspectives, experiences, and viewpoints.

The rest of this paper will discuss the two main themes and five associated sub-themes generated by thematic analysis. This will begin with the first main theme and sub-theme (as identified in Table One).

Main Theme One: Perceived Impact on Property Values

Sub-Theme One: Perceived Positive Impacts on Property Values Based on Existing Oil and Gas Activity in the U.K.

Whilst it has been noted that onshore gas extraction in the U.K. has been negligible with regards to the use of conventional drilling techniques, gas extraction has occurred more substantially offshore, particularly in the North Sea and South of England. These areas are associated with historically high property values compared to other areas of the U.K., and this was acknowledged by participants. Aberdeen (Scotland) and Pool Harbour (Dorset), for example, house workers from the offshore oil and gas industry:

PN05: “The largest onshore oil field in the U.K. until very recently was underneath Pool Harbour and house prices in Pool Harbour are about the highest in the U.K. Now, the infrastructure there is very well hidden, most people don’t really know it’s there... but it doesn’t seem to have had an effect on house prices."

PN17: “Property in Aberdeen was extremely expensive and, ok, it’s dropped off a little bit now as the industry has started to contract but for the last 30 years or so, you know, it’s been a very expensive place to live, probably one of the most expensive outside London."

Despite the high-value of property in areas that host existing (mainly offshore) oil and gas production and exploration, many participants were of the view that fracking would have a negative impact on property values in the localities that host fracking which is discussed in ST2.

Sub-Theme Two: Perceived Negative Impacts on Property Values

Most participants expressed the view that fracking would have some sort of negative impact on property values in the U.K. However, they gave varying estimates of what percentage depreciation in property value may be applicable, ranging from 7% to 50%. This demonstrates the unpredictability of the impact of UHF on property values in the U.K.:

PN02: “We know for tests done in Ryedale for instance by residents that they have actually approached insurance companies, um as well as, er, valuers and their properties have dropped anywhere between 30 and 50 percent and in some cases they cannot get insurance.”

PN06: "Over the longer term it might not have a huge impact on house prices in those kinds of areas. But, um, if you were to do it in a more beautiful rural area like... Balcombe in Surrey where house prices are significantly higher than they are in the North-West then you know if you lose 10% of the value of your house you know, it’s quite a substantial amount of money."

PN11: “I suppose it could depress the property market by, people speculate 7%, 10%.”

Similarly, PN20 suggests that fracking does bring down property prices, although this is not the biggest concern as to why he is opposed to fracking:

PN20: "It's not one of my prime concerns of why I am opposed to it. Um, if it was the right thing to do but bring property prices down then we would need to do it. But it is the wrong thing to do, and happens to put property prices down."

The U.K. has conducted only a very small number of onshore UHF operations, mainly in the North-West of England (such as at PNR). As a result, there is virtually no research into the effect of fracking on property values in the U.K. (see Gibbons et al. 2016 for some discussion), simply because fracking has not yet been performed on a commercial scale as in several other countries (for example the U.S. and Australia). This state of affairs may be responsible for the large discrepancy between participants' estimations of how property markets in the U.K may be affected by fracking. However, many participants expressed concerns not over the potential depreciation of property values as a result of fracking, but the ability to sell a property, particularly if it resides in close proximity to a fracking site. Due to this potential inability to sell, many participants also expressed the belief that properties near fracking sites may be (at least temporarily) *worthless* or have *no economic value* as can be witnessed in the following quotes from PN04, PN07 and PN11:

PN04: "Those properties next to fracking sites have no economic value because I wouldn't buy them, um, and those people are really stuck… and there are sometimes you know very sad human stories about why people feel the need to get rid of them. It might be for health reasons it might be, you know they need to move, um, and if they cannot dispose of their property with enough, what should be the real market value, then they are in real trouble."

PN07: “I’ve got anecdotal evidence to suggest that, um, property prices will be affected. Um, we’ve had evidence locally… a house sale did fall through when they found out that there was just an exploratory development going on.”

PN11: “I would have thought that there’s a number of properties in and around that community that will become unsaleable. Er, I can’t see how it can be other than that. I mean who is going to buy a house that has got the noise and the air pollution and so on that we would associate with the fracking process?"

Similarly, PN12 alludes to a number of interesting aspects that could impact property value or the ability of a property-owner to sell. This includes: the media’s coverage of fracking; the impact of anti-fracking protests on properties within close proximity of such demonstrations; and those houses where the views of a property are within sight of a fracking well, thus impacting the enjoyment of one’s property:

PN12: “Especially at the moment when you know the two main fracking sites, potential fracking sites are very much in the news everyone is going to know where fracking is, you are not going to be able to sell your house on PNR in Blackpool and not have the, um (laughs) the people come to look at it turn up and realise that there’s a fracking site and a fracking protest going on down the road. So how negative, I mean I imagine people living within sight of the fracking well will probably simply be unable to sell their houses and will effectively become valueless for the time, for the duration of the frack.”

Alongside the potential inability to sell a property close to a fracking site, PN13 also makes an important point that fracking may impact the enjoyment of a property due to above-ground disruption:

PN13: “Above ground it is more disruption and lack of enjoyment of your property and I can see that, nobody wants a frack site at the end of the road or, you know, at the end of their garden.”

Enjoyment of one’s property links to the potential human rights infringements of UHF (Short et al. 2015). As Kerns (2011: 13) suggests when discussing the implications of fracking on article 17[ix] of the International Covenant on Civil and Political Rights[x], quintessential reasons for concern include:

> ‘Discomfort experienced at home, or a compromised ability to enjoy one’s home and property due to air and water contaminants, as well as noise and light pollution, associated with hydraulic fracturing operations, even without adverse health effects. Potential adverse physical health effects from exposures to air and water contaminants associated with hydraulic fracturing operations and suffered in the home.’

Linked to these pertinent thoughts on human rights is the large visual impact that is likely to result from UHF operations in the U.K.:

PN06: "Fracking in its early stages is quite, has quite a big visual impact. You know you’ve got the drilling rig that’s lit up all the time, and it has, it’s a very visible presence."

A further visual and auditory implication of fracking wells is the necessity for a large number of truck movements during the production stages of development (Short and Szolucha, 2019). These truck movements are essential to the success of fracking operations as vehicles are likely to contain (amongst other things) water, proppant (sand) and chemicals, all vital components in the natural gas production process. Wastewater is also likely to be transported via heavy goods vehicles from the fracking site to a waste water treatment facility (O'Donnell et al. 2018). As Stephenson (2015: 104-105) notes 'this means an enormous amount of truck traffic: between 7,000 and 10,000 single truck journeys have been estimated per well pad through the period of construction and fracking.' Although such truck movements would only last the duration of the construction and production stages of the fracking process, this volume is likely to have an impact on those people living in properties that reside on roadsides. Additionally, Stephenson (2015: 105) notes that:

> 'this number of trucks would hardly go unnoticed – there would be more trucks on public highways affecting traffic flow and increasing congestion. Large trucks on narrow roads are a hazard, and they damage roads and bridges… Trucks carrying hazardous fluids sometimes crash or leak. Of course we shouldn't forget the emissions of the trucks – and the diesel that's burnt in the engines.'

Finally, there are two similar points provided by PN08 and PN16 respectively regarding the uncertainty of the fracking industry, and the large number of negative attention the industry has received in the U.K., both of which have the ability to negatively impact property values:

PN08: "One of the difficulties at the moment is not so much property prices but actually being able to sell your property. And I think that both of them come back to the fact that at

the moment there is a lot of uncertainty so people aren't sure if it is going ahead, they aren't sure how it is controlled, they aren't sure if it's safe. And I think it's more that uncertainty that is affecting the property prices."

PN16: "It will also have a negative effect based on the fact that in America fracking, the development of fracking attracted a fairly large amount of negative comments and it is sometimes just the, er, the very excessive, er, examples that then lead away to reduction for instance people turning on their tap and flames coming out."

Finally, PN20 suggests that the local impacts of UHF development will negatively influence buyers who are unlikely to purchase property in an area where fracking is prominent:

PN20: "Common sense says, who is going to want to buy a property, not just in the locations that are likely to be impacted really by the increased traffic, by the, um, pollution, er, but in any locality, that is named as being a locality in which fracking takes place. So, people will look twice at buying a property in Ryedale because they know Ryedale is a location for fracking."

Despite these perceived impacts of UHF on property values, other participants (PN01, PN09) did suggest that any such impacts would be negligible in the long-term, even if there was a short-term negative effect on property values. This is because the production of shale gas usually only lasts a short period of time (less than a year).

Summary of Main Theme One: Perceived Impact on Property Values

The impact of fracking on property values is uncertain due largely to the fact that UHF is not a fully established industry in the U.K., and therefore there is no U.K. research available to draw upon that analyses the potential impact of this type of fracking on property values. Participants were largely of the view that fracking may have a negative effect on property values for those people whose properties reside near production sites. The three main conclusions were that fracking may contribute to a percentage decrease in the price of property, fracking may prevent a person from being able to sell their property, and fracking may impact the enjoyment that one receives from their property.

However, some participants alluded to some potential positive impacts on property prices as a result of fracking. Other locations that have experienced industrial development by means of oil and gas extraction, such as Pool Harbour in Dorset and offshore developments off the coast of Aberdeen, have seen improvements in property values as a direct result of such industrial development.

The final main theme discussed by participants is the perceived impact of UHF processes on energy security in the U.K. The term energy security refers here to 'the continuity of energy supplies relative to demand' (Winzer, 2012: 36).

Main Theme Two: Perceived Impact on Energy Security

Sub-Theme Three: The Effect on Energy Security Depends on the Success of the Technology

Many participants were reluctant to give in-depth responses regarding the potential effect that fracking may have on the U.K.'s energy security because fracking was not yet an established industry in the U.K. At the time interviews were conducted (May 2016-September 2017), fracking was very much at the exploration phase, rather than a commercial, production phase

of development, and this continues to be the case at the time of writing (September 2020). Because companies were not yet producing consumable gas, participant's answers were speculative as they felt unable to comment on any effect that fracking had had on energy security previously, because the gas which could have impacted energy security, had not yet been produced. As a result, participants often suggested that the potential effect on energy security depends on the success of the technology in the future:

PN01: "It depends really on the rate in which it is developed… it could have a significant effect if it's developed rapidly and is very successful as it has been in the States it could have a significant impact (short pause) on the security and supply of energy."

PN09: "It depends on what is down there. Um, if… our wildest dreams are realized then it could provide, it could make a significant contribution I would imagine, to our energy security."

As can be seen from these two quotes, multiple factors may affect fracking's impact on energy security. Firstly, as PN01 notes, energy security depends on the rate upon which shale resources are developed. Shale gas has positively affected energy security in the U.S. because production has been rampant since the mid-2000's (Kefferpütz, 2010). Such fast production has been attributed to a lack of federal level legislation and weak environmental laws and regulations around fracking for shale gas in the U.S. (Brady and Crannell, 2012). Such rampant extraction is unlikely to occur in the U.K. because of more stringent environmental laws and regulations, such as the *Infrastructure Act 2015*.

Fracking's impact on energy security also depends on the extent of the shale gas resource in the U.K. in terms of the quality of the gas, how much is able to be extracted, and how profitable it is for companies to remove. Shale resources vary around the world depending on the geological make-up of different shale reservoirs, and the history regarding how they formed. Due to these factors, it is very difficult to accurately predict the extent of a country's shale gas resources, particularly when different geological research studies employ varying methods to calculate their predictions (McGlade et al. 2013). However, many studies and reports have alluded to differences in the U.S. and the U.K. which will make it more difficult for the U.K. to economically benefit from shale gas production to the same extent as the U.S. (Department of Energy and Climate Change (DECC), 2013: 4; Stevens, 2013). These differences include variations in the comparative underlying geology of the two countries (Reap, 2015: 2) and the divergence in fracking legislation and regulation (Hawkins, 2015).

Despite this, there are some positive differences in the U.K. which may make shale gas production more attractive than the U.S. For example, when reporting to the U.K. government's Economic Affairs Committee, Professor Richard Davies noted that 'UK shale is… much thicker than US shales, so perhaps we will see that some of the UK wells produce much more gas than the ones in the United States' (Economic Affairs Committee, 2014). Similarly, and although the U.S. industry has experienced a comparable phenomenon since the establishment of the *Energy Act 1980* (Stevens, 2013: 7-8), the U.K. government is offering tax breaks and other 'attractive fiscal incentives to shale gas operations in the hope of kick-starting the industry' (Stevens, 2013: 8). However, there is a general recognition that the U.K. will not experience the same economic benefits that have occurred in the U.S. since the beginning of the 21st Century. According to the DECC (2013: 32):

> ‘Even if one assumes that the American shale gas producing analogies are valid, many of the operating conditions are different in the UK. In the UK, land owners do not own mineral rights, so there is less incentive to support development, and local authorities must grant planning consent. The US has relatively permissive environmental regulations, low population densities, tax incentives, existing infrastructure, well developed supply chains and access to technology. Cumulatively, these factors mean that it is far from certain that the conditions that underpin shale gas production in North America will be replicable in the UK.’

Therefore, shale gas production in the U.K. may not be as economically beneficial as shale the U.S. and, consequently, the effect on the U.K.’s energy security will be lesser. However, it is likely that U.K. shale gas production will have *some* positive impact on the security of oil and gas resources in the U.K. Nevertheless, this does not necessarily mean U.K. production is essential to energy security. Whilst importing energy may be more expensive than producing home-grown energy, PN16 explained the wealth of potential resources available to the U.K. in terms of importing energy:

PN16: "The U.K. has probably one of the most diverse energy supply mixes you can think of, even if you just looked at methane. A large portion of our gas comes from Norway… which is coming in in Easington near Hull, close by. We have an interconnector with Holland, er, as well. Er, LNG, liquefied natural gas is in plentiful supply… there’s the Middle East, west of Africa, um, and even the Caribbean, um, Trinidad is producing quite large volumes. Um, plus the U.S. which has started exporting liquefied natural gas as well. So, there are plenty of sources for us to draw on when it comes to getting hold of natural gas, clearly there is oil as well. Um, ok, coal that is out of fashion, nuclear you know, that is a bit of a baseload and the

last one in the picture is renewable energy. Last but not least I should say because the growth in that is fantastic, er, I think that that will temper, it should temper any debate around whether, um, the gas that you win from fracking is an essential source to this country. It competes with tidal energy, wind energy, solar energy."

As well as energy security depending on the success of fracking in the U.K., participants also alluded to the low gas storage capability of the U.K. and how this may adversely affect energy security.

Sub-Theme Four: Low-Storage Capability

As noted by PN 16 above, the U.K. has a very diverse energy supply, particularly when it comes to gas. Gas is available from a variety of different sources including: U.K. North Sea oil and gas production, conventional onshore oil and gas wells, and through the importation of gas in the form of Liquefied Natural Gas (LNG) from around the world, or via interconnectors supplied from Norway and other continental gas networks. Whilst some of this gas can be stored in long-range and medium-range gas storage systems (National Grid, 2019: 39), the U.K. still has a relatively low total gas storage capacity in comparison to most other gas-consuming European nations. This is due primarily to the U.K.'s historical (post-World World II) reliance on plentiful, flexible oil and gas supplies from the U.K. continental shelf (Le Fevre, 2013). However, because oil and gas production from the North Sea is in steady decline, a lack of gas storage capacity could have a significant impact on the U.K.'s energy security in terms of being able to provide gas to consumers for the foreseeable future, a concept identified by PN13:

PN13: “We have what is called a very low storage ratio to our needs so we actually can’t store very much gas in this country. So, like, Hungary has got loads and loads of storage capacity, we’ve got very little. So, if somebody turns off the tap, we haven’t got lots to spare, lots in storage, we’re you know, we haven’t got a big larder. So that also reduces our energy security so we’re not in a very good position. So, ultimately having gas under our feet makes us much much more secure.”

If fracked gas is sold on the European market and is not used for domestic consumption – the potential for which has been suggested by some authors (Institute of Directors, 2013: 110), this may mean that fracking will not have any effect on the U.K.’s energy security. However, gas sold in this way would have other economic benefits in terms of balancing the U.K.’s fiscal position in relation to gas (by increasing revenue from selling rather than importing).

PN13 (above) alludes to the political advantages of domestic gas production using phrases such as “if somebody turns off the tap,” “we haven’t got a big larger” and “gas under our feet makes us much much more secure.” Although this response is in relation to the perceived economic effects of fracking on energy security, PN13 is clearly concerned with the perceived problems associated with relying too heavily on politically unpredictable nations who supply large volumes of gas into the European network. This is confirmed by an earlier response from PN13 to the question of the extent to which fracking may affect the U.K. economy:

PN13: "Where it is going to be most positive is actually the effect it will have on the economy overall in terms of cheaper fuel prices. That’s what makes us resilient to, um, the changes in oil price from the rest of the world. Changes in fuel prices. And also, energy

security because we get from Russia and Norway and you don't want Russia turning off the tap, those usual scare stories. But actually, it's quite possible, um, so it makes, it's better for the economy as a whole because we will have cheaper fuel costs if we go forward with it."

Such concerns are potentially fuelled by the on-going volatile gas supply relationship between Russia and the Ukraine (Van de Graaf and Colgan, 2017) which has resulted in Russia 'turning off the taps' in terms of the gas that they supply to the Ukraine. The arbitrary political make-up of Russian politics, particularly where fossil fuels are concerned, is arguably to blame for such perceptions entertained by PN13. However, whilst the U.K. should be concerned about Russia's political and economic dominance from a security and defence point of view, the diversity of the U.K.'s energy supply (particularly of gas) means there are plenty of options in terms of accessing natural gas in the future. It is also worth mentioning at this stage that consuming energy from less economically and politically volatile sources may overcome the perceived problems on the reliance of gas originating from 'unsavoury' origins. The U.K. is an island country that has the option to utilise inexhaustible coastal and offshore renewable energy generation such as wind, wave, tidal and solar energy. Such renewable and home-grown energy creation is not only more environmentally positive, but would avoid any concerns regarding the volatile politics of fossil fuel energy.

Sub-Theme Five: Domestically Produced Gas is Preferable to Imported Gas

In fiscal terms, it is more economically beneficial to produce and use domestic gas supplies than it is to import gas from overseas. The U.K. has long been an exporter of oil and gas due to abundant resources from the North Sea. However, due to recent production decline, the economics of the U.K.'s oil and gas supply relationship between imports and exports is

changing. According to the Institute of Directors (2013: 26) ‘in 2000, the UK was exporting gas equivalent to 14% of UK gas demand. By 2011, net imports had risen to 45% of demand and by 2030, net imports are expected to increase to 76%.’ Such drastic change is arguably the result of an over-reliance on fossil fuel resources that are, critically, non-renewable.

Shale gas presents an opportunity for the U.K. to continue producing domestic fossil fuel resources which may go some way in re-shaping the declining offshore services industry via the creation of an onshore replacement. However, prolonging fossil fuel usage is a very divisive issue that varies (generally) depending on a person’s motivations and, therefore, the extent to which extending U.K. fossil fuel production can be seen as socially, environmentally and morally acceptable, is an ongoing debate (Harriss-White and Harriss, 2007).

Despite this, participants were largely of the view that, if gas is to play a role in the U.K.’s energy mix, producing it domestically is more logical (in an economic sense), than importing gas from overseas:

PN09: “Given that we are going to be using gas in some shape or form for the foreseeable future, um, then, if it doesn’t come from under our feet it is going to come from somewhere else. Um, the U.S. up to a certain point but there are an awful lot of other people we might get gas from and are getting gas from who are potentially somewhat unpredictable.”

Similarly, PN13 describes that exploring and producing gas domestically is necessary in the current financial and political climate. Not exploring such resources would be “nonsensical”

to PN13 who was clearly open to the financial and economical possibilities that shale gas could bring to the U.K. economy:

PN13: “There’s potentially trillions of cubic feet under our feet which would seem, especially in the current climate… nonsensical not to actually see what’s there, or to at least explore the possibility."

Whilst many participants thought that fracking may have a positive effect on the U.K.’s energy security, only one participant alluded to the idea that fracking could have a negative effect on the U.K.’s energy security. According to PN20, UHF may prevent investments in other areas such as reducing energy usage:

PN20: "Energy security is a very important factor, but you can get that energy security quicker, more reliably, er, and much more sustainably, er, by, um, by going for reducing, um, use... basically if you put anything like the investment that is going into either Nuclear or fracking, er, into reducing use, we would get the impact quicker, more reliably, um, and healthier. So, it is not necessary."

Main Theme Two Summary: Perceived Impact on Energy Security

For energy security, participant responses have been grouped through thematic analysis into three key sub-themes. This began with ST3, the simplistic notion that the impact of fracking on energy security ultimately depends on the extent (and success of) UHF operations. ST4 considered the low gas storage capability of the U.K. and the subsequent attractiveness of UHF practices as a temporary solution to overcome this. Finally, ST5 considered

environmental and energy security benefits of utilising domestically produced gas as opposed to LNG or otherwise imported gas from overseas.

Conclusion

Interview responses have been analysed in terms of whether participants perceived UHF to have a positive or negative impact on property values. Whilst most interviewees believed fracking would have a negative effect, PN17 in particular alluded to the high property values that exist in current oil and gas producing regions of the U.K. such as those in Aberdeen and Pool Harbour, demonstrating the difficulty in predicting what impact UHF may have on property values.

However, most participants were of the view that fracking would have a negative effect on property prices in the U.K., for a variety of reasons. Firstly, various suggestions were given on the percentage depreciation in property price that may occur in the U.K. with estimations ranging from 7%-50%. Such vast difference is likely to reflect the fact that fracking had not yet taken place in the U.K. at the time interviews were conducted, meaning there was little empirical evidence to draw upon to back-up participant's views. Thirdly, participants were concerned about the ability of people within fracking localities to actually sell their property. Similarly, hesitations were raised over the ability to enjoy one's property and, finally, some participants alluded to the uncertainty of fracking leading to a negative effect on property prices in areas that host fracking in the U.K.

Other issues were also raised concerning the potential effect that fracking may have on property prices. PN14 suggested some people may use the depreciation of property values as a "scare-mongering" technique to persuade people that fracking is a bad idea. Additionally, it

was suggested that the effect of fracking on property prices was too difficult to predict because UHF was not yet at a production phase of development in the U.K.

A further conclusion concerns the U.K.'s low gas storage capacity. Participants alluded to the insecurity that such low storage brings in terms of having to rely on other nations to provide consumable gas, some of whom are politically volatile. These concerns are fuelled by the on-going hostile relationship between Russia (the largest supplier of gas into the European network) and the Ukraine. These arguments are not overly concerning to the impact of fracking on the U.K.'s energy security due to the diversity of the U.K.'s energy supply mix, and the ability to obtain natural gas from a variety of abundant, gas-rich nations around the globe.

Finally, participants were generally in agreement that domestically produced gas is both more logical and economically advantageous than imported gas from overseas. This argument was placed in the context of the continual decline of North Sea hydrocarbon production which is innately placing a greater strain on natural gas imports.

As a result, this article has highlighted several important developments concerning the economic implications of UHF in the U.K. Due to the fact that there is very little academic research in this area, the intention of this article is to call for further research. Doing so would not only inform the government of the salient economic impacts of UHF on property values and energy security, but would help to identify the ramifications of the industry for environmental justice (XXX, XXX).

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[i] This is compared to the U.S. where shale formations are generally much shallower, less than 1 kilometres below the Earth's surface. This is important because the deeper the shale, the more difficult (and costly) it is to extract.

[ii] Eleven interviews were conducted face-to-face, and nine over the telephone. Interviewees resided or held occupations all over the U.K. Exact locations cannot be revealed due to participant confidentiality.

[iii] Key-informants are defined as an expert source of information (Marshall, 1996) and consisted of a range of people with diverse experience of UHF in the U.K., from persons working within regulatory bodies, to independent consultants, geologists, academics, and anti-fracking campaigners.

[iv] The perceived impact of UHF on: water aquifers, water resources, seismicity, well integrity, waste gases, chemical usage and wastewater disposal (see: XXX, XXX).

[v] The perceived impact of UHF on: the economy, energy security, jobs, property values and community financial incentives (XXX, XXX).

[vi] CFI's are payments enshrined within the Infrastructure Act 2015 whereby fracking companies are required to make financial payments to communities as a requirement of their fracking operations. These payments consist of £100,000 per well site (where fracking occurs) and an additional 1% of revenue once fracking is underway (for more detail, see: Hawkins, 2015).

[vii] This was done following Miles et al.'s (2014: 71-85) coding strategy which involved assigning important sections of data different codes in order to enable thematic analysis to take place (by grouping different sections of data together under the same code types: invivo, emotion, holistic, protocol and sub codes, see XXX, XXX: 121-125 for more detail).

[viii] 'Ideal' refers to people whom the researcher subjectively deemed to possess the requisite knowledge or experience to take part in the research. This was done following a year-long literature review on UHF in the U.K. enabling the researcher to select knowledgeable participants.

[ix] 'No one shall be subjected to arbitrary or unlawful interference with his privacy, family, home or correspondence' (Kerns, 2011: 13).

[x] Often referred to as the international bill of human rights.