



Project Acronym and Title:
**M4ShaleGas - Measuring, monitoring, mitigating and managing the
environmental impact of shale gas**

INTEGRATED REVIEW OF PUBLIC PERCEPTIONS OF SHALE GAS IMPACTS

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Public introduction

M4ShaleGas stands for *Measuring, monitoring, mitigating and managing the environmental impact of shale gas* and is funded by the *European Union's Horizon 2020 Research and Innovation Programme*. The main goal of the M4ShaleGas project is to study and evaluate potential risks and impacts of shale gas exploration and exploitation. The focus lies on four main areas of potential impact: the subsurface, the surface, the atmosphere, and social impacts.

The European Commission's Energy Roadmap 2050 identifies gas as a critical fuel for the transformation of the energy system in the direction of lower CO₂ emissions and more renewable energy. Shale gas may contribute to this transformation.

Shale gas is – by definition – a natural gas found trapped in shale, a fine grained sedimentary rock composed of mud. There are several concerns related to shale gas exploration and production, many of them being associated with hydraulic fracturing operations that are performed to stimulate gas flow in the shales. Potential risks and concerns include for example the fate of chemical compounds in the used hydraulic fracturing and drilling fluids and their potential impact on shallow ground water. The fracturing process may also induce small magnitude earthquakes. There is also an ongoing debate on greenhouse gas emissions of shale gas (CO₂ and methane) and its energy efficiency compared to other energy sources. There is a strong need for a better European knowledge base on shale gas operations and their environmental impacts particularly, if shale gas shall play a role in Europe's energy mix in the coming decennia. M4ShaleGas' main goal is to build such a knowledge base, including an inventory of best practices that minimise risks and impacts of shale gas exploration and production in Europe, as well as best practices for public engagement.

The M4ShaleGas project is carried out by 18 European research institutions and is coordinated by TNO-Netherlands Organization for Applied Scientific Research.

Executive Report Summary

This integrated review pulls together the findings of three reports that examined: existing European data on public perceptions of shale gas; public perceptions of shale gas operations in the USA and Canada; and the lessons learned on public perceptions and engagement of large scale energy technologies (CSS, nuclear and onshore wind). The review is organised around three themes: acceptability and awareness, risks and benefits and trust and information. In the review the experience from USA and Canada is discussed before analysis of the current situation in Europe, as North America provides the context for the current debate in Europe. In the case of North America, it is important to understand that body of research that has been reviewed reflected the situation in 2012-13, before the collapse in the oil price and the change in the fortunes of the oil and gas industry. Even so, research shows substantial regional variations in levels of acceptability with the level of awareness being greatest areas of actual commercial development. Although the studies suggest slightly more support than opposition, there is some evidence of opposition growing over time. In Europe there is a much greater level of variation in national attitudes towards shale gas development and many member states have banded development or have an embargo in place. The study that is reviewed focused on: Poland, the UK, Germany and the Netherlands. Poland was the obvious outlier with a high level of public acceptance, the UK is divided with a majority still undecided, in Germany opposition seems to be the dominant attitude, and in the Netherlands the lack of detailed research makes it difficult to reach a conclusion. In all cases the public professes a lack of knowledge and feels that they lack sufficient information to make informed decisions. The review of other large scale technologies raises the issue of 'pseudo decisions' whereby people form a strong opinion on the basis of limited knowledge. However, experience warns against assuming that those holding opposing views will change their minds if provided with more information. When it comes to risks and benefits there seems commonality between research findings in the USA and Europe. In both regions the benefits are largely seen as economic in nature, while the risks are seen as both environmental and social. The similarity is not surprising given that the experience in North America is forming the evidence base for the debate in Europe. However, in the European context greater currency is also given to the wider issues of energy security and climate change. When it comes to trust and information, it is clear that where people get their information from is important, with the

local media being the main source in the USA. In Europe there have been very effective campaigns by environmental groups that have stressed the risks associated with shale gas development and people seem uncertain where to obtain independent views, though scientists are seen as one source of such information. When it come to trust, it would seem that in the USA few organisations, groups and individuals are trusted. Mistrust of industry is common place and government is often perceived to be too closely aligned to industry. Much can be learnt about matters of trust and knowledge from studying the experience of other large scale energy technologies and this will be the subject of further work. At the end of the report, six observations are made by way of conclusions. First, it is clear that public awareness of the issues of shale gas is growing in Europe. Second, there also appears to be growing levels of opposition. Third, a significant share of the public remains undecided. Fourth, there appears to be a lack of trust of key stakeholders and a concern about a lack of transparency and the availability of intendent information. Fifth, national and local context matters a great deal in shaping public opinion. Sixth, evidence from other large scale energy technologies suggests that attitudes are often shaped by emotion and that providing additional information is unlikely to change attitudes. Consequently, the key policy insight is that it would be wrong to think that all that government and industry needs to do is provide the public with the ‘right’ information and they will then support shale gas development.



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1 INTRODUCTION

1.1 Context of M4ShaleGas

Shale gas source rocks are widely distributed around the world and many countries have now started to investigate their shale gas potential. Some argue that shale gas has already proved to be a game changer in the U.S. energy market (EIA 2015¹). The European Commission's Energy Roadmap 2050 identifies gas as a critical energy source for the transformation of the energy system to a system with lower CO₂ emissions that combines gas with increasing contributions of renewable energy and increasing energy efficiency. It may be argued that in Europe, natural gas replacing coal and oil will contribute to emissions reduction on the short and medium terms.

There are, however, several concerns related to shale gas exploration and production, many of them being associated with the process of hydraulic fracturing. There is also a debate on the greenhouse gas emissions of shale gas (CO₂ and methane) and its energy return on investment compared to other energy sources. Questions are raised about the specific environmental footprint of shale gas in Europe as a whole as well as in individual Member States. Shale gas basins are unevenly distributed among the European Member States and are not restricted within national borders, which makes close cooperation between the involved Member States essential. There is relatively little knowledge on the footprint in regions with a variety of geological and geopolitical settings as are present in Europe. Concerns and risks are clustered in the following four areas: subsurface, surface, atmosphere and society. As the European continent is densely populated, it is most certainly of vital importance to understand public perceptions of shale gas and for European publics to be fully engaged in the debate about its potential development.

Accordingly, Europe has a strong need for a comprehensive knowledge base on potential environmental, societal and economic consequences of shale gas exploration and exploitation. Knowledge needs to be science-based, needs to be developed by research institutes with a strong track record in shale gas studies, and needs to cover the different attitudes and approaches to shale gas exploration and exploitation in Europe. The M4ShaleGas project is seeking to provide such a scientific knowledge base, integrating the scientific outcome of 18 research institutes across Europe. It addresses the issues raised in the Horizon 2020 call LCE 16 – 2014 on *Understanding, preventing and mitigating the potential environmental risks and impacts of shale gas exploration and exploitation*.

¹ EIA (2015). Annual Energy Outlook 2015 with projections to 2040. U.S. Energy Information Administration (www.eia.gov).



1.2 Study objectives for this report

It is widely recognized that a lack of public acceptability presents a major barrier to shale gas exploration and development in Europe. The first phase of Study Programme 4 (SP4) has involved the production of three detailed reviews of the peer-reviewed literature relating to three issues: first, existing European data on public perceptions of shale gas (D17.1), second; evidence of public perceptions of shale gas operations in the USA and Canada (D18.1); and third, lessons learned from public perceptions and engagement with large scale energy technology (D19.1). This report pulls together the findings of the three reports to produce a review and synthesis in relation to public perceptions of shale gas. The review is organized around three key issues that cut across the three reports: acceptability and awareness; risks and benefits; and trust and information.

1.3 Aims of this report

The aim is to present and synthesise the findings of the first phase of the work programme in M4ShaleGas that has examined the public understanding of the impacts of shale gas development. The three reports are:

Alexsandra Lis, Caudia Braendle, Torston Fleischer, Merryn Thomas, Darrick Evensen, Jessane Mastop (2015) *Existing European Data on Public Perceptions of Shale Gas*. M4ShaleGas Consortium, D17.1, 70 pp.

Merryn Thomas, Nick Pidgeon, Darrick Evensen, Tristan Partrdige, Ariel Hasell, Catherine Enders, Barbara Herr Harthorn (2015) *Public Perceptions of Shale Gas Operations in the USA and Canada—A Review of the Evidence*. M4ShaleGas Consortium, D18.1, 40 pp.

Jessanne Mastop, Marielle Rietkerk (2015) *Review of Lessons Learned on Public Perceptions and Engagement of Large Scale Energy Technologies*. M4ShaleGas Consortium, D19.1, 21 pp.

Copies of the reports can be obtained from the SP4 download page of the M4ShaleGas website.² This review is not intended to replicate the detail of the original reports. The references that support the initial reports are not replicated here, instead the reader is referred to the pages of the relevant report where further information and supporting documentation can be found. The conclusions identify the key policy implications and suggest an agenda for future work in a European context.

² The individual reports can be obtained from M4ShaleGas (<http://www.m4shalegas.eu>), sub-page 'Downloads' (<http://www.m4shalegas.eu/reports4.html>), visited on 20 January 2016.



2 REVIEW & SYNTHESIS

Before examining the key themes, it is necessary to say something about the scope of the three reports and the order in which they are discussed below. The review of public perceptions of shale gas operations in the USA and Canada (D18.1) provides the starting point for the simple reason that this is where shale gas originated and is most developed. It is also the case—rightly or wrongly—that European perceptions are in large part based on evidence gained from the North American experience. The review then turns to the literature on Europe (D17.1) which is focused on four countries: Poland, the United Kingdom (UK), Germany and the Netherlands. These are countries that have generated the most research. The country case studies are complimented by an assessment of the results of Eurobarometer surveys that included questions on shale gas. The third report (D19.1) considers the lessons that can be learnt from experience with other large scale energy technologies. Three energy technologies are considered: wind energy, nuclear energy (but not waste disposal) and Carbon Capture and Storage (CCS).

2.1 Acceptability and Awareness

2.1.1 North America

What some call ‘the shale gas revolution’ in North America took decades to develop, but the large-scale commercial development of shale gas is a relatively recent phenomenon that has had a very significant impact on the North American energy landscape in a very short period of time. Ten years ago the US Energy Information Administration (EIA) was not even reporting statistics on shale gas production, but in 2015 the EIA reported that it accounted for 46% of US natural gas production. The review of the literature on the North American experience reflects the currency of the issue of public perceptions of shale gas operation; the first articles reviewed were published in 2009, but the vast majority (74.6%) were published between 2013 and 2015. The other factor to consider is that the review focuses on refereed academic journal articles and it takes time to undertake the underlying research and then publish it. If we assumed a one to two-year gestation period for the research and publishing process, then research published in 2014—when the majority of articles were published—reflects the situation in 2012-13. This is important because the shale gas industry was under pressure from low prices much earlier than tight oil and was supported by the production of wet gas (with natural gas liquids) and tight oil. Thus, the collapse in the oil prices in 2015 already compounded a deteriorating situation, but it means that the shale gas boom is now over for the moment and, for many regions, there is now a shale gas bust. This is important for the results of the review because it is based on research that was conducted during the period of relative boom and it is highly likely that attitudes have changed with the fortunes of the industry. It is also the case that new research on attitudes, perceptions and impacts is now coming out, adding to a growing evidence base that critiques the development of shale gas. This suggests a need to maintain the review process to capture how perceptions are changing with the downturn in the industry and the emergence of new evidence.



More than half of the studies reviewed on the North American (USA/Canada) experience had something to say about the awareness and knowledge of ‘fracking’ and shale gas/oil developments (D18.1, page 15). The research was commonly quantitative and based on surveys, most had a regional or comparative focus, though some were at the national scale. Researchers found that close to 50% of individuals in areas in close proximity or subject to development were aware of the issue. But another way of looking at this is that around half were not! Not surprisingly, given the size of the USA and Canada, and the fact that shale gas development is restricted to particular regions, there is considerable regional variation in awareness and attitudes. As one would expect, in the USA, awareness is greatest in regions where there is already development underway or where it is a prospect. In Canada, there are significant differences in exposure to the issues, with the West, primarily Alberta, having experienced decades of oil and gas development, while such development is new to provinces such as Quebec and New Brunswick in the east. Awareness is also relatively high in places like New York State where there is a ban on development. Interestingly, there is some evidence that the terms used influence the level of awareness, with ‘shale gas’ being associated with greater levels of awareness than ‘fracking.’ There was only one repeated survey study in the review and this showed that over a period of a year the level of awareness increased (D18.1, page 15).

Just as there is significant regional variation in the level of awareness, so there is variation in the levels of acceptability. Again, more than half of the work reviewed paid attention to the issue of overall attitudes (D18.1, page 20). In some regions, the results are contradictory with some studies showing strong support and others opposition, Michigan is such a case. On average, studies of the Marcellus in Pennsylvania showed support for development. The majority of research on New York State showed opposition, as did the one study of California. In Canada, as noted above there was opposition in Quebec and New Brunswick. Clearly, the findings reflect where studies have been conducted, and not necessarily where shale gas development is most significant; it is interesting to note the lack of research on acceptability in places like Texas. Studies at a national scale had different findings as they revealed that while there was, on average, slightly more support than opposition, they tended to find that a majority of survey respondents were undecided. There was also some evidence of opposition growing over time, presumably as proportionally more who were previously undecided joined the ranks of the opposition.

2.1.2 Europe

The shale gas industry in Europe is far less advanced than in North America and in reality is only at the very earliest stages of exploration, with many European countries actually placing a ban or moratorium on development. Of the EU member states, Poland is the most advanced with over 100 exploratory wells drilled, but, so far at least, with disappointing results. The UK has a number of petroleum exploration and development licenses (PEDL) active, but progress has been very slow. The UK Government supports the development of shale gas, but there is an effective opposition and the result is a



highly polarized debate. In Germany the focus has been on tight gas, that uses the same technologies, and at present there is no shale gas development to speak of. Likewise, in the Netherlands, which, like the UK, has a significant conventional gas industry, there is a moratorium placed on commercial shale gas activity until 2020. However, in the UK case almost all conventional production is offshore, while in the Netherlands there is a significant amount of conventional production onshore. This means that the national contexts are quite different. Nonetheless, in both cases public awareness and attitudes towards shale gas are shaped by a debate around whether or not there should be development, rather than direct experience of commercial development. In such a context, where people get their information from and how they formulate their opinions is particularly important and this is discussed in detail later in this report (2.3).

The evidence from a review of surveys and opinion polls in the four case study countries shows a complex and shifting situation in relation to public awareness and attitudes. In Poland, the first survey was conducted in 2011 and showed a high level of public support with 73% in favour, 4% against and 23% with no opinion. The most recent surveys of public opinion were conducted in 2013. One survey was limited to the northwest Poland and the Lubelski region, which are some of the most prospective regions for shale gas development. This survey revealed a very high level of awareness (92%) and a high level of support (72%), but a relatively low level of knowledge (only 57% said that they knew what shale gas technology was). A second study revealed that more than half (58%) thought shale gas development was safe and one third (29%) thought it was not safe. However, one third of respondents wanted more information. This limited, and now rather dated, set of surveys suggests a high level of awareness and support, but based on a limited understanding of the issues. The Flash Eurobarometer 420 (2015, pages 6-7) survey carried out in June 2015 included two regions in Poland—Lubelski and Pomorski—and the results suggest the highest level of awareness (82% and 80% respectively) and highest level of knowledge compared to the other 10 regions considered across the EU. In fact, in most aspects of the survey the two Polish regions were the outliers, suggesting that a rather different situation prevails in Poland.

In the UK, despite the low level of actual activity, there have been a large number of surveys and opinion polls. Many of the opinion polls are one-off surveys that are usually part of a larger polling exercise conducted by the media. However, there are two cross-sectional surveys³ that provide insights into changing levels of awareness and attitudes: the first is the so-called WAVES Public Opinion Tracker⁴ conducted by the Department of Energy and Climate Change; the second is a series of opinion polls conducted by YouGov⁵ on behalf of researchers at the University of Nottingham. The

³ In the case of the Nottingham survey the same questions are asked of different respondents over-time, in the case the the DECC survey the questions have varied between surveys.

⁴ For details on the DECC WAVES opinion tracker visit:

<https://www.gov.uk/government/collections/public-attitudes-tracking-survey>. Accessed 21 January 2016.

⁵ For information on YouGov visit: <https://yougov.co.uk/?stay>. Accessed 21 January 2016. You can search this site for the results of their last shale gas-related surveys.



latest WAVE survey published in December 2015⁶ showed a high level of awareness with 12% knowing a lot about shale gas, 42% knowing a little and 21% were aware of the issue, but did not know a lot about it (a total of 75% were aware). Interestingly, there was a higher level awareness in rural areas (81%). Overall, 43% neither supported nor opposed shale gas extraction, 23% supported it and 30% opposed it. The Flash Eurobarometer 420 survey included Lancashire in its sample and showed a high level of awareness (80%), but less than half of the respondents felt that they were well informed. There are also examples of experimental surveys examining public attitudes towards shale gas development, and other energy technologies (Whitmarsh et al. 2015) as well as qualitative deliberative work (Williams et al. 2015). We can make a number of generalisations based on this relatively rich set of data. First, that the general level of awareness in the UK has increased since around 2012 when the surveys started. Second, that there are still a large number of respondents that are undecided as to whether or not shale gas should be developed in the UK. Third, that over time as the numbers of undecided have declined the relative level of opposition to development has increased. However, the number that either support it or are undecided is still significantly higher than the number that oppose development. Fourth, that shale gas is considered far less attractive than other energy technologies, including new nuclear and renewables. Fifth, that women seem more opposed to shale gas than men. Sixth, although the evidence is somewhat mixed, younger respondents tend to be more opposed than older respondents. Finally, it is clear that the level of opposition is much greater in regions where there is the potential for shale gas development. Overall, we can conclude that there is a growing level of opposition amongst an increasingly aware population, but that does not mean that they are well informed about the detailed issues (the detail to support these conclusions can be found in D17.1 pages 12-16).

The first opinion poll in Germany was conducted in February 2013, the first question asked whether you have heard about shale gas and half (49%) said yes and half (51%) said no. The second question asked whether or not shale gas should be strictly regulated and 79% favoured strict regulation. A second survey in 2013 asked whether fracking should be allowed in Germany and the vast majority (66%) said no, one quarter (23%) said yes and only 10% were undecided. Also in 2013, a YouGov poll showed that almost half of respondents (49%) thought a moratorium was a good thing and a quarter (26%) thought it should be banned in the future. In this survey about half (48%) said they knew what fracking was. More recent surveys conducted in 2015 showed high levels of opposition, with a relatively low level undecided and limited approval (around the 20% level). There were no German regions in the Flash Eurobarometer 420 survey. However, in Germany we can conclude that there is a reasonable level of awareness and understanding and a high level of opposition and this probably reflects the strong position of the environmental movement in German society.

⁶https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/474170/Wave_15_Summary_of_Key_Findings.pdf. Accessed 21 January 2016



The evidence in the Netherlands is limited, contradictory and restricted to surveys conducted in 2013. One survey showed that two-thirds had no opposition to test drilling and the majority (64%) thought that shale gas development should take place in the Netherlands. However, another poll suggested that 44% were against fracking and only 35% in favour. An opinion poll commissioned by the Ministry of Economic Affairs showed that 80% of the public were against shale gas development; but a gas industry association survey found 81% in favour exploratory drilling, though the same survey showed 65% against shale gas extraction. Given the problems that have been experienced with conventional gas production in the Netherlands in recent years, it seems unlikely that public support for shale gas development has increased, but the lack of recent survey data is a problem.

Two surveys (2012 and 2015) conducted by Eurobarometer and a public consultation (between 20 December 2012 and 23 March 2013) provide insights into attitudes across the EU and amongst various stakeholders (see D18.1, pages 57-62). The Eurobarometer 2012 survey revealed that 74% of respondents would be concerned if there were to be a shale gas project located in their neighbourhood and of that 40% would be very concerned. But this is not surprising as national surveys show the same high level of opposition at the local scale. The survey showed high levels of support for harmonised and consistent approaches to regulation across the EU. Interestingly, respondents in EU15 showed higher levels of concerns than those in NMS12 (New Members States 12). There were very high levels of concern in France (89%), Germany (82%), Ireland, Luxembourg (both 81%) and Austria (80%). Overall, Poland was the only member state where less than half would be concerned if a shale gas project was to be located in their neighbourhood. The public consultation by the European Commission also showed that a majority of respondents (over 50%) felt that unconventional fossil fuels should not be developed in Europe (more detailed results can be found at D18.1, page 59-60). The Flash Eurobarometer 420 survey discussed earlier focused on 12 regions, in 6 EU member states where shale gas projects have been permitted or may be planned. The results show substantial regional variations in the level of awareness even though these are areas where development might take place. Respondents were asked whether the EU should consider banning hydraulic fracturing. The results were divided by gender and in all cases there was slightly higher support for a ban by women rather than men, but in four of the six around a quarter of respondents were in favour of a ban, the level was highest in Spain (42%) and lowest in Poland (6%).

The Eurobarometer surveys either ask about development in the respondent's neighbourhood or targeted regions where there may be development, and they revealed a higher level of concern or opposition from those that targeted the general population and asked about support or opposition to development. In general, we can conclude that the level of awareness and the level of opposition/concern is greatest in areas of potential development, but it does not necessarily follow that they are any better informed than the wider population.



2.1.3 Lessons from other large scale energy technologies

What can we learn from other large scale energy technologies in relation to levels of awareness and acceptance and how they might change over time? The report raises the problem of ‘pseudo opinions’ which arises from a situation where you ask people their opinion of a technology which they know little or nothing about (D19.1, page 5). This would seem highly relevant to the issue of shale gas where respondents may have a high level of opposition (or in the Polish case support) and then confess to not knowing much about the issues. This limitation is particularly true for opinion poll surveys and while there are other informed choice approaches that can obtain more informed opinions, they are time consuming and resource intensive. Nonetheless, people do appear to hold strong feelings about shale gas, whether informed or not, and it would be wrong for those seeking to promote shale gas development to reject public opinions because they do not consider the public sufficiently informed. Equally, evidence from other forms of energy development suggests that improving the level of awareness and knowledge will not necessarily result in a significant change in attitudes. Evidence from nuclear power suggests that attitudes tend to be stable overtime and are only changed by significant events. Even then, the response that follows can be very different. For example, after the Fukushima disaster, there was strong and continuing support for an early phase out of nuclear power in Germany, versus a general acceptance in the UK that the construction of a new fleet of nuclear power stations is a necessary evil given the problem of climate change and a lack of alternatives. Certainly, in the UK the nuclear industry has been much more successful at gaining support for the construction of new power stations than the shale gas industry has been at gaining public acceptance.

The lesson here would seem to be that although there is currently significant opposition to shale gas, it would be wrong to assume that providing more information will significantly change attitudes. However, in some cases—particularly the UK—there is a large share of the population that remain undecided and it is important to assess the basis upon which they might form an opinion for or against development.

2.2 Risks and Benefits

Here we must be cognizant of the very different contexts in North America and Europe. One of the most significant differences between the USA, on the one hand, and Canada and Europe, on the other, is the distribution of sub-soil rights. In the US, the sub-soil rights are largely privately owned (except on Federal Lands) and thus the mineral owner stands to benefit financially from any development. In Canada and in Europe the rights are usually in the hands of the state and there is a perceived need to provide a mechanism so that the community or region that is subject to development derives some financial benefit. At the same time, in all instances, there will differences in the level of taxation and the re-distribution of revenues streams from shale gas development. The detail of the different fiscal regimes is not the subject of SP4, nor are variations in regulation; but these differences are important in explaining variations in risk/benefit perceptions (and warrant further research).



2.2.1 North America

The report has a significant section (D18.1, pages 16-19) on risk and benefit perceptions and the findings are summarized here. A starting proposition is that perceived benefits tend to be economic, while perceived risks tend to be environmental. Job creation is the most significant perceived economic benefit along with a boost to the local economy and individual prosperity. Thus, there is a perceived material benefit from shale gas development both to the individual and the community. However, other research suggests that these benefits are spread unevenly within communities and that the number of local jobs created is actually small. Furthermore, it is local expenditure related to shale gas activities (consumption of goods and services) and the consumption funded by shale gas income that generates a positive local economic impact. The research also suggests that greater exposure to shale gas development results in a higher level of perceived economic benefits and support for development. However, there is a significant body of research that challenges the claims of economic benefits associated with development, but that lies outside the remit of the current review. Whatever the case, clearly, these benefits are now being challenged by the downturn in the industry and the significant reduction in drilling activity and it will be important to capture the findings of new research in this area.

The environmental risks tend to be associated with contamination rather than levels of resource usage. This is followed by concerns about more general impacts on the landscape and on wildlife. Interestingly, climate change and issues of methane emissions do not seem to be widespread concerns, although more environmentally-conscious individuals are likely to be concerned about this. Social risks such as those related with increased traffic—road safety and the condition of the roads—and noise and light pollution are also significant. Thus, the potential risks and benefits are perceived to be highly localized and focused on material benefits versus environmental risks. Given the private ownership of sub-soil rights this means that a significant amount of the benefit is concentrated in private hands—though there is an uplift of the local tax base—while the risks are faced by all in the community, many of whom are not benefitting materially and whose livelihood might be threatened by shale gas activity. Thus, shale gas development seems to reinforce existing inequities and creates new sources of inequality, although in the case of New Brunswick opposition to shale gas development promoted community cohesion. On reflection, it also seems the case that the perception of risks and benefits in the USA is highly parochial and does not link to wider debates around issues such as climate change and energy security; this is in marked comparison to the situation in Europe.

2.2.2 Europe

Because the context in Europe is very different from North America, with very limited levels of exploration activity and a total absence of commercial activity, we can only assess potential risks and benefits and often this assessment is based on an understanding of the North American experience. However, as this often results in a negative assessment, proponents of shale gas development point out that the regulatory situation is very different in Europe. The structure of the report (D18.1) does not allow



for a straightforward reading of how risks and benefits are assessed in the four country case studies, but a careful reading of the report does reveal some interesting differences and many similarities.

Given the high level of support for shale gas in Poland it is no surprise that the public do not perceive it as particularly risky, in fact it is seen as environmentally safer than coal and oil. There are localised concerns about environmental issues such as water pollution and seismicity. There is also limited support for the idea that shale gas development will promote economic development or lower energy costs. The overwhelming perceived positive benefit is that shale gas will improve Poland's energy security by reducing reliance on imported (Russian) gas by providing a new source of indigenous energy.

A reading of the shale gas debate in the UK, and the literature produced by the government and industry, on the one hand, and the local protest groups environmental organisations, on the other hand (see D17.1, pages 27-34), suggests that those that promote development tend to stress the energy security and economic impacts and see shale gas development as consistent with climate change policies. Those that oppose it focus on the negative local environmental impacts and inconsistencies with national climate change policies (see: Bomberg 2015, Bradshaw 2016). The national government maintains that the risks associated with shale gas can be managed effectively and that development will only take place if it is safe to do so. The results of the opinion polls and surveys discussed above reveal continued public concern about water contamination and water usage, methane leakage (so-called fugitive emissions), and the impacts of operations in terms of increased traffic, congestion, noise and disturbance. There are also concerns about the overall negative impact on the landscape and possible negative impacts on public health, existing businesses and property values. These concerns are influencing local planning decisions that have, so far at least, declined to give developers planning permission for hydraulic fracturing. The Nottingham surveys suggest that induced seismicity is no longer a major concern, perhaps since measures have been introduced to mitigate the risk. But also because there has been very limited drilling activity with no high volume hydraulic fracturing. There is also strong sense that the government should not be supporting the development of a new fossil fuel given its commitment to climate change and emissions reduction. However, the Flash Eurobarometer 420 (2015, page 10) review suggested that Lancashire was third after the two Polish regions in terms of their relative optimism about new opportunities created by shale gas development, 21% total agreed that there would be new opportunities and 32% tended to agree, but nearly half disagreed to some extent. The more detailed questions on opportunities show that local employment is the most important factor, followed by a domestic source of energy and revenues for the local community. In sum, the major concerns relate to local negative environmental, social and economic impacts and compatibility with national climate change targets and there seems to be ambivalence as to the perceived benefits proposed by the Government and the Industry

In Germany the surveys show an overwhelming concern about the potential negative environmental impacts and the high level of opposition—over 500,000 citizens have



signed a petition calling for a complete ban on hydraulic fracturing in Germany. This probably also explains the relative absence of perceived benefits. Among the potential negative environmental impacts, water pollution seems to attract the greatest attention, possibly because it is the focus of environmental campaigns and other stakeholders such as the brewing industry. The coalition Government has stopped short of a ban, but is clearly concerned about the opposition on environmental grounds and has outlawed development in particularly environmentally sensitive areas (D17.1, page 41).

The situation in the Netherlands is complicated by the problems of seismicity associated with conventional gas production and by the relative lack of survey research and their contradictory results. The main reasons favouring development included decreased energy prices, economic competitiveness and a reduction in import dependence. The opposition to shale gas, led by NGOs and citizen's associations and largely at a local and regional scale (D17.1, page 44) is based on concerns about human health and the environment, especially pollution of air, soil and water and damage to the landscape. In 2015 the Dutch Government imposed ban on commercial drilling until 2020 and plans further research and risk assessment.

Overall, the evidence would seem to suggest that the profile of risks in North America and Europe is broadly similar with an emphasis on water pollution and other localised negative impacts related to traffic and congestion and noise and light pollution. There is also a common concern about the wider landscape impacts and a sense of place attachment whereby shale gas development is not seen as compatible with the existing locale (place and community). Where things differ is that in the European case there seems to be concern for wider issues such as compatibility with climate change policies. Equally, the issue of energy security has greater traction in the Europe due to on-going concerns about dependence on gas imports—particularly from Russia—and falling indigenous production. The profile of benefits is somewhat different as well with a strong focus on local economic benefits in the USA and much greater attention to energy security benefits (particularly in Poland) in Europe. This is not surprising given the difference in property rights and the fact that there is no commercial development at present in Europe.

2.3 Trust and Information

The review of the situation in both North America and Europe suggests that where people get their information (or who is providing it through communication activities) and whom they trust is very important in the way that they assess potential risks and benefits and reach a judgement for or against development.

2.3.1 North America

The research suggests that even in areas subject to development, the population has a relatively low level of knowledge and often attitudes are shaped without an in-depth understanding of the issues. Multiple authors contend that the mass media and particularly newspapers are the most important information on the topic of shale



operations (D18.1, page 16). Certainly national titles such as the *New York Times* have covered the issue in detail, but because these are mainly small rural communities it is more likely that local papers are the most important source of information. Additional key sources of information are: industry and conservation/environmental groups, landowner coalitions, and peers via word of mouth.

When it comes to trust and decision making in relation to shale gas development, the literature suggests that there is concern about a lack of agency and control over development. There are also concerns about a lack of transparency around decision making and the distribution of benefits. There seems to be a particular issue of a lack of local control over developments. Landowner coalitions are seen as one way that local communities can counter the power of industry actors. Activism seems to be related to getting a better deal at the local level and protecting their 'way of life.' As noted above in relation to risks and benefits, there are important distributional issues here and around half of the papers reviewed paid some attention to ethical issues around the degree to which wealth, social costs, and changes in the quality of life are distributed (D18.1, page 25).

When it comes to trust, the dominant theme emerging in relation to public perceptions of stakeholders is (mis)trust of industry, government, scientists and environmental groups. This is seen as important when assessing risk as it suggests that the public does not trust governing bodies to protect their interests and manage negative local impacts. The literature suggests that mistrust of the gas industry is common and results from various factors including: perceived fairness, lack of information and heavy-handed corporate tactics. The availability of information and a lack of transparency about operations seems to be particularly problematic. This situation is compounded by the fact that some studies suggest a lack of trust in government, largely because they are perceived to be too closely aligned with the interests of the industry; after all the state benefits from the tax income generated by shale gas development. However, in Pennsylvania and Michigan there is strong support for maintaining legislative control at the state level, rather than the federal or local level (in the Flash Eurobarometer 420 survey opinion is divided on the role that the EU should play in relation to shale gas regulation). One group that seems to be trusted more than most is scientists and experts, although there is some concern about the role of industry in funding research. The industry would probably counter that it is concerned about the role of environmental foundations in funding scientific research. The key issue would seem to be the need for independent research. While they may be trusted, there is research to suggest that the views of experts are unlikely to change attitudes once formed. The attitude to environmental groups is mixed and some research suggests that there is equal doubt about the media. Thus, one can conclude that while current attitudes are based on limited knowledge, the public seems to mistrust the key stakeholders and are concerned about a lack of transparency and availability of reliable information. This situation leads to polarization and entrenchment into people's own positions. People who oppose shale gas development will have enhanced concerns and people who support development will become more likely to dismiss concerns.



2.3.2 Europe

Despite the fact that there is no commercial industry in Europe there is no shortage of information on the shale gas industry. The European Commission, through the JRC, has published a number of studies;⁷ national governments are also active in conducting reviews and publishing reports and both the nascent industry and established environmental groups have been active. In addition, there has been significant media coverage of the issues. In fact, one could argue that there is a disproportionate amount of information and level of coverage given the limited amount of industry activity.

The report on Europe focuses explicitly on the communication activities of the various stakeholders in the case study countries, but only touches on the issue of trust via the review of the surveys and limited experimental research. In Poland the state oil company PGNiG and the Ministry of Environment have engaged with regions where drilling activity has been taking place. There has also been some NGO activity, but there seems to be a lack of local interest in engaging in the issues. This may be because the local populations are not used to being asked what they think. However, the lack of research at the local level makes it difficult to reach any firm conclusions. It would be surprising if there were not local concerns about trust and the nature of decision making, but the strong level of national support (including a positive media portrayal) and the lack of commercial success may also explain the situation at present.

In the UK, by contrast, there has been a huge amount of information generated and the issue of potential shale gas development has become particularly contentious in places such as Sussex and Lancashire where planning applications to carry out exploration have been refused. The key agencies involved in the decision process: the Department of Energy and Climate Change, the Environment Agency and the British Geological Survey have all been active in disseminating information and engaging with local communities. The industry organization, the UK onshore oil and gas industry (UKOOG) has also been very active promoting the benefits of shale gas development (D17.1, pages 51-52). On the other side of the argument, a wide range of environmental NGOs and citizen's associations have been active producing information and lobbying against development at both a national and local scale (D17.1, pages 28-30).

Unfortunately, at present, there is a limited amount of published research that can tell us about public attitudes to these various stakeholders. What exists seems to suggest some similarities with the situation in the US, with the important distinction that while there is a mistrust of the position of the national government, there is support for the role of local government in deciding on planning permission. The events surrounding the planning decisions in Lancashire in July 2015 have yet to be subjected to academic analysis, but the media coverage at the time suggests that a vocal local opposition—supported by national NGOs such as Friends of the Earth—was able to influence the outcome. There was a strong sense of place attachment that shale gas development is not compatible with the existing landscape and community, but such notions don't

⁷ For information on JRC publications in relation to shale gas visit: <https://ec.europa.eu/jrc/en/news/jrc-support-commissions-recommendation-shale-gas>. Accessed 27 January 2016.



easily sit with existing planning rules. The initial decisions have gone to appeal and the final outcome will be decided by central government, which will undoubtedly raise concerns about a local democratic deficit.

The deliberative research that has been conducted has not focused on areas of potential development, but the results do suggest a mistrust of national government and industry, while scientific researchers are seen as a possible source of independent information. However, there is one NGO sponsored study that suggests that many in the scientific community are on the side of Government and Industry in promoting development. There has been analysis of the role of the media, but this is not considered in the report. Overall, we can conclude that in the UK there is now a polarized debate with key stakeholders on both sides of the argument generating information and conducting activities to support their position, however, the results of the surveys discussed above suggest that the public is undecided and feels uninformed. More research is required in areas of potential development to gain a better understanding of how public attitudes are determined.

In both Germany and the Netherlands there is a very limited evidence base on which to draw any hard conclusions. However, in Germany the case against shale gas has been championed by a very effective environmental movement and the Government does not seem to be interested in pushing the case (D7.1, pages 35-39). In the Netherlands there seems to be some friction between central and local government over the issue, but the moratorium on commercial development means that there are no communities having to face potential development and the focus of concern is conventional gas production.

The Flash Eurobarometer 420 study does suggest concerns about the nature of the decision making process around shale gas development. The study concludes that: “In most regions, respondents are divided over whether they feel they can express their views effectively before decisions are made on these projects.” As noted earlier, there is also evidence from the report that less than half of people in these regions felt sufficiently informed.

2.3.3 Lessons from other large scale energy technologies

The body of evidence suggests that the role of knowledge in shaping public opinions on energy technologies is limited and it is perception that plays a much more important role. Consequently, the fact that there is a perceived lack of information from trusted sources may not be important in shaping public attitudes as they may be based more on emotion and/or a ‘gut feeling’ that shale gas development is not a good thing to do and that the risks outweigh the benefits. As noted earlier, this means that providing more information is not likely to sway negative attitudes once established. However, much of the public is still undecided and the literature does suggest that it is important that the source of information/communication is trusted by the community. The evidence with regard to stakeholder engagement and communication suggests that researchers and NGOs are trusted most as sources of information, while energy companies and government face low levels of trust. This would seem to be true of the current situation



in the UK. Trust in actors to achieve a fair outcome also seems to be important, as does the related issue of procedural fairness. The problems in the USA seem to reflect both a mistrust of the key actors and the unfairness of the outcome at the local level. More generally, a situation where the public mistrusts the motives of government and the industry, and feel that they lack reliable information and are concerned about a lack of transparency over decision making, is not going to result in a positive attitude towards shale gas development. Subsequent reports from SP4 will consider best practice in improving public engagement, but the first round of reports suggests that where there is already substantial opposition it will be very difficult for those promoting development to change attitudes.



3 CONCLUSIONS

This section draws together the policy implications of the three reports and this integrated review and identifies areas for future work. The emphasis is on the implications for policy formulation in the EU.

First, it is clear that public awareness is growing about the issue of shale gas development in the EU member states. This is not surprising given the level of media coverage in many states, as well as environmental activism.

Second, the review of the European data suggests that there is also a growing level of opposition (with the notable exception of Poland).

Third, in many cases a significant share of the public remain undecided. In fact, in many cases those in favour and those undecided outweigh those that are clearly opposed. This means that shale gas remains a divisive issue and the focus of ongoing debate.

Fourth, there appears to be a lack of trust of key stakeholders, particularly government and industry and a concern about a lack of transparency and the availability of independent information. There is some ambiguity over the role of environmental NGOs, but scientists and institutes are seen to be relatively impartial and trustworthy.

Fifth, national and local context matters a great deal in shaping public opinion; particularly in those regions where there is the possibility of development. This also means that there is often a difference between the nature of public attitudes as revealed by national surveys and studies conducted in the potential shale gas regions. At the regional/local level there is a much higher level of opposition and concern about the negative impacts on environment and society. This is often because of a strong sense of place attachment and a view that shale gas development is not compatible with the existing landscape and community.

Sixth, evidence from research on other large scale energy technologies suggests that it is not unusual for the public to form attitudes based on emotion, rather than an objective analysis of impartial information, and often this is simply a feeling that something is right or wrong. Furthermore, once those opinions are formed, supplying further information or correcting inaccuracies is unlikely to change attitudes.

To sum all this up, the key policy insight is that it would be wrong to think that all that the government and industry needs to do is provide the public with the ‘right’ information and they will understand that shale gas development can be carried out with manageable levels of environmental and socio-economic impacts. Even if those who have decided to oppose development were to trust these sources of information it is unlikely that they would change their minds. However, in situations where the public is still largely undecided it is important to understand what information they require to



make a more informed decision (this does not infer any judgment on the likely outcome).

In terms of the on-going research agenda, there are four areas of activity that lead from this report (note that we do not have funding to conduct primary research).

First, already there are important lessons that can be learnt about best practice from the North American experience, but there is a need to continue to monitor research outputs from North America to gain new insights into changing public attitudes and assessment of the risk/benefit profile as the fortunes of the industry are changing.

Second, things in the EU are also in a state of flux—particularly in the UK and Poland—and there is a need to continue to monitor developments, particularly in relation to changing public attitudes and assessments of the risks and benefits of commercial development at the regional/local scale.

Third, comparative surveys across member states in the EU are instructive, but there is a clear lack of comparative research at the regional/local scale that adopts a more experimental approach to provide insights into the reasoning behind the regional variations in perceptions and attitudes (note that SP4 does not have funding for primary research). Surveys such as the Flash Eurobarometer 420 report tell us what people think, but not why they have those attitudes, how they reach them, and how they might change in the future.

Fourth, the consideration of lessons learned from other large scale energy technologies shows that many of the challenges related to public perceptions of shale gas are not new; thus, there is real value in continuing to place shale gas research and policy making in this comparative perspective.



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