

DIRECTORATE-GENERAL FOR INTERNAL POLICIES
POLICY DEPARTMENT **C**
CITIZENS' RIGHTS AND CONSTITUTIONAL AFFAIRS



Constitutional Affairs	
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**Workshop on shale gas in the
EU: its impact on the
environment and the energy
policy, from the perspective of
petitions received**

NOTES



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PETITIONS

**Workshop on shale gas in the EU:
its impact on the environment and the
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of petitions received**

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Abstract

In the context of the work which the European Parliament has undertaken on this important and controversial subject Petitions Committee organised this workshop to provide a platform for petitioners and experts to compare, contrast and confront their views. Answering to the allegations, questions and demands of different petitioners (from France, Romania, Poland, Bulgaria, United Kingdom and Germany), the experts highlight the important implications of shale gas exploration on the environment and the climate, and at the same time its potential significance in terms of the diversification of energy supply and security. In addition to the petitioners and the members' representatives of the shale gas industry, Member States and European Commission officials have been invited to take the floor.

These documents were requested by the European Parliament's Committee on Petitions.

AUTHORS

Florent Pelsy and Marta Ballesteros, Legal analysis of petitions on shale gas extraction

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Committee on Petitions

PROGRAMME

Workshop on *The exploration and exploitation of shale gas in the European Union and its impact on the environment and the energy policy, from the perspective of petitions received*

Tuesday, 9 October 2012, from 15.00 to 18.30
European Parliament, Brussels,
Room: PHS 5B001

In the context of the work which the European Parliament has undertaken on this important and controversial subject it is the responsibility of the Petitions Committee to allow citizens to have their voices heard and taken into account. Given the important implications of shale gas exploration on the environment and the climate, and at the same time its potential significance in terms of the diversification of energy supply and security this workshop will provide a platform for petitioners and experts to compare, contrast and confront their views. Parliament's rapporteurs from ENVI and ITRE have been invited along with representatives of industry and member state officials.

The workshop will be chaired by Ms. Erminia Mazzoni, Chairman of the Committee on petitions

15.00–15.05 Welcome and opening by Ms. Erminia Mazzoni, Chairman of the Committee on petitions.

** Note: Each of the presentations by the experts will be followed by a question and answer session with Members.*

15.05–15.20 Updated version of the study "**Impacts of shale gas extraction on the environment and on human health**", by *Matthias Altmann, Ludwig-Bölkow-Systemtechnik GmbH*

15.20–15.35 "**Unconventional gas resources- a challenge for the future**" by *Professor Nicolae Anastasiu, Member of Romanian Academy, University of Bucharest*

15.35–15.45 Questions and Answers Session

15.45– 16.00 Presentation of petition received from France (0504/2012) by the petitioner Ms. Danièle Favari. Brief introduction by the Chairman of petitions received from Romania (0444/2012 and 0596/2012).

16.00– 16.15 **Legal analysis of the petitions received from France and Romania** by *Florent Pelsy and Marta Ballesteros, Milieu (Consultancy Company)*

16.15- 16.30 Questions and Answers Session

16.30-16.45 Presentation of petition received from Bulgaria (0886/2011) by the petitioners, Mr. Vesko Dimov and Ms. Dushana Zdravkova. Presentation of one petition received from Poland (0578/2012) by the petitioner, Teresa Wojda. Brief introduction by the Chairman of two other petitions received from Poland (1378/2011 and 0761/2012)

16.45-17.00 **Analysis of the petitions received from Bulgaria and Poland** by *Dr Michael LaBelle, Assistant Professor, Central European University and Mr Stanisław Nagy PhD, Associate Professor of the AGH University of Science and Technology in Krakow, Poland*

17.00-17.10 Questions and Answers Session

17.10-17.20 Presentation of petition received from the United Kingdom (0895/2012) by the petitioner, Mrs. Rosemary Rechter

17.20-17.30 **Analysis of the petition received from the United Kingdom** by *John Broderick, Tyndall Centre for Climate Change Research Manchester*

17.30-17.40 **"Risks and assets of the exploration of shale gas, the case of UK"** *Professor Michael Stephenson, the British Geological Survey, UK*

17.40-17.50 Questions and Answers Session

17.50-18.25 **Response by the stakeholders:** petitioners, representatives of local authorities, European Commission (DG Environment and DG Energy), representatives of industry.

18.25-18.30 Closure of the Workshop by the Chair

Presentation of the experts for the workshop on shale gas extraction and exploitation, 09.10.2012.

1. Ludwig-Bölkow-Systemtechnik GmbH

LBST is an expert consultant for energy and environment, supporting international clients from industry, finance, politics, and non-governmental organisations in strategy, technology, and sustainability.

- **Matthias Altmann**

Matthias Altmann is Senior Consultant at Ludwig-Bölkow-Systemtechnik (LBST) of Munich/Ottobrunn, Germany. He specializes in sustainable energy technologies, energy markets, and transport fuels. He has a long track record in managing comprehensive consulting projects for international clients from industry, politics, and non-governmental organizations in strategy, technology, and sustainability. Since 2008 Matthias has supported the ITRE Committee for Industry, Research and Energy of the European Parliament as an external expert on energy and climate change issues. From 2004 to 2007, he took a leading role in the Secretariat of the European Hydrogen and Fuel Cell Technology Platform.

Matthias Altmann holds a Diploma in Theoretical Physics from University of Dortmund (Germany), a European Diploma in Environmental Sciences from University of Arlon (Belgium) and University of Kaiserslautern (Germany) as well as a Master of Business Administration from Technische Universität München (Germany).

2. Nicolae Anastasiu

Professional activity:

- Department of Mineralogy – University of Bucharest
- Correspondent Member of the Romanian Academy
- Chairman of the Geological Society of Romania (2000-2006)

Scientific activity:

- In the field of granite bodies petrology and feldspar mineralogy (until 1974), the alkaline rocks (1974-1984), the sedimentary rocks petrography and sedimentology, applicative researches in oil and mineral resources in Eastern and Southern Carpathians and Apuseni Mountains, Dobrogea.
- His scientific activity was published in 30 books, 73 scientific articles, 2 monographs, 6 field guides, and 48 geological reports for the Corporate and National Companies, 56 communications at national and international events.

3. Milieu, Brussels

Milieu is an independent multi-disciplinary consultancy based in Brussels. Although its core competence originated in the area of environmental protection, over the last two decades it has grown and expanded its competences and skills to cover a range of other policy areas, including public health, worker health and safety, labour relations, fundamental rights, cohesion policy, and consumer protection.

- **Marta Ballesteros**

As Principal Legal and Policy Advisor for Milieu, Marta Ballesteros' key responsibilities include supporting public sector clients to develop more effective policies as well as legal

and regulatory frameworks in different areas of EU law including environmental protection, climate change, sustainable development, fundamental rights, citizens' rights, and the development of civil society and related fields.

Mrs Ballesteros has more than 20 years' experience of European law. Before joining Milieu she worked at ClientEarth where she was responsible for ensuring the proper establishment and management of the Brussels office. As a senior lawyer there working on the climate and energy programme she provided legal advice and analysis on issues related to the Emissions Trading Scheme, state aid for energy, legal options for EU emission reduction and decarbonisation objectives. She was also responsible for the development of the programme on EU law institutional issues regarding enforcement of EU environmental legislation, legislative procedures, including comitology, and the analysis of the Lisbon Treaty. Additionally, based on her previous experience, she initiated the development of ClientEarth's biodiversity programme.

Prior to that she was in charge of Eurosite's establishment and representation in Brussels and as EU Policy Coordinator she initiated and led a policy group to develop a strategy to be jointly implemented through policy positions and co-ordinated advocacy actions at national and EU level.

As Deputy Director / Programme Director at World Wildlife Fund (WWF) European Policy Office she was responsible for the direction of policy programmes on biodiversity, structural funds, agriculture and rural development, trade and environment, development aid, and European neighbourhood policy. At WWF, she also initiated the establishment of its European Biodiversity Policy programme leading an active team with representatives of all European national organisations monitoring the implementation of EU nature laws and international conventions. Her entrepreneurial approach helped her advise the network on how to get EU funding for European projects.

- **Florent Pelsy**

He holds two degrees in law, in France (*Maîtrise*- Paris I- Panthéon-Sorbonne) and in Spain (*Licenciatura*- Universidad Complutense Madrid) and an LLM in environmental law from the School of Oriental and African Studies in London. He is also titular of the Distance Learning Course Diploma in international environmental law of the United Nation Institute for Training and Research.

Mr Pelsy joined Milieu in February 2009 after completing a six-month traineeship at the European Commission within the Unit in charge of the regulation of renewable energy where he had the opportunity to follow up the negotiations of the Directive on the promotion of renewable energy sources.

Working for Milieu, he has gained in-depth knowledge of EU environmental law and policies. He has experience in the development of policy options, transposition of EU legislation in Member States, their implementation and enforcement. At Milieu he has been involved in several studies for EU institutions in the field of chemicals (e.g. scope of REACH, regulation of nanomaterials, biocidal products), waste (e.g. ship-dismantling, review of EU waste legislation), energy and industrial activities (e.g. regulation of shale gas, classified installations), water (e.g. review of the EU water legislation), and environmental governance (e.g. science and policy interface, environmental foresight studies).

He has published two papers in the Law Environment and Development Journal, on the European Commission 2008 Directive Proposal on Biofuels and on the Blue Lady case and the international issue of ship-dismantling.

4. Central European University, Budapest

Central European University is a graduate institution in the social sciences, the humanities, law and management. It is accredited in both the United States and Hungary, and offers English-language Master's and doctoral programs. Located in Budapest, Hungary, CEU has developed a distinct academic and intellectual focus, combining the comparative study of the region's historical, cultural, and social diversity with a global perspective on good governance, sustainable development and social transformation.

The Department of Environmental Sciences and Policy is a center of excellence in research on environmental policy and management. Both general academic and specialized knowledge in a variety of related fields are offered. Emphasis is on an interdisciplinary approach to solving environmental problems; leading environmental academics from around the world contribute to both the taught curriculum and fieldwork. Focus is on international or trans-boundary problems in sustainable environmental development. The department also serves as a focal point in a network of collaborating scientists and environmental professionals from developed and developing countries worldwide.

- **Michael LaBelle**

He is an assistant professor at the Central European University Business School and in the Department of Environmental Sciences and Policy. He teaches courses on sustainability and innovation in business and energy policy. He conducts research on how institutions and organizations foster change to contribute to a low carbon future. Currently his research concentrates on international regulatory networks and the shale gas revolution. Previous work assessed the efforts of institutions in the European Union to encourage the use of new low or zero carbon technologies in the energy sector, including energy efficiency measures. Much of his research involves issues of risk governance, with special attention paid to the sunk cost of energy investments. In addition, he has written peer reviewed articles and consulting publications on the strategic movement of energy firms and the regulatory environment in the Central Eastern European region.

Dr. LaBelle is a member of the Atlantic Council's Emerging Leaders in Environmental and Energy Policy Network. Previously, he worked in the CEU Center for Climate Change and Sustainable Energy Policy (3CSEP) and at the Regional Center for Energy Policy Research (REKK) at Corvinus University. He has worked on projects for the European Commission, United States Agency for International Development, the National Association of Regulatory Utility Commissioners, the Energy Regulators Regional Association and with energy consulting companies and European universities. He holds an MSc and PhD in Geographical Sciences from the University of Bristol.

5. Stanislaw Nagy

Associate Professor of the AGH University of Science and Technology in Krakow. Currently he is the Dean of the Faculty of Drilling, Oil and Gas as also the Head of the Department of Gas Engineering. His research career began in 1984 with the completion of a degree in Mining and Geology at AGH University. In 1988 he was awarded the PhD degree in the subject of mining and geological engineering, specializing in Natural Gas Engineering. His doctoral dissertation is titled "[Capillary adsorption effects in gas-condensate in tight rocks.](#)" In 2004 he received his habilitation dissertation for his work entitled "[Capillary adsorption effects in gas-condensate in tight rocks.](#)" Since 1995 he has been involved in coordinating the implementation of several international projects.

In 2003 he was appointed as the head of postgraduate studies, "Management and marketing oil and gas industry." His main areas of research activity are: ground gas

industry; hydrocarbon thermodynamics; engineering fields: oil, gas and thermal waters, engineering and the environment. He is also the author and co-author of more than 180 publications in the subject of reservoir engineering, thermodynamics and gas industry. He is a member of the Association of Scientific and Technical Engineers Oil and Gas Industry [SITPNiG](#) and Society of Petroleum Engineers of AIME. Stanisław Nagy is expert in a subject of NGS in Poland.

6. Tyndall Manchester

Tyndall Manchester is primarily based in the [School of Mechanical, Aerospace and Civil Engineering](#), but has close affiliations with the [School of Environmental, Atmospheric and Earth Sciences](#), the [Sustainable Consumption Institute](#), and [Manchester Business School](#).

It has a research community that brings together scientists, engineers, social scientists and economists, providing considerable and diverse academic expertise on all aspects of energy and climate change. Tyndall Manchester also undertakes external consultancy projects and offers postgraduate supervision and other opportunities for early career researchers.

Established in 2000 with funding from the UK Research Councils, The [Tyndall Centre for Climate Change Research](#) was founded to undertake interdisciplinary research. Its work covers the whole spectrum of geographical, time and human scales, linking research efforts across disciplines through an integrated approach.

- **John Broderick**

John Broderick has been a researcher in the Manchester group since 2006 specialising in emissions accounting and carbon trading. He has published in academic and policy outlets, including citations by the Parliamentary Office of Science and Technology, and has presented at international conferences and workshops. His role is now dedicated to climate policy and targeted consultancy projects with organisations outside of academia. Recent work undertaken by Tyndall Manchester includes decarbonisation scenarios for the Welsh Assembly Government, analysis of the environmental impacts of shale gas for The Co-operative Group and an appraisal of UK carbon budgets for Friends of the Earth.

He holds a BA in Natural Sciences from Cambridge University, an MSc in environmental management from Newcastle University and a PhD from Manchester Business School.

7. Michael Stephenson

- 2010 Appointed Special Professor at the University of Nottingham
- 2008–current: Head of Energy Science
- 2005–2008: Principal Research Scientist: palynology and stratigraphy
- 1999–2005: Palynologist and stratigrapher
- 1996–1998: PhD University of Sheffield
- 1995–1996: MSc University of Sheffield
- 1986–1995: School teacher in Mahalapye, Botswana
- 1979–1982: BSc Imperial College

Research interests

- Palynology, isotopes, stratigraphy and Earth events
- Energy science and policy
- Carbon capture and storage

Current projects and collaboration

- Stratigraphical and palynology consultancy with Petroleum Development Oman, Saudi Aramco
- The Palaeocene-Eocene Thermal Maximum
- Shale gas and Carboniferous environments
- PhD supervision: Issam Al Barram (PhD) Sheffield University, 2007. Carys Bennett (PhD) Leicester University, current. Irfan Jan (PhD) Leicester University, current. Sven Könitzer (PhD)? Leicester University, current. Rachel Jamieson (PhD) Edinburgh University, current



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CONSTITUTIONAL AFFAIRS

PETITIONS

**Legal analysis of petitions on shale gas
extraction**

NOTE

Abstract

The legal analysis provided in this note aims at answering the questions raised in the petitions on shale gas activities in the EU which are related to certain pieces of EU legislation. It gives an overview of the existing legislation (for instance the EIA or "Water" Directives) while tackling the idea of new EU legislation required such as a legal and regulatory framework at EU and national level to ensure that all individual and cumulative risks associated to unconventional gas extractions through hydraulic fracturing are properly manage. The note analyses as well the possibility, envisaged by the petitioner, of an 'EU prohibition of the exploration and exploitation of shale oil and gas'.

This document was requested by the European Parliament's Committee on Petitions.

AUTHORS

Florent Pelsy and Marta Ballesteros for Milieu

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LIST OF ABBREVIATIONS

- EIA** Environmental Impact Assessment
- EU** European Union
- GHG** Greenhouse gas
- IEA** International Energy Agency
- IED** Industrial Emissions Directive
- TEU** Treaty of the European Union
- TFEU** The Treaty on the Functioning of the EU

EXECUTIVE SUMMARY

Milieu is a consulting company based in Brussels focusing on European law and policy. Our key areas of expertise include environmental, climate and energy legislation at EU level. Milieu has been requested to provide a briefing note on legal aspects of shale gas in relation to the petitions received by the European Parliament Petitions Committee.

There is a strong political interest for the development of the industry and technology related to shale gas extractions as it could contribute to secure Member States energy supply through local production minimising imports from countries outside the EU (e.g. Poland, Lithuania and Romania reliance on Russian gas). On the other hand, the increasing public concerns over the environmental and health impact of the methods of extraction of unconventional gas in all Member States together with the uncertainty of the existence of an appropriate legal framework have lead France, Bulgaria and Czech Republic to impose a moratorium on shale gas extraction using hydraulic fracturing until uncertainties on the legal framework are clarified and cleaner and safer technologies are developed. Similarly a legislative proposal is being debated in Romania.

The legal analysis provided in this note aims at answering the questions raised in the petitions related to certain pieces of EU legislation; they do not raise questions on national legislation. The present note, therefore do not provide an exhaustive overview of all legal elements involved in shale gas exploitation.

The European Commission is in the process of assessing whether the existing EU and national legal framework is appropriate to cover all aspects and impacts related to the prospection, exploration and exploitation of shale gas. It might take the decision to amend existing pieces of legislation or to propose the adoption of new ones. One of the instruments currently being considered is the design of a legal and regulatory framework at EU and national level to ensure that all individual and cumulative risks associated to unconventional gas extractions through hydraulic fracturing are properly managed.

Our analysis identifies legal gaps in some of the areas raised by the petitions as follows:

There is no comprehensive EU mining framework law and the mining aspects of shale gas hydraulic fracturing are not properly dealt with in the existing legislation. Directive 2006/21/EC on mining waste regulates the features related to the construction and maintenance of waste facilities as well as their safety management systems, management plans and internal and external emergency plans. All aspects of hydrocarbons extraction are not dealt with by this legislation. Directive 1994 on authorizations for hydrocarbon extractions does not cover the mining aspects and leaves Member States the possibility to impose conditions in the permits due to environmental protection objectives. However this is not mandatory. A potential option for the Commission's consideration would be to propose a new mining legislative act specifically regulating the exploration and exploitation of shale oil and gas.

At the time of the adoption of the Water Framework Directive 2000/60/EC shale gas activities in Europe were at an infancy stage and it was not considered as an issue to be covered by this Directive. Under the principle of legal certainty, there is justification for requesting a re-assessment of the Water Framework Directive potential to effectively protect water from accidents and regular operations derived from hydraulic fracturing.

The last sentence of Article 11(3)(e) of the Water Framework Directive provides that Member States can exempt from required controls, abstractions or impoundments which

have no significant impact on the ecological and chemical water status. However, it is likely that the impact of shale gas activities would be considered significant and that water abstraction exemptions under Article 11(3)(e) of the Water Framework Directive 2000/60/EC would therefore not apply to shale gas activities.

According to Article 4 of Directive 2011/92/EU (EIA Directive) on the assessment of the effects of certain public and private projects on the environment, projects listed under Annex I must be subject to an environmental impact assessment while for projects listed under Annex II, Member States must determine whether they shall be subject to an environmental assessment through a case-by-case examination or the setting of thresholds or criteria. Shale gas exploration and extraction activities are not explicitly mentioned in Annexes I and II to the EIA Directive 2011/92/EU. The threshold under Annex I of 500 000 cubic metres/day may not cover all shale gas projects as the amount extracted per day might be lower in certain periods than the threshold required. It is also not entirely clear whether Annex II (2)(d) and (e) could be applied to the remaining shale gas projects not falling under Annex I, leaving the decision to request environmental impact assessments to be carried out for shale gas projects.

In light of this legal uncertainty, we consider that a more efficient protection of the environment would require these projects to be expressly listed in Annex I to the EIA Directive and therefore be subject to a compulsory environmental impact assessment without any thresholds.

Additional requirements are needed to regulate greenhouse gas emissions (e.g. methane) from shale gas activities under the EIA and IED Directives or other legislative acts such as the ETS Directive 2003/87/EC.

Directive 2003/35/EC¹ was adopted to amend Directive 85/337/EEC (former EIA Directive) and Directive 2010/75/EU² on industrial emissions (IED Directive) (former Directive 96/61/EC Directive) in order to comply with the 1998 Aarhus Convention provisions on public participation in environmental matters, at Member State level. This Directive requires Member States to adopt public participation obligations during the permitting procedure of projects requiring an environmental impact assessment under the EIA Directive and classified installation projects falling under the IED Directive. However as it is not clear whether all shale gas projects fall within the scope of the EIA Directive and the IED Directive, it is still uncertain that public participation requirements would apply to all shale gas project permitting procedures in Member States.

We therefore consider that the current legal framework does not provide clear provisions requiring a public consultation procedure and generally public participation in the decision making of the permitting process for shale gas extraction projects due to their potential significant effect. Article 11 of the TEU recognises a higher role of citizens in the decision making process of Union's acts on all policy areas.

The EU does not have the competence to ban the exploitation of shale gas through a measure falling within the sphere of Article 194(2) of the TFEU. However, the EU has the competence to impose conditions for shale gas activities on the basis of environmental requirements under Article 192 TFEU which could be adopted by unanimity voting if

¹Directive 2003/35/EC of the European Parliament and of the Council of 26 May 2003 providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment and amending with regard to public participation and access to justice Council Directives 85/337/EEC and 96/61/EC *OJ L 156, 25.6.2003, p. 17–25.*

affecting significantly Member States choice between energy sources. Decisions on the enforcement of the current and future legislation applicable to shale gas activities fall within the European Commission responsibility under Article 17 of the Treaty of the European Union (TEU).

The current scientific debate on the impact of shale gas activities points out to the sensitive of this issue and leads to a similar debate at a policy or political level. This debate includes balancing the economic interest behind shale gas exploitation in relation to energy security and the EU objective for decarbonisation of the energy system link to the EU target to reduce GHG emissions to 80-95% below 1990 levels by 2050. In this situation, the role of renewable energy sources now and in 2050 and the planning of the required investments might be affected by investment decisions in shale gas technology.

1. OVERVIEW OF THE PETITIONS

The petitions covered by this note are related to EU legislation and do not raise questions on national legislation. For that reason, this note and presentation are limited to the EU legal framework and do not refer to the national level. Similarly, the legal overview provided in this note aims at answering the questions raised in the petitions and do not provide an exhaustive list of the legal elements involved in shale gas exploitation. For example, the petitions analysed do not refer to the use of chemicals in fracking and their impact on the environment and human health. For that reason, the current note does not refer to this part of the EU legal framework.

1.1. Justification of the petitions

According to the petitioners the current EU legal framework applying to hydraulic fracturing is inadequate and contains gaps and loopholes:

- There is no complete and detailed analysis of the EU legal framework on shale gas exploitation which would be publicly available.
- A specific directive regulating shale oil and gas mining activities at European level does not exist.
- There are too many exemptions under the EU legislation on water for water abstraction for industrial use whereas water needs are increasing mainly in urban areas while the groundwater recharges are at 50% level.
- Impacts of hydraulic fracturing on the surface water are not taken into account in the Water Framework Directive.
- The Environmental Impact Assessment (EIA) Directive threshold requiring compulsory environmental impact assessment is inadequate for shale oil and gas industrial activities.

The petitioners also stress:

- The lack of initiative of the EU to regulate shale oil and gas activities.
- The fact that the exploration and exploitation of shale oil and gas goes against the

²Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions

energy transition toward a decarbonised society which according to the petitioners is the only viable option to mitigate climate change.

- The depletion of fossil fuel resources and the impact of shale gas exploitation on such process.
- The potential risks from chemical substances (e.g. carcinogens) used in the hydraulic fracturing technology.

1.2. Claims of the petitioners

The Petitioners require the EU to:

- Adopt a new EU legal framework, ie EU mining legislation that would specifically regulate the exploration and exploitation of shale oil and gas.
- Revise exemptions on water abstraction for industrial purposes.
- Revise the scope of the Water Framework Directive that should take into account the hydraulic fracturing activities and their impact on upstream surface water.
- Amend the EIA Directive to set other threshold so that shale oil and gas activities project would be subject to an EIA.
- To adopt not only a moratorium on the exploration and exploitation of shale oil and gas but a legislation prohibiting the exploration and exploitation of shale oil and gas, because of the pollution on groundwater induced by this industrial activity.

2. OVERVIEW OF THE LEGAL FRAMEWORK

KEY FINDINGS

- The European Commission is in the process of assessing whether the existing EU and national legal framework is appropriate to cover all aspects and impacts related to the prospection, exploration and exploitation of shale gas. It might take the decision to amend existing pieces of legislation or propose the adoption of new ones.
- One of the instruments currently being considered is the design of a legal and regulatory framework at EU and national level to ensure that all individual and cumulative risks associated to unconventional gas extractions through hydraulic fracturing are properly managed.
- There is no comprehensive EU mining framework law and the mining aspects of shale gas hydraulic fracturing are not properly dealt with in the existing EU legislation. Directive 2006/21/EC on mining waste regulates the construction and maintenance of waste facilities as well as their safety management systems, management plans and internal and external emergency plans. All aspects of hydrocarbons extraction are not dealt with by this legislation. Directive 1994 on authorizations for hydrocarbon extractions does not cover the mining technical aspects and leaves Member States the possibility to impose conditions in the permits due to environmental protection objectives. However this is not mandatory. A potential option for the Commission's consideration would be to propose a new

mining legislative act specifically regulating the exploration and exploitation of shale oil and gas.

- Additional requirements are needed to regulate greenhouse gas emissions (e.g. methane) from shale gas activities. This could be done through the revision of the EIA and IED Directives (eg. emission limit values) or other legislative acts such as the ETS Directive 2003/87/EC.
- The principle of legal certainty requires amending the Water Framework Directive 2000/60/EC and the EIA Directive 2011/92/EU in order to ensure that shale gas activities and all the aspects derived from shale gas exploitation are properly covered, including public participation in decision making following the Aarhus Convention and the Lisbon Treaty requirements.
- The EU might not have the competence to ban the exploitation of shale gas if it is decided that such a measure would fall within the sphere of the energy policy under Article 194(2) of the TFEU. However, the EU has the competence to impose conditions for shale gas activities due to environmental requirements under Article 192 TFEU. A ban of shale gas activities, even if based on environmental requirements, would most likely be considered an energy measure.

2.1. Regarding the adoption of a new legal framework on shale oil and gas activities.

Since the 80's, the United States has developed a policy to increase exploitation of shale gas while reducing its production costs. The US shale gas revolution has pushed down energy prices. The exploration and exploitation of shale gas as a new energy source has emerged in the European landscape as a potential solution to reduce EU's dependence on gas imports as well as GHG emissions. While the choice of energy mix falls within the national competence, the European Commission has started a process to assess whether the current EU legal framework is applicable and appropriate to cover all aspects related to the prospection, exploration and exploitation of shale gas.

This objective must be achieved taking into account the European Council mandate calling for an assessment of Europe's potential for sustainable extraction and use of conventional and unconventional fossil fuels resources in order to further enhance Europe's security of supply (Council Conclusion of 4 February 2011).

The Commission has already started assessing the EU environmental '*acquis*' in view of its application to unconventional gas practices,³ and has produced a guidance note on the application of Directive 2011/92/EU⁴ (EIA Directive) to projects related to the exploration and exploitation of unconventional hydrocarbons.⁵

One of the possible instruments under scrutiny is the design of a legislative and regulatory framework at EU and national level to ensure that all individual and cumulative risks

³See relevant study available September 2012 at: http://ec.europa.eu/environment/integration/energy/pdf/legal_assessment.pdf

⁴Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment

⁵See relevant study available September 2012 at: http://ec.europa.eu/environment/integration/energy/pdf/guidance_note.pdf

associated to unconventional gas extractions through hydraulic fracturing are properly managed. The report voted on 19 September 2012 by the Environment, Public Health and Food Safety (ENVI) Committee on environmental impacts of shale gas and shale oil extraction activities⁶ requests the Commission to “introduce an EU wide risk management framework for unconventional fossil fuels exploration or extraction”.

The Commission has already started assessing the EU environmental ‘acquis’ in view of its application to unconventional gas practices,⁷ and has produced a guidance note on the application of Directive 2011/92/EU⁸ (EIA Directive) to projects related to the exploration and exploitation of unconventional hydrocarbons.⁹

Furthermore, the Commission is currently in the process of ‘examining the need for a risk management framework for shale gas developments in Europe and, if necessary, the form it might take.’¹⁰ Specifically, in May 2012, the Commission launched two calls for tenders related to shale gas:

- Technical support for assessing the need for a risk management framework for unconventional gas extraction.

According to the Commission: ‘The objective of this service contract is to provide support, especially socio-economic and legal, for the preparation and the development of possible Commission initiatives on managing potential impacts and risks of unconventional gas extraction in Europe’¹¹

- Regulatory provisions governing key aspects of unconventional gas extraction in selected Member States.

The Term of Reference for the study states: ‘The objective of this service contract is to identify and assess environment- and health-related regulatory provisions applicable to unconventional gas in 8 selected EU Member States: Bulgaria, Denmark, Germany, Spain, Lithuania, Poland, Romania and United Kingdom’¹²

The Commission has also recently published three studies on unconventional fossils fuels carried out by external consultants. These studies respectively looked at the potential effects of these fuels on energy markets,¹³ the potential climate impact of shale gas production,¹⁴ and the potential risks shale gas developments and associated hydraulic fracturing (‘fracking’) may present to human health and the environment.¹⁵ However, they do not provide a full assessment of the current EU legal framework from an environmental, climate and energy point of view while respecting EU objectives on security of energy supply enshrined in the Lisbon Treaty as well as the commitments for the establishment of a low carbon and resource efficient economy and the development of renewable energy

⁶ Point 7 of ENVI Committee Report on environmental impacts of shale gas and shale oil extraction activities. Rapporteur: MEP B.Sonik adopted by the Committee on 19 September 2012

⁷ See relevant study available September 2012 at: http://ec.europa.eu/environment/integration/energy/pdf/legal_assessment.pdf

⁸ Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment

⁹ See relevant study available September 2012 at: http://ec.europa.eu/environment/integration/energy/pdf/guidance_note.pdf

¹⁰ Information retrieved from the website of the Commission. Available on 13 September 2012 at: http://ec.europa.eu/environment/integration/energy/unconventional_en.htm

¹¹ Ibid.

¹² Ibid.

¹³ Study available at: http://ec.europa.eu/dgs/jrc/downloads/jrc_report_2012_09_unconventional_gas.pdf

¹⁴ Study available at: http://ec.europa.eu/clima/policies/eccp/docs/120815_final_report_en.pdf

¹⁵ Study available at: <http://ec.europa.eu/environment/integration/energy/pdf/fracking%20study.pdf>

sources. One of the studies urges the Commission to consider the "gaps, possible inadequacies and uncertainties identified in the current EU legislative framework".

Conclusion of the Commission in its press release on the result of these three studies:

'A considerable number of questions relating to legislation and regulation have been identified, implying the need for an appropriate framework to enable a sustainable shale gas extraction in Europe. The Commission remains neutral as regards Member States decisions' concerning their energy mix. It will oversee compliance with EU legal requirements, and ensure that an appropriate framework to enable sustainable shale gas extraction is in place. EU policy objectives towards a decarbonised and resource-efficient economy remain a key priority, together with EU commitments towards improving energy efficiency and further developing renewable energy sources. The studies published today will inform on-going work examining the need for a risk management framework for shale gas developments in Europe and, if necessary, the form it might take. Discussions will also be held with the Member States and stakeholders'

Source: Midday Express of 2012-09-07 (MEX/12/0907) available at:
<http://europa.eu/rapid/middayExpressAction.do?date=07/09/2012&guiLanguage=en>

The Commission is therefore in the process of assessing the legislative framework and might decide to amend existing pieces of legislation or propose the adoption of new ones.

Specifically, in relation to the question of **EU legislation on mining**, it is important to acknowledge that there is no comprehensive EU mining framework. The mining law in Member States is originated at national level and falls within national responsibility. There are four Directives mainly covering certain aspects of mining. This legislation entered into force prior to the development of shale gas activities in the EU and would not necessarily cover all required aspects.

Waste from mining activities such as shale gas exploration and exploitation activities is covered by the waste mining Directive 2006/21/EC¹⁶. This Directive applies to waste resulting from the extraction, treatment and storage of mineral resources and the working of quarries. Waste covered by this Directive no longer falls within the scope of Directive 1999/31/EC on the landfill of waste. This particular waste must be managed in specialised facilities in accordance with specific rules. However the requirements for construction and maintenance under this Directive relate to the waste facility and not to the well construction for the shale gas extraction activities. The Directive requires safety management measures and the adoption of internal and external emergency plans but only in relation to the waste facility. Under this Directive, the operator must obtain a permit to be based on the Best Available Technologies. At present, such best available technology rules for the treatment of used fracturing fluid do not exist at EU level. In accordance with the Environmental Liability Directive 2004/35/EC, operators of such facilities are subject to liability in respect of environmental damage caused by their operation.

The mining issues related to well construction and drilling applicable to unconventional gas are not specifically regulated under Directive 1994/22/EC concerning the conditions for

¹⁶ Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries

granting and using authorizations for the prospection, exploration and production of hydrocarbons. This Directive only sets general requirements on the permitting process without specific environmental requirement and therefore does not properly deal with the specificity of shale gas activities. Article 6 enables the competent authorities to introduce conditions on environmental protection objectives and monitor them but without any mandatory character and therefore it is left up to the Member States discretion which do not provide the necessary certainty. This Directive requires the establishment of a financial guarantee for the damages caused through hydrocarbon exploitation activities to be submitted prior to the granting of the exploitation permit.

Under Article 37(5) of the REACH Regulation, downstream users of chemicals, such as companies using hydraulic fracking techniques, shall ensure that the chemicals used are registered for their intended use. They must take risk management measures on substances for which safety data sheets are not required. However, these companies are not obliged to disclose the substances used for fracking.

The Report on industrial, energy and other aspects of shale gas and oil also refers to the requirements for well construction to avoid damages to water supplies through leakage and proposes the *“adoption of best practices in well development and construction, especially casing, cementing, and pressure management, together with pressure testing of cemented casing and state-of-the-art cement bond logs to confirm formation isolation”*¹⁷.

The specificities of shale gas exploitation would require the establishment of quality criteria for well construction and drilling to avoid leakage of chemical substances to the groundwater, monitoring obligations to prevent accidents, communication obligations of accidental leakages, etc. Those measures are not in any of the legislative acts currently under the EU *acquis*.

We can conclude that one potential option for the Commission to consider would be to adopt a new mining legislation specifically regulating the exploration and exploitation of shale oil and gas.

Additional gaps in the EU legislation to properly regulate all risks derived from shale gas and shale oil extraction activities have been identified or need to be further assessed. Current EU measures do not regulate the greenhouse gas emissions (eg. methane) from shale gas activities but these emissions could be covered with few amendments to the relevant EU legislation. For example, the ETS Directive 2003/87/EC does not include these projects in Annex I list of activities. Further clarity on the scientific basis for the climate change impacts of shale gas projects is however needed.

Examples of legislative gaps identified by Milieu in the report on climate change impacts of shale gas¹⁸:

The analysis of EU legislation and a limited number of country studies have shown that the applicability of some EU legal acts e.g. the EIA and the Industrial Emissions Directives, is uncertain and subject to interpretation.

In addition the EU requirements related to Greenhouse gas (GHG) emissions reduction are often worded in a very general manner and do not include shale gas and shale oil

¹⁷ Point 39 of ITRE Committee Report on industrial, energy and other aspects of shale gas and oil.

¹⁸ Ibid footnote 17

extraction activities in the EU legislation itself, or in the national transposing act. In order to adequately regulate GHG emissions from shale gas the following issues could be further investigated:

- the scope of the EIA Directive with regard to shale gas exploration and exploitation activities (Annex I or II);
- information requirements on measures taken by developers to limit GHG emissions under the EIA Directive or possibly other pieces of legislation;
- the need for measures to limit GHG emissions for shale gas exploration and exploitation;
- the scope of the Industrial Emissions Directive with regard to shale gas exploration and exploitation activities;
- the application of the emission limit values requirements under the Industrial Emissions Directive to methane emissions from exploration and exploitation activities.

The report voted of the ENVI Committee on environmental impacts of shale gas and shale oil extraction activities refers to the questions on GHG emissions.

It urges the Commission to “bring forward legislative proposals to make the use of completion combustion devices ‘green completions’ mandatory for all shale gas wells in the EU, to limit flaring to cases where there are concerns about safety and to completely forbid venting of all shale gas wells, in an effort to reduce the fugitive methane emissions and volatile organic compounds linked to shale gas”¹⁹ and calls on Member States “which decide to develop shale gas or other unconventional fossil fuel reserves to send national plans to the Commission detailing how the exploitation of these reserves fits in with their national emission reduction targets under the EU Effort Sharing Decision”²⁰

2.2. Shale gas activities impact on water and Water Framework Directive 2000/60/EC

The Water Framework Directive 2000/60/EC’s ultimate objective is to achieve “good ecological and chemical status” for all EU waters by 2015. In addition, it has other set of objectives such as preventing and reducing pollution, promoting sustainable water usage, environmental protection, improving aquatic ecosystems and mitigating the effects of floods and droughts.

The potential impacts of shale gas activities on the pollution of water courses were not taken into account at the time of the Water Framework Directive 2000/60/EC adoption. The proper enforcement of current provisions as well as the reassessment and review of the Directive are therefore on the table.

In this context, the ENVI Committee Report on environmental impacts of shale gas and

¹⁹ Points 49 of ENVI Committee Report on environmental impacts of shale gas and shale oil extraction activities. Rapporteur: MEP B.Sonik

²⁰ Ibid footnote 19 referring to Point 45

shale oil extraction activities²¹ highlights the Member States obligation "to implement the measures necessary to prevent the deterioration of the status of all bodies of groundwater, including from point sources such as hydrocarbon exploration and extraction". It requests the industry to "take the measures needed to prevent the status of relevant bodies of groundwater from deteriorating, and thereby maintain good groundwater status as defined in the Directive and the Groundwater Directive"²²;

Indeed, the REACH Regulation, requires the registration of chemicals for its intended use by December 2011 (Article 7(7)). If chemicals have not been registered by that date, they cannot be used. However, even if they are registered, their use does not exclude any potential contamination to the water sources, particularly the groundwater.

Furthermore, the Committee demands the Commission to issue "guidance on the establishment of both the baseline water monitoring data necessary for an environmental impact assessment of shale gas exploration and extraction and the criteria to be used for assessing the impacts of hydraulic fracturing on groundwater reservoirs in different geological formations, including potential leakage and cumulative impacts"²³;

The other relevant report voted on 18 September 2012 by the Committee on Industry, Research and Energy on industrial, energy and other aspects of shale gas and oil proposes the adoption of best practices in well development and construction for dealing with damages to water supplies through fracturing liquid leakage.²⁴

- *Derogation for water abstraction authorisation*

Under Article 11(3)(e) of the Water Framework Directive 2000/60/EC Member States must include in their programme of measures for each river basin district 'basic' measures such as: controls over the abstraction of fresh surface water and groundwater and impoundment of fresh surface water, including a register or registers of water abstractions and a requirement of prior authorisation for abstraction and impoundment.

The last sentence of Article 11(3)(e) of the Water Framework Directive 2000/60/EC provides that Member States can exempt from these controls, abstractions or impoundments which have no significant impact on the ecological and chemical water status.

According to the Commission, one shale gas well consumes 1,500 m³ of water during the drilling process and a further 11,000 m³ in the form of fracturing fluids, during the hydraulic fracturing process.²⁵ It can thus be considered that shale gas activities are water intensive and that abstraction impacts are usually significant during the fracturing phase. It is therefore unlikely that the impact of shale gas activities would be considered no significant and that water abstraction exemption under Article 11(3)(e) of the Water Framework Directive 2000/60/EC would therefore apply to shale gas activities.

In answer to one of the petitions, it is worth clarifying that the groundwater Directive

²¹ Point 31 of ENVI Committee Report on environmental impacts of shale gas and shale oil extraction activities. Rapporteur: MEP B.Sonik

²² Ibid Footnote 19 referring to point 32

²³ Ibid, Footnote 19 referring to point 36

²⁴ Point 39 of ITRE Committee Report on industrial, energy and other aspects of shale gas and oil, Rapporteur: N.Tzavela, adopted by the Committee on 18 September 2012

²⁵Note for the attention of Mr Matthias Groote, Chair of the ENVI Committee, European parliament, on the EU environmental legal framework applicable to shale gas projects, Brussels 26.01.2012 91850 available at: http://ec.europa.eu/environment/integration/energy/pdf/legal_assessment.pdf

2006/118/EC does not regulate water abstraction authorisations and derogations. This Directive aims at ensuring the protection of groundwater against pollution from chemicals and complementing the Water Framework Directive 2000/60/EC in limiting inputs of pollutants into groundwater.

- *On the revision of the scope of the Water Framework Directive*

At the time of the adoption of the Water Framework Directive 2000/60/EC shale gas activities in Europe were at an infancy stage and it was not considered as an issue to be covered by this Directive. A reassessment of the Directive in view to cover all aspects of shale gas has been raised by the petitioners.

Article 11(3)(j) of the Water Framework Directive 2000/60/EC provides that Member States *'may also authorise, specifying the conditions for injection of water containing substances resulting from the operations for exploration and extraction of hydrocarbons or mining activities, and injection of water for technical reasons, into geological formations from which hydrocarbons or other substances have been extracted or into geological formations which for natural reasons are permanently unsuitable for other purposes. Such injections shall not contain substances other than those resulting from the above operations.'*

On the basis of this provision, if strictly interpreted, Member States could allow the injection of the flow back water used for fracking into geological formations without treatment or even injecting the fracturing fluids for technical reasons. The Commission, in its note on the EU environmental legal framework applicable to shale gas projects²⁶, considers that this provision should not apply to shale gas activities since this exception clause was adopted for conventional hydrocarbon operations. Furthermore this Water Framework Directive authorisation procedure should not be used for shale gas projects.

Those interpretation issues can however lead to legal uncertainty and demonstrate the need to re-assess the Water Framework Directive 2000/60/EC in light of the new shale gas developments in the EU. Therefore we conclude that under the principle of legal certainty, there is justification for requesting a re-assessment of the Water Framework Directive 2000/60/EC's potential to effectively protect water from accidents and regular operations derived from hydraulic fracturing.

Furthermore, the legislation might also need to govern pollution of water courses through chemicals injected in the ground or the situation when hydraulic fracturing is completed and a mixture of hazardous materials remains in the ground.

2.3. On the revision of the thresholds under Annex I and II to the EIA Directive

According to Article 4 of Directive 2011/92/EU (EIA Directive) on the assessment of the effects of certain public and private projects on the environment, projects listed under Annex I must be subject to an environmental impact assessment while for projects listed under Annex II, Member States must determine whether they shall be subject to an environmental assessment through a case-by-case examination or the setting of thresholds or criteria.

²⁶ See European Commission "Guidance note on the applicable EU environmental legislation to unconventional hydrocarbon projects using advanced technologies such as horizontal drilling and high volume hydraulic fracturing,"

Annex I point 14 of the EIA Directive refers to the 'extraction of petroleum and natural gas for commercial purposes where the amount extracted exceeds 500 tonnes/day in the case of petroleum and 500 000 cubic metres/day in the case of gas' meaning that this activity is subject to a compulsory environmental impact assessment. In other words only shale gas extraction activities where the amount extracted exceeds 500,000 cubic metres/day must be subject to an environmental impact assessment.

On the other hand, Annex II(2)(d) and (e) of the EIA Directive respectively leave up to the Member States the possibility to define whether activities related to deep drillings and surface installations for the extraction of coal, petroleum, natural gas and ores as well as bituminous shale should be subject to environmental impact assessment.

However shale gas exploration and extraction activities are not explicitly mentioned in Annexes I and II to the EIA Directive 2011/92/EU. The threshold under Annex I of 500 000 cubic metres/day may not cover all shale gas projects as the amount extracted per day might be lower in certain periods than the threshold required. It is also not entirely clear whether Annex II (2)(d) and (e) could be applied to the remaining shale gas projects not falling under Annex I, leaving the decision to request environmental impact assessments to be carried out for shale gas projects.

In light of this legal uncertainty, the potential divergent interpretations of the EIA Directive by Member States and the environmental risks derived from the use of the fracking technology during the extraction of shale gas, we consider that a more efficient protection of the environment would require these projects to be expressly listed in Annex I to the EIA Directive and therefore be subject to a compulsory environmental impact assessment without any thresholds.

As mentioned above the Commission has drafted a guidance note on the 'application of the EIA Directive to projects related to the exploration and exploitation of unconventional hydrocarbons' and considers that the correct interpretation would be to require shale gas projects subject to an environmental impact assessment under this directive. However, this statement does not remove the problem of the thresholds.

Finally, Directive 1994/22/EC concerning the conditions for granting and using authorizations for the prospection, exploration and production of hydrocarbons establishes rules for Member States' granting of exploration licences or exploitation concessions of hydrocarbons. It is, however, noteworthy that those authorisations or concessions do not include requirements regarding environmental impact assessments.

Under these circumstances, the ENVI Committee Report requests the European Commission to:

"bring forward proposals to ensure that the EIA Directive adequately covers shale gas activities" and that projects including hydraulic fracturing are included in Annex I of the Environmental Impact Assessment Directive.²⁷

²⁷ Points 23 and 24 of ENVI Committee Report on environmental impacts of shale gas and shale oil extraction activities. Rapporteur: MEP B.Sonik adopted by the Committee on 19 September 2012

2.4. The EU legal framework for public participation and consultation in shale gas projects

A petition from Bulgaria refers to articles 3 to 8 of the **Aarhus Convention**²⁸, as ratified by this Government on 16 March 2014. The petition argues that the permitting procedure granted to Chevron to start exploring shale gas in a field without requiring environmental impact assessment has not respected the step for residents of the region to present their opinions on a project where polluting substances (mutagenic, carcinogenic substances), explosive and flammable effluents and radiation substances are being used.

The Aarhus Convention entered into force at the end of October 2001, when it became part of EU law. The articles 6 to 8 require Parties to the Convention to ensure public participation in relation to decisions concerning activities listed under Annex I of the Convention (which do not mention drilling for shale gas) or decisions related to activities not listed in Annex I but having a significant effect on the environment. Annex I includes in the list related to energy activities: "Installations for gasification and liquefaction"; "Thermal power stations and other combustion installations with a heat input of 50 megawatts (MW) or more" which would be the next phase after shale gas extraction. It also includes under point 12, the "Extraction of petroleum and natural gas for commercial purposes where the amount extracted exceeds 500 tons/day in the case of petroleum and 500 000 cubic metres/day in the case of gas. This provision is similar to the provisions in the EIA Directive (see below).

Annex I (21) of the Aarhus Convention requires public participation in cases where the "provision of article 6, paragraph 1 (a) of this Convention, does not apply to any of the above projects undertaken exclusively or mainly for research, development and testing of new methods or products for less than two years unless they would be likely to cause a significant adverse effect on environment or health. However, the methodology for fracking shale gas does not need to be tested and exploration situations do not fall within this category.

Directive 2003/35/EC²⁹ was adopted to amend Directive 85/337/EEC (former EIA Directive) and Directive 2010/75/EU³⁰ on industrial emissions (IED Directive) (former Directive 96/61/EC Directive) in order to comply with the second pillar of the 1998 Aarhus Convention on public participation in environmental matters, at Member States level. This Directive requires Member States to adopt public participation obligations during the permitting procedure of projects requiring an environmental impact assessment under the EIA Directive and classified installation projects falling under the IED Directive.

Examples of public participation requirements applying to EIA projects:

The public shall be informed, whether by public notices or by other appropriate means such as electronic media where available, of the following matters early in the environmental decision-making procedures [...]:

- the request for development consent;
- the fact that the project is subject to an environmental impact assessment procedure [...]

²⁸ Convention on access to information, public participation in decision making and access to justice in environmental matters, signed on 25 June 1998.

²⁹ Directive 2003/35/EC of the European Parliament and of the Council of 26 May 2003 providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment and amending with regard to public participation and access to justice Council Directives 85/337/EEC and 96/61/EC *OJ L 156, 25.6.2003, p. 17-25*.

³⁰ Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions

- details of the competent authorities responsible for taking the decision, those from which relevant information can be obtained, those to which comments or questions can be submitted, and details of the time schedule for transmitting comments or questions;
- the nature of possible decisions or, where there is one, the draft decision;
- an indication of the availability of the information gathered pursuant to Article 5;
- an indication of the times and places at which, and the means by which, the relevant information will be made available;
- details of the arrangements for public participation made pursuant to paragraph 5 of this Article.

(Article 6(2) of the EIA Directive)

The public concerned shall be given early and effective opportunities to participate in the environmental decision-making procedures referred to in Article 2(2) and shall, for that purpose, be entitled to express comments and opinions when all options are open to the competent authority or authorities before the decision on the request for development consent is taken.

[...]

Reasonable time-frames for the different phases shall be provided, allowing sufficient time for informing the public and for the public concerned to prepare and participate effectively in environmental decision-making subject to the provisions of this Article.

(Article 6(4) and (6) of the EIA Directive)

Examples of public participation requirements under the IED Directive:

Member States shall ensure that the public concerned are given early and effective opportunities to participate in the following procedures:

- the granting of a permit for new installations;
- the granting of a permit for any substantial change
- [...]
- the updating of a permit or permit conditions for an installation [...]

(Article 24(1) of the IED Directive)

(See also Annex IV of the IED Directive for the full public participation requirements)

However as it is not clear whether all shale gas projects fall within the scope of the EIA Directive and the IED Directive, it is still uncertain that public participation requirements would apply to all shale gas project permitting procedures in Member States.

The extraction of shale gas is therefore not properly dealt with by the Aarhus Convention or the EIA Directive which use both the same terminology. The reference to energy activities relate to the energy generation, which is a phase after shale gas has been extracted. Even if the construction and use of installations would clearly be subject to impact assessment and public participation, the activity itself of shale gas extraction is not properly covered and public participation cannot be legally claimed for, until legislation is properly modified.

The ENVI committee confirms this assessment in its Resolution voted on 19 September 2012 on environmental impacts of shale gas and shale oil extraction activities and requests “Public participation should be ensured through adequate public information and through public consultation before each stage of exploitation and exploration”³¹

The report voted on 18 of September by the ITRE Committee on industrial, energy and

³¹ Point 53 of ENVI Committee Report on environmental impacts of shale gas and shale oil extraction activities. Rapporteur: MEP B.Sonik

other aspects of shale gas and oil, focus on public participation derived from legislation and practices at a national level. It highlights the importance of transparency and full consultation of the public, particularly in the context of a gas exploration new approach (probably referring to the new legal framework) during both the ex ante and the monitoring phases, based on the scientific evidence.

It requires Member States to *"evaluate their legislation to see whether proper account is taken of this aspect, including the full application of the provisions of the Aarhus Convention and the corresponding provisions in Union law"*; and requires the Commission and Member States to ensure that the *"modifications to the legal framework necessary for the licensing of shale gas exploration require the mandatory approval of the local authorities affected"*³²

The Lisbon Treaty has reinforced the role of the citizens in the decision making process. Article 11 TEU requires the institutions to ensure public involvement in all areas of Union's activities. Citizens concerns must be heard and transparency in decisions and their impacts ensured.

We therefore consider that clearer provisions requiring public participation and consultation procedures as part of the permitting process for shale gas extraction projects would ensure a higher involvement of the public concerned in these decisions which a high potential significant effect on the environment .

2.5. On the possibility of an 'EU prohibition of the exploration and exploitation of shale oil and gas'

The Treaty on the Functioning of the EU (TFEU) recognises the EU the competence to regulate issues related to environmental policy (Article 192 TFEU) and to energy policy (Article 194 TFEU). The EU has consequently competence to legislate on unconventional gas exploitation and adopt the necessary measures providing proper environmental and health protection.

Currently the EU already has legislation in place establishing measures on certain aspects of unconventional gas extraction in each of the relevant phases even though it is not specifically targeting this activity (See Annex I non exhaustive list). Any amendments to the existing legislation would fall within the EU competence (Principle of conferral and the definition of share competence under Article 2 of the TFEU where Member States may only exercise their competence to the extent that the union has not exercise its competence). As previously mentioned, additional legislation might be required in order to fill in anticipated gaps and deal with certain impacts of unconventional gas exploitation on the environment or human health.

However, it can be argued that a prohibition on the use of this technology falls within the traditional sphere of Member States' sovereignty on energy issues. The EU does not have competence to adopt legislation prohibiting shale gas production if the legislation would be considered as part of the energy policy, which is the most likely option. EU energy measures affecting Member States' choice between different energy sources and the general structure of their energy supply cannot be adopted according to Article 194(2)

³² Point 33 to 39 of the ITRE Committee Report on industrial, energy and other aspects of shale gas and oil.

TFEU. The EU Treaty has prominence to secondary legislation which has to respect in all cases the Treaty's provisions. For that reason no legislation can annul the application of Article 194(2) TFEU as suggested by some petitioners.

On the other hand, if the legislation imposing conditions to shale gas exploitation were justified under environmental objectives and were considered as part of the environmental policy, a prohibition of hydraulic fracking for shale gas exploitation could be adopted but would require unanimity voting by the Council. However, it would most likely be considered an energy measure even if subject to environmental objectives. Under the Treaty, EU environmental measures significantly affecting Member States' choice between different energy sources and the general structure of their energy supply are required to be adopted by unanimity (under Article 192(2) TFEU. More interestingly, any measures "not significantly affecting" affecting Member State's choice on the energy mix would be adopted by ordinary legislative procedure. Any environmental or energy policy measures related to land planning or of fiscal nature affecting unconventional gas exploitation should be adopted by unanimity (Article 192(2) TFEU and Article 194(3) TFEU).

Environmental requirements are justified as according to Article 191(2) TFEU, the environmental policy shall be based on the principles of preventive action and environmental damages be corrected at source.

One of the petitions from Poland asks why potentially dangerous technologies are introduced in the EU when there are not legal provisions regulating them. In the EU system, industrial processes can be developed without the need to be specifically regulated, unless concrete circumstances of this industrial technology make it subject to environmental protection legislation or other type of EU law protecting specific interests.

The EU might not have the competence to ban the exploitation of shale gas if it is decided that such a measure would fall within the sphere of Article 194(2) of the TFEU. However, the EU has the competence to impose conditions for shale gas activities, including environmental requirements under Article 192 which could be adopted by unanimity voting if affecting Member States choice between energy sources. Decisions on the enforcement of the current and future legislation applicable to shale gas activities fall within the European Commission responsibility under Article 17 of the Treaty of the European Union (TEU).

2.6. Shale gas extraction and the EU objective for decarbonisation of the energy sector and development of renewable energy

2.6.1. Scientific debate on the impact of shale gas on climate change

Until recently it was commonly recognised that shale gas had less impact on climate change than coal. However in 2011 Robert Howarth a professor at Cornell University published a study stating that between 3.6% and 7.9% of shale gas produced in the USA was leaking methane from installations to the atmosphere in its entire lifetime, the so called 'fugitive methane emissions'. The conclusions of this study were confirmed by researchers of the National Oceanic and Atmospheric Administration (NOAA) and the University of Colorado that carried out on the ground measurements in the North-East of Colorado where tight gas is exploited using the fracking technology. According to this study around 2% to 8% of shale gas is released during the exploitation phase. Several on the ground measurements studies are underway and should soon be released. The AEA study

on climate change impacts of shale gas, recently published by the Commission³³, considers, however, that the impact of shale gas activities on climate change is less than coal taking into account a time-frame of one hundred years. According to Robert Howarth it is however more accurate to take into account the impact of shale gas on climate change within a time-frame of 20 years in regard of the urgency to tackle climate change within the next decades.³⁴

2.6.2. EU policy on energy decarbonisation

This scientific debate shows how sensitive this issue is and leads to a similar debate at a policy or political level. The ITRE Committee refers to this issue in the report on the industrial, energy and other aspects of shale gas where it states that *"Shale gas has in the short to medium term a role to play in the EU, contributing to achieving the EU's goal of reducing greenhouse gas emissions by 80-95 % by 2050 compared to 1990 levels in the context of reductions by developed countries as a group, while at the same time ensuring security of energy supply and competitiveness, which is the basis of the Energy Roadmap for 2050"*;

On the other hand the ENVI Committee report, points out that *"any favourable comparison of lifecycle GHG balance between shale gas and coal is dependent on a one-hundred-year atmospheric lifetime assumption; considers that the necessity to peak global emissions by 2020 would warrant examination over a shorter period, e.g. 20 years, as more appropriate"*; On those basis, the Committee calls for *"further scientific research into fugitive methane emissions to improve accounting for such emissions under Member States' annual inventories and targets under the EU Effort Sharing Decision"*

President Barroso has called energy policy 'the next great European integration project'. Such ambition is reflected in the Commission Communication on the 2020 Strategy³⁵ and the Commission Communication Energy Roadmap 2050³⁶ which encompass the main orientations and actions of the EU energy policy up to 2050, setting an ambitious, long-term, and comprehensive energy strategy for the European Union.

The core of this EU strategy is to define how to achieve the full decarbonisation of energy systems while guaranteeing security of supply³⁷ and competitiveness. The 2050 roadmap tries to reduce uncertainty about the path to follow, and give incentives for investment across the entire energy system. According to this roadmap gas will be critical for the transition to the transformation of the energy system and it is present in the scenarios for 2030. It underlines the role of conventional and unconventional gas sources for this transformation.

³³ Study available at: <http://ec.europa.eu/environment/integration/energy/pdf/fracking%20study.pdf>

³⁴ Information retrieved from lemonde.fr, *faut-il avoir peur du gaz de schistes?* Authors : Marie-Beatrice Baudet, Jean-michel Bezart, Stephane Foucart et Herve Kempf available 14 September 2012 at: http://www.lemonde.fr/planete/article/2012/09/14/faut-il-avoir-peur-du-gaz-de-schiste_1759902_3244.html

³⁵ It refers to the energy targets (GHG emissions 20% -or 30% if the conditions are right- lower than in 1990, 20% energy from renewables and 20% increase in energy efficiency). See: http://ec.europa.eu/europe2020/europe-2020-in-a-nutshell/targets/index_en.htm

³⁶ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Energy Roadmap 2050 COM(2011) 885/2 available at: http://ec.europa.eu/energy/energy2020/roadmap/doc/com_2011_8852_en.pdf

³⁷ According to a 2011 Eurostat report, more than half of the EU-27's energy comes from countries outside the EU – and this proportion is rising. Eurostat "Energy production and imports" - Statistics Explained (2012/3/2) available September 2012 at: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Energy_production_and_imports#

Energy Roadmap 2050 states on shale gas:

'Global gas markets are changing, notably through the development of shale gas in North America. With liquefied natural gas (LNG), markets have become increasingly global since transport has become more independent from pipelines. Shale gas and other unconventional gas sources have become potential important new sources of supply in or around Europe. Together with internal market integration, these developments could relax concerns on gas import dependency. However, due to the early stage of exploration it is unclear when unconventional resources might become significant. As conventional gas production declines, Europe will have to rely on significant gas imports in addition to domestic natural gas production and potential indigenous shale gas exploitation.'

2030 scenarios towards the 2050 Roadmap:

The European Climate Foundation has assessed the 2030 scenarios to achieve the objectives described in the 2050 Roadmap. Their assessment states:

"In all scenarios, the analysis shows that gas-fired generation will play an important role going forward. Gas-fired plants provide 22% of the annual power demand in 2010, 25% in 2020 and 28% (25% unabated, 3% gas-with-CCS) in the 2030 *On Track case*. Gas-fired plants act both as flexible baseload (replacing coal-fired generation) and as back-up resource in support of increased shares of diverse, variable RES generation, while conforming to the EC's 2020 and 2030 power sector CO₂ emission reduction goals. Beyond 2030, CO₂ abatement goals are such that gas can only remain a significant fuel source in the power mix if commercially deployable solutions are developed to substantially eliminate carbon emissions from gas-fired generators."

"Power Perspectives 2030: On the road to a decarbonised power sector.

A contributing study to Roadmap 2050: a practical guide to a prosperous, low-carbon Europe 2011."³⁸

2.6.3. Shale gas and the development of renewable energy sources

In order to achieve the decarbonisation of the energy system and to commit to the EU target to reduce GHG emissions to 80-95% below 1990 levels by 2050, the 2050 Energy roadmap highlights the need to switch to renewable energy sources.

Energy Roadmap 2050 refers to renewable energy sources stating:

The analysis of all scenarios shows that the biggest share of energy supply technologies in 2050 comes from renewables. Thus, the second major pre-requisite for a more sustainable and secure energy system is a higher share of renewable energy beyond 2020. In 2030, all the decarbonisation scenarios suggest growing shares of renewables of around 30% in gross final energy consumption. The challenge for Europe is to enable market actors to drive down the costs of renewable energy through improved research, industrialisation of the supply chain and more efficient policies and support schemes. This could require greater convergence in support schemes and greater responsibilities for system costs among producers, in addition to Transmission System Operators (TSO).

Renewables will move to the centre of the energy mix in Europe, from technology development to mass production and deployment, from small-scale to larger-scale, integrating local and more remote sources, from subsidised to competitive. This changing

³⁸ Study from the European Climate Foundation available September 2012 at: http://www.roadmap2050.eu/attachments/files/PowerPerspectives2030_FullReport.pdf

nature of renewables requires changes in policy parallel to their further development.

Incentives in the future, with increasing shares of renewables, have to become more efficient, create economies of scale, lead to more market integration and as a consequence to amore European approach. This has to build on using the full potential of the existing legislation, on the common principles of cooperation among Member States and with neighbouring countries, and possible further measures.[...]

Renewables such as wind power or solar panels are intermittent sources of energy. They therefore require back-up capacity. According to a recent JRC report '*Gas-fired CCGTs, combustion turbines and steam boilers are well suited to 'cycling' and 'peaking' capacity requirements, in that utilisation rates can be changed in response to load variations, while fuel injection can commence rapidly to meet high but infrequent levels of electricity demand*'.³⁹

It therefore considers that natural gas would be a good solution to accompany intermittent renewable electricity generation, ensuring grid stability during peak demand in a much more efficient way than coal or nuclear plants. It concludes that the rise of renewable electricity generation may entail new markets for natural gas even though other back-up options exist such as reservoir hydro or pumped storage.

Similarly, the ITRE report on industrial, energy and other aspects of shale gas states that: "*certain forms of renewable energy – for example wind power – are variable and need to be backed up or balanced by a reliable and flexible energy technology; natural gas – including shale gas – could be one of the options available for that purpose among several other solutions such as increased interconnection, better system management and control via smart grids at all network levels, energy storage and demand side management*"⁴⁰;

It can however be argued that the development of a shale gas industry in the EU may affect investments in renewable energy sources as would entail a decrease of investments from economic operators in renewable energy. According to an economic modelling study of the Massachusetts Institute of technology applying different scenarios to the US energy markets, shale gas would most likely limit the development of renewable energy that could co-exist with shale gas only if mandatory targets are set.⁴¹

There are a lot of debates going-on with regard to the impacts of shale gas on climate change and the role of this new energy source to either limit or support the development of renewable energy. It is therefore difficult to ascertain that the development of shale gas in Europe would help or hinder the EU to achieve the decarbonisation of its energy system. Further studies and research should thus be required on these issues.

³⁹JRC Scientific report: Unconventional Gas: Potential Energy Market Impacts in the European Union, EU 2012 available September 2012 at http://ec.europa.eu/dgs/jrc/downloads/jrc_report_2012_09_unconventional_gas.pdf

⁴⁰ Point 17 of ITRE Committee Report on industrial, energy and other aspects of shale gas and oil, Rapporteur: N. Tzavela

⁴¹Henry D. Jacoby, Francis M. O'Sullivan, and Sergey Paltsev, *The Influence of Shale Gas on U.S. Energy and Environmental Policy*, Economics of energy and Environmental Policy, 1(1): 37-51, 2012

ANNEX I: NON EXHAUSTIVE LIST OF RELEVANT LEGISLATION FOR SHALE GAS

In order to assess the current EU legal and regulatory framework in relation to hydraulic fracturing, the following list of EU pieces of law should be considered:

Given the type of activity required for shale gas production, it is key to consider the area of **EU law applied to extractive industry**. There is however no comprehensive EU mining framework. There are four Directives mainly covering waste aspects of mining and the rest of the mining law is the responsibility of the Member States. The existing legislation entered into force prior to shale gas activities and would not necessarily cover all required aspects.

The Directive 2006/12/EC on waste (Waste Framework Directive) and the EC Directive 2006/21/EC on the management of waste from extractive industries (Mining Waste Directive) are fundamental for the safe handling of the liquid mixture used for fracking. Directive 1999/31/EC on the landfill of waste, complemented by Commission Decision 2000/532/EC, regulate relevant waste issues such as hazardous wastes. It needs to be noted that gaseous emissions are excluded from the definition of waste.

Safety and health protection of workers specifically in a mining environment are defined in two further directives, Directive 1992/104/EEC on the minimum requirements for improving the safety and health protection of workers in surface and underground mineral extracting industries and Directive 1992/91/EEC on concerning the minimum requirements for improving the safety and health protection of workers in the mineral-extracting industries through drilling. These requirements could indirectly and potentially control the air emissions of methane even if it is not the aim of the directive.

The Directive 1994/22/EC concerning the conditions for granting and using authorizations for the prospection, exploration and production of hydrocarbons, establishes rules for Member States' granting of exploration licences of hydrocarbons that can be applied to shale gas exploration and production.

In addition, Directive 1996/29/Euratom lays down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation arising from naturally occurring radioactive material (NORM).

On **Water pollution** the following legislative measures are relevant for the analysis:

Water framework Directive 2000/60/EC establishing a framework for Community action in the field of water policy; Directive 2006/118/EC on the protection of groundwater against pollution and deterioration repealing with effect from 22 December 2013 the Groundwater Directive 1980/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances; Directive 2008/105/EC on environmental quality standards in the field of water policy and Directive 1998/83/EC on the quality of water intended for human consumption.

The following pieces of EU law would be relevant to regulate the **use of chemicals in fracking** for shale gas production:

Regulation EC 1907/2006 Regulation concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency REACH, including the possibility to limit the use of chemicals if they have not been registered by the end of 2011 ; Council Directive 1996/82/EC as amended by Directive 2003/105/EC (Seveso II Directive) on the control of major-accident hazards involving dangerous substances (this Directive is currently under review) covers risks arising from storage and processing activities in mining, from pyrotechnic and explosive substances and from the storage of ammonium nitrate and ammonium nitrate based fertilizers; Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures (CLP Regulation), Directive 1998/8/EC concerning the placing of biocidal products on the market requiring that only those biocidal products authorized according to the directive could be used.

The impact of shale gas production in **air pollution and GHG emissions** requires to look into the following EU legislative measures:

Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control), as well as the Decision 2000/479/EC on the implementation of a European pollutant emission register (EPER) which includes an Annex A1 list of pollutants to be reported if threshold value is exceeded. Directive 2008/50/EC on ambient air quality and cleaner air for Europe requires the assessment and management of concentrations of sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter (PM10 and PM2,5), lead, benzene and carbon monoxide as well to the ozone. The most common pollutant from conventional extraction is methane, which is not included in the scope of this Directive.

Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants sets upper limits for each Member State for the total emissions in 2010 of the four pollutants responsible for acidification, eutrophication and ground-level ozone pollution (sulphur dioxide, nitrogen oxides, volatile organic compounds and ammonia). Mitigation of methane or GHG emissions falls currently outside its scope. It requires Member States to draw up programmes in order to reduce emissions and ensure that these limits are complied with. It also requires Member States to ensure that emission ceilings for these pollutants are not exceeded in any year after 2010.

During gas production, transmission and storage, certain amounts of methane leak into the atmosphere. Directive 2003/87/EC as amended by Directive 2009/29/EC establishes a scheme for GHG emission allowance trading where Member States allocate or auction allowances to power generation or industrial manufacturing activities in order to reduce emissions and encourage the use of clean or more efficient technologies. Methane, which is emitted during shale gas activities, is listed in Annex II of Directive 2003/87/EC and therefore considered a GHG. However, shale gas extraction activities or hydraulic fracking are not included in Directive 2003/87/EC's Annex I, and therefore an emission permit is not required even if there are methane emissions.

Other measures linked to this Directive are Directive 2009/31/EC setting up a legal framework to promote the development and safe use of carbon capture and storage (CCS) or the Effort Sharing Decision 406/2009/EC establishing rules for reducing emissions from sectors not covered by the EU ETS, such as transport, housing, agriculture and waste.

Other pieces of EU energy law are affected by the development of unconventional gas extraction such as the legislation on Renewable sources of energy. The International Energy Agency (IEA) report on "golden age of gas" concluded that if governments don't take action, the current plans for tripling the resources from fracking shale gas and other sources of unconventional gas by 2035 will cause the discontinuation of renewable energy, which is more expensive than gas, in part because the greenhouse gas emissions from fossil fuels are still not taken into account in the price of energy. Other pieces of EU law that might need further development relate to state aid measures.

General environmental protection legislation relevant for shale gas production include:

General environmental protection legislation relevant for shale gas production include the Environmental Impact Assessment Directive 2011/92/EU (EIA Directive) and Directive 2003/35/EC providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment and amending with regard to public participation and access to justice Council Directives 85/337/EEC and 96/61/EC;

Other pieces of legislation on environmental protection might be relevant to cover certain GHG emissions from unconventional gas extraction such as Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment Strategic Environmental Assessment (SEA) or Directive 2004/35/EC on environmental liability with regard to the prevention and remedying of environmental damage.

Relevant legislation including provisions for **landscape and biodiversity protection** are:

Directive 1992/43/EEC on the conservation of natural habitats and of wild fauna and flora and Directive 1979/409/EEC on the conservation of wild birds (Natura 2000) would only be applicable in cases where the opening of wells would affect land use close or in the Natura 2000 sites. The Environmental Impact assessment requirement would consider all impacts on the site, including climate.

ANNEX II: OVERVIEW OF SHALE GAS ISSUES IN ROMANIA AND FRANCE

Romania

According to a 2012 report on Central and Eastern European shale Gas outlook published by KPMG, Romanian underground contains unconventional gas resources in the Carpathian-Balkanian Basin, and in the Pannonian-Transylvanian Basin. This report stresses that initial exploration efforts suggest that the cost to recover the gas may be quite high and that the exact amount of shale gas resources is still uncertain.⁴²

⁴²KPMG Global Energy Institute Central and Eastern European Shale Gas Outlook (2012) Available September 2012 at: <http://www.kpmg.com/CEE/en/IssuesAndInsights/ArticlesPublications/Documents/cee-shale-gas-outlook-section-01.pdf>

In April this year, Ms. Sulfina Barbu (former Minister of Environment and current member of the Parliament) declared to the press that shale gas developments would not require the adoption of special environmental legislation in Romania, as the current legal framework provides a complete protection (including the protection of the soil).

However, the Romanian Senate received a proposal in May concerning the adoption of a law to ban the exploration and exploitation of underground hydrocarbons by hydraulic fracturing as well as the cancellation of the *exclusive* exploration licences that use this method. The proposal also provided that the use of hydraulic fracturing represented a criminal offence. The Senate rejected the proposal in June and forwarded its decision to the Deputies Chamber, which is the decisional camera in this case. According to the website of the Deputies Chamber, the proposal currently awaits the opinion of the specialized Parliamentary Committees (including the environmental committee) before being debated.

Also, in May this year the new centre – left Government made public their official Governance Programme that provided an *'immediate establishment of a moratorium on shale gas operation until the completion of the ongoing studies at European level on the environmental impacts of hydraulic fraction.'* According to the Government website, the Prime-minister's answer early this month to the question on whether the Government would adopt further acts to transpose the moratorium and his answer was that the Government intended to implement it in the coming period by not granting new exploration rights.⁴³

France

According to the US Energy Information Administration, France's underground, together with Poland's, contains the most important shale gas reserves in Europe. Only in France it is estimated a potential of technically feasible exploitation of 5.1 trillion cubic meters (equivalent to 90 years of the current gas consumption in France).⁴⁴ These figures are considered rough estimations that should however be used with caution.⁴⁵

The French Government granted nine permits of exploration of shale oil and gas in France but following a very strong public campaign from the civil society and environmental associations, the law 2011-835 of 13 July 2011 was passed prohibiting the exploration and exploitation of oil and shale gas through hydraulic fracturing technology. This prohibition is based on the application of the principle of preventive and corrective action encompassed in Article L-110-1 of the Environmental Code.

This Law also establishes a national commission⁴⁶ in charge of assessing the environmental risks due to the hydraulic fracturing technology and alternative techniques.

Article 2 of the Law 2011-835 stipulates that within a timeframe of 2 months from its promulgation, the holders of mining rights for shale gas explorations must submit to the relevant administrative authority a report specifying the technology used or envisaged for

⁴³ Information provided by Milieu's expert, Raluca Radu, in charge of assessing the national legislation of Romania applying to shale gas activities in a project carried out for the European Commission.

⁴⁴US Energy Information Administration, World Shale Gas Resources: An Initial Assessment of 14 Regions Outside the United States April 2011. Available 08-05-2012 at: <http://www.eia.gov/analysis/studies/worldshalegas/>

⁴⁵General Council of Economy, Industry, Energy and Technologies, General Council of Environment and Sustainable Development, Shale gas and oil in France, February 2012. Available 08-05-2012 at: http://www.developpement-durable.gouv.fr/IMG/pdf/007612-01_et_007612-03_rapports.pdf

⁴⁶This Commission is composed of members of the Parliaments, State representatives, representatives of communities and local administrations, NGOS, associations of employers and workers concerned.

their exploration and research activities. This report would be made available to the public. These mining rights would be withdrawn if the report is not submitted or if this report mentions that the hydraulic fracturing technology is used or planned to be used. As a consequence of these provisions three exploration mining rights were withdrawn by an Order of 12 October 2011.⁴⁷ In a recent intervention at the opening of the environmental conference⁴⁸ on 14 September 2012, the President of the French Republic F.Hollande, stressed that nobody in the current state of knowledge could assert that the exploitation of shale oil and gas by hydraulic fracturing, which is the only known technique, is free of heavy risks for health and the environment. He has requested Delphine Batho, the Minister of Ecology, to reject without delay the seven permit applications for exploration of shale gas.⁴⁹

⁴⁷Arrêté du 12 octobre 2011 portant publication de la liste des permis exclusifs de recherches de mines d'hydrocarbures liquides ou gazeux abrogés en application de la loi n° 2011-835 du 13 juillet 2011.

⁴⁸The purpose of the environmental conference was to invite NGOs, labour unions, employers associations, representatives of local authorities, but also members of the parliament to debate on the policy roadmap of the French Government on sustainable development during a two days event.

⁴⁹The speech of President Hollande at the environmental conference is available at: http://www.developpement-durable.gouv.fr/IMG/pdf/discours_ouverture_conf_environnementale_140912.pdf



DIRECTORATE GENERAL FOR INTERNAL POLICIES
POLICY DEPARTMENT C: CITIZENS' RIGHTS AND
CONSTITUTIONAL AFFAIRS

PETITIONS

**Analysis of the petitions from Bulgaria
and Poland on shale gas extraction**

NOTE

Abstract

The exploitation of shale gas in Poland and Bulgaria is tightly connected to energy security and efforts to reduce greenhouse gas (GHG) emissions. Petitioners expressed concerns in three areas about shale gas extraction: 1) institutional; 2) environmental; and, 3) financial. Analysis of the petitions demonstrates that these concerns are valid and need to be assessed within each of these categories. A risk analysis approach is used to categorize and assess petitioners' concerns; this elevates petitioners concerns to the broader policy level. This in turn makes them eligible to engage with the national and EU level shale gas debate. The approach draws on a peer-reviewed risk typology previously developed to assess institutional efforts in the European Union to transition towards a low carbon economy by 2050.

This document was requested by the European Parliament's Committee on Petitions.

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LIST OF ABBREVIATIONS

RES	Renewable Energy Sources
GHG	Greenhouse gases

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EXECUTIVE SUMMARY

The exploitation of shale gas in Poland and Bulgaria is tightly connected to energy security and efforts to reduce greenhouse gas (GHG) emissions. Petitioners expressed concerns in three areas about shale gas extraction: 1) institutional; 2) environmental; and, 3) financial. Analysis of the petitions demonstrates that these concerns are valid and need to be assessed within each of these categories.

Table 1 Concerns expressed by Bulgarian and Polish Petitioners

<i>Area</i>	<i>Petition Concerns</i>
Institutional	Method of issuing concessions (BG & PL)
	Redressing of local stakeholders (PL)
Environmental and Technical	Issued for concessions for EU Natura 2000 (PL)
	Destruction of roads and fields (PL)
	Monitoring of pipes for corrosion (PL)
	Use of explosive materials (BG & PL)
	Borings contain heavy metals and radioactive elements (BG & PL)
	Storage of borings in unauthorized locations with no oversight or monitoring (PL)
	Use of illegal poisons and not registering compounds using REACH (BG & PL)
Financial	Reduction in economic activity for agro-tourism, farming and forestry (PL)
	Payment for water is not enough for the large amount (BG & PL) Higher tax on mineral extraction means higher price for coal and gas for consumers (PL)
	No legal or financial guarantee from concession holders for ecological or social catastrophe (PL)
	No requirement to carry out land restoration or offer compensation to residents (PL)

A risk analysis approach is used to categorize and assess petitioners' concerns; this elevates petitioners concerns to the broader policy level. This in turn makes them eligible to engage with the national and EU level shale gas debate. The approach draws on a peer-reviewed risk typology previously developed to assess institutional efforts in the European Union to transition towards a low carbon economy by 2050.⁵⁰ There are a range of risks that influence and impact the decision to invest and explore for shale gas using hydraulic fracturing technology (Table 2). **These risks are highly relevant to how governments make decisions and impact the regulatory environment that is created in a country. They also influence the activities of firms and how they make business decisions (including decisions about the types of technologies used). The environment is impacted by this decision-making process.** Essentially, the more risks that are mitigated, the more effective the transition to a low carbon economy by 2050 can be – with minimal environmental impact.⁵¹

⁵⁰ Ibid.

⁵¹ Ibid.

Table 2 Risk categories for shale gas extraction

Risk categories	
Short term – contractual related risks	
Fuel price risk	Price variability and uncertainty over future costs (e.g. Russian pipeline gas vs. shale gas).
Demand risk	Gas produced will not be needed as projected (e.g. impact of renewables, LNG, market pricing)
Performance risk	Wells do not produce as predicted (e.g. contracted supply or environmental issues cause stop in production).
Environmental compliance risk	The financial risk to which parties to an energy contract are exposed, stemming from both existing environmental regulations and uncertainty over possible future regulations.
Long term – Governance regime risks	
Financial risk	No or limited amount of money to finance investment into energy infrastructure.
Regulatory risk	Future laws, regulations, regulatory reviews will be altered.
Technological lock-in	To reduce uncertainty and to provide continuity to past investors regulatory institutions may change only incrementally. In doing so they continue to rely on approved older technologies and inhibit the emergence of newer technologies.
Administrative capacity risk	Constrained staffing levels in government institutions prevent a larger policy and regulatory response.
Investment risk	Investments are impacted due to uncertainty in the operational environment.

The data used in this study were collected using a mixture of methods. Sixteen semi-structured interviews were conducted in Poland between September 19 and 21, 2012. The Bulgarian analysis is informed by a literature review and consultation with Bulgarian energy and environmental experts. In addition, the Polish case study is informed by a review of relevant, media, policy and academic reports along with government legislation. In Poland, the interviews were focused on a cross-section of stakeholders that were able to comment on the concerns raised in the petition. In Poland, these included the ministries of Environment, Foreign Affairs and Treasury; five companies active in the exploration of shale gas were also interviewed. Other interviews were undertaken with an academic, a former political adviser and organizations actively engaged in the shale gas debate.

Findings: Poland

KEY FINDINGS (abridged)

- Shale gas in Poland is a potential strategic domestic energy source
- Polish shale gas is becoming a 'state project' where different state institutions and state-owned firms are actively involved in understanding shale gas extraction techniques and their environmental and economic impacts
- Information about activities and findings by state ministries are not shared; currently there is limited cooperation. There are no official mechanisms or channels for more openly sharing information about planned activities or concerns
- The Polish state is investing in shale gas R&D to improve extraction process and lessen the environmental impact
- The shale gas sector is viewed as an innovative sector that can play a leading role in Poland's economic development (including technology exports)
- Significant shale gas may not lie underneath Natura 2000 areas. If shale gas is extracted then disturbance of the area can be avoided by technical means or by mitigating environmental disruption to the source of the Natura 2000 designation
- The current time lag in reviewing shale gas exploration plans indicates authorities are being cautious, as well as indicating areas where improvement is necessary
- Uncertainty over future environmental and financial regulations is slowing the speed of shale gas exploration
- Regulations could be modified as experienced is gained with shale gas exploration
- Gas power plants using shale gas, compared to future domestic coal power plants, offer avoided CO₂ emissions of 51% to 64% for electricity generation. With current inefficient coal power plants, avoided emissions using shale gas are higher at 70% to 78%. Based on these calculations, shale gas used in power production holds significant potential to reduce carbon emissions in Poland – if it displaces domestic coal in electricity production.
- The Ministry of Foreign Affairs and local authorities have participated in study tours to the US and Canada to learn about the impact of shale gas on communities
- Shale gas can replace the declining amount of conventional gas on the Polish market and mitigate international price volatility
- Shale gas offers the chance to prevent greater dependency on imported gas from Russia
- Poland requires international investors to increase shale gas extraction to significant levels

Summarized Recommendations and Suggestions: Poland

- Polish shale gas is becoming a 'state project' sufficient independence must be given to state bodies through clearly defining their roles to protect objectivity. This comment even applies to state-owned firms which must make investment decisions in the interests of shareholders
- The shale gas sector in the US did not engage with (Corporate) Social Responsibility until social tensions were already too high; significant local and national stakeholder involvement should be achieved in Poland at an early stage
- International best practices for shale gas extraction must be used, but should be localized to Polish institutional and environmental milieu
- If shale gas development in Poland is to be perceived as a highly innovative sector with export potential then state administration must be educated in innovation, technology and public administration to properly foster a domestic shale gas industry
- International shale gas capital will avoid Poland unless the tax and regulatory regime are conducive to global innovators
- Joint technology projects should be fostered with international firms rather than solely Polish R&D which may duplicate past efforts
- R&D projects financed by the state must *not* only go to R&D about the technical equipment needed for shale gas extraction. Social and environmental sciences need funding as well. The impact of shale gas development – and its success or failure – rests with local communities. Understanding the short to long-term impact on residents and their surrounding infrastructure and environment, particularly in the early exploratory period, is essential prior to any ramping up of the shale gas sector. Societal perceptions have a significant influence on technological development.
- How Natura 2000 areas are regulated for shale gas extraction needs to be clearly communicated; a voluntary agreement among shale gas companies about how sensitive areas are treated could alleviate tensions in this regard. This issue will not disappear, so a pro-active industry approach (based on Social Responsibility guidelines) needs to be developed
- Changes to Poland's energy tax and royalty regime must be clarified sooner rather than later. The risks of investing remain high until this issue is resolved
- The potential displacement of coal by shale gas across the EU must be studied, GHG emission benefits may be significant; the impact on RES development must also be assessed
- Effective procedures or 'walls' must be put in place to prevent state owned companies receiving less restrictive environmental conditions than would normally be justified by the Ministry of Environment. If shale gas becomes a 'state project', sufficient independence needs to be ensured for environmental regulators. To date this does not appear to be a problem; however, greater attention should be paid to this issue when (and if) the industry grows. Instilling a culture of regulatory independence early on can have important benefits later
- Further study is needed to see if shale gas is liable to displace RES or coal on the Polish market. This examination needs to consider GHG emission allowance pricing levels and the possible cost scenarios for shale gas extraction

- Administrative procedures and 'ways of doing business' must address the technological and industrial demands of the shale gas sector to ensure the most up-to-date technology can be used in the sector
- Study tours of the US and Canada should continue to be conducted so local authorities are made aware of the impact of medium to large scale shale gas extraction
- Administrative capacity risks are highlighted 1) as a potential barrier to ramping up shale gas extraction; and, 2) for ensuring the environment and citizens are adequately protected. It is suggested that sufficient institutional and political effort is made to ensure proper staffing levels and training so that both the public's concerns and companies' technical needs are responded to in an appropriate way.

Findings for Bulgaria

KEY FINDINGS (abridged)

- Since January 2012, the use of hydraulic fracturing to extract Shale gas has been banned in Bulgaria
- Bulgaria is heavily dependent on Russia for most of its gas supply
- Gas supplies contracted through Russia's Gazprom ensure a stable and predictable price for gas
- New gas interconnectors to neighbouring countries offer Bulgaria an additional option for gas diversification
- The discovery of a large gas field in the Black Sea could large enough to change the security of supply of gas for Bulgaria
- More social discussion needs to occur over Bulgaria's future energy mix
- The planned pipelines of South Stream and Nabucco West offer a way to diversify supply routes, with only Nabucco West offering the potential to diversify supply
- LNG terminals in the Southeast of Europe offer additional gas diversification possibilities
- Over the next 5 to 10 years more gas will become available to Bulgaria. Without shale gas, the country will still have sufficient options to diversify away from Russia

Summarized Recommendations and Suggestions: Bulgaria

Current suggestions and recommendations, based on the analysis detailed above:

- Alternative gas supply routes and sources must be secured to ensure Bulgaria's long term energy security
- Bulgaria must fully participate in new gas projects that offer diversified sources of supply

- Potential shale gas reserves in Bulgaria could be significant. If the currently proposed gas projects do not come to fruition, broader social dialogue should take place to discuss alternative gas sources, including shale gas
- Short term risks are minimal in Bulgaria. It can be expected (because of the competing diversification routes) that all parties would strongly desire to avoid another event such as that which occurred in 2009 between Russia and the Ukraine. Therefore, long-term risks should be addressed in a planned and long-term strategic manner
- Regulatory and investments risks exist in the energy sector in Bulgaria. If Bulgaria requires foreign investment in energy projects, then a more stable and predictable environment should be encouraged

Conclusion

The development of shale gas in Poland and Bulgaria is proceeding along different paths. Justifications for its development in Poland differ from those used in Bulgaria. While the necessity exists for both countries to reduce the cost of gas and increase the security of supply, the two countries have chosen different ways to do so. The plethora of gas projects that could provide a sufficient level of diversification for Bulgaria mean that it does not need to develop a strong pro-shale gas position. Poland differs in its level of energy security due to its geographic proximity to Russia, its historical relations and its need to introduce cleaner energy sources. The dominance of coal in Poland's electricity mix must be reduced for environmental reasons. The economic benefits – *if shale gas can be extracted safely at reasonable prices* - represents a significant opportunity for the country to reduce its dependence on imported gas while increasing the proportion of cleaner electricity in the energy mix. The environmental concerns expressed over the use of hydraulic fracturing must be considered and addressed more pro-actively by authorities. Relevant information should be documented and distributed to the public and greater public involvement in programs should be promoted. These activities can play an important part in making shale gas more acceptable to communities, whose concerns must be addressed – if they accept this technology, and who must share the benefits of shale gas exploitation.

Finally, energy security concerns in former Communist countries must be accounted for at the EU level. Environmental concerns over energy technologies need to be considered and accommodated. Yet, even considering this fact, it is essential when dealing with current environmental and security issues to consider the need to diversify away from using Russian sourced gas which has a monopolistic position in the energy markets of many new EU Member States. Shale gas is changing the global gas market and understanding how this can affect European - particularly Eastern European - energy security must be part of the debate.

Aim and methodology

The aim of the present work is to review the petitions of citizens of Poland and Bulgaria over concerns about shale gas extraction.

There is significant overlap in the concerns reported in the petitions filed in both Bulgaria and Poland.

Table 3 General concerns expressed by petitioners

<i>COUNTRY</i>	<i>PETITIONER</i>
Poland #1	"A moratorium on shale gas production in all member states of the European Union should be introduced at the earliest opportunity." "Why are potentially dangerous technologies being introduced into the EU when there are no legal provisions in this respect?"
Poland #2	"We urge you to take action to revoke all extraction concessions issued in breach of the law and introduce a national ban on: [lists reasons to ban hydraulic fracturing]"
Bulgaria #1	"Would like to turn your attention to our anxiety of the danger that follows from the exploration and the extraction itself of shale gas in the region we live in." [lists problems connected to pollution from shale gas extraction]

Source: Petitions received from Bulgaria and Poland

To understand these concerns in the context of each country it is important to be able to assess them in an organized and comparable manner. The concerns raised by petitioners (Table 3 **Error! Reference source not found.** and Table 4) can be used to inform and guide the examination of each country's decision, justification for and ability to protect the environment. They can also be used to provide suitable oversight of the institutional environment and assist in the making of reasonable economic decisions about citizens' access to affordable and secure energy sources.

A risk analysis approach is used to categorize and assess petitioners' concerns.

The approach draws on a peer-reviewed risk typology previously developed to assess institutional efforts in the European Union to transition towards a low carbon economy by 2050.⁵²

The strength of using this approach is that it elevates the discussion to a higher policy level where concerns are connected with the policy discussion or policy analyses and can be addressed through modifications to current policies. The limitations of elevating concerns to this level are that the precise technical concerns of some petitioners may be bundled into the larger policy debate. However, by expanding concerns within the broader shale gas debate, they contribute to understanding the broader risks associated with shale gas exploitation. It is hoped that the concerns that were voiced will not be diluted but given additional weight to influence policy discussions.

The methodology used to assess the petitions examines the risks that petitioners in Bulgaria and Poland perceive to exist. The petitioners are most concerned by the technology that is/would be used to extract shale gas (hydraulic fracturing).

⁵² European Commission, "A Roadmap for Moving to a Competitive Low Carbon Economy in 2050."

The risk typology mentioned above was specifically designed to assess new technologies and their impact on the environment and society. Adapted to the topic of shale gas, the risk typology is used to assess the three main areas of concern expressed in the petitions (Table 4).:

- Institutional (state agencies)
- Environmental and technical
- Financial

Table 4 Detailed concerns expressed by petitioners

Area	Petition Concerns
Institutional	Method of issuing concessions (BG & PL)
	Redress of local stakeholders (PL)
Environmental and Technical	Issued for concessions for EU Natura 2000 (PL)
	Destruction of roads and fields (PL)
	Monitoring of pipes for corrosion (PL)
	Use of explosive materials (BG & PL)
	Borings contain heavy metals and radioactive elements (BG & PL)
	Storage of borings in unauthorized locations with no oversight or monitoring (PL)
	Use of illegal poisons and not registering compounds in REACH (BG & PL)
Financial	Reduction in economic activity for agro-tourism, farming and forestry (PL)
	Payment for water is not enough and large amounts (BG & PL) Higher tax on mineral extraction means higher price for coal and gas for consumers (PL)
	No legal or financial guarantee from concession holders for ecological or social catastrophe (PL)
	No requirement to carry out land restoration or compensation to residents (PL)

Source: Petitions received from Bulgaria and Poland

These correspond with specific risk categories (short-term contractual related risks and long-term governance regime risks Table 5 below) that reflect not only petitioners' concerns but also how the Bulgarian and Polish state institutions are formulating the role that shale gas will play in each country's energy mix. There is a range of risks that influence and impact the decision to invest and explore for shale gas using hydraulic fracturing technology. These risks are highly relevant to how governments should make decisions and should impact the regulatory environment that is created in a country. They also influence the activities of firms and how they make business decisions including the types of technologies used. The environment is directly impacted by these decision-making processes. Essentially, the more risks that are mitigated, the more effective a transition to a low carbon economy by 2050 can be – with minimal environmental impact.⁵³

This section of the document attaches the concerns expressed by petitioners to identifiable risks and the role that shale gas does or does not play in each country.

⁵³ LaBelle, "Constructing Post-carbon Institutions: Assessing EU Carbon Reduction Efforts Through an Institutional Risk Governance Approach."

A clearer view of risks associated with shale gas extraction in Bulgaria and Poland can be created when petitioner-identified risks are combined with analysis commissioned in two recent reports by DG Environment⁵⁴ and DG CLIMA.⁵⁵ This enables the citizen's concerns to be categorized with environmental, social and economic factors. To date, both the assessment of the climate impact of shale gas⁵⁶ and the environmental and human health study⁵⁷ lack a broader risk assessment of the "potential role of shale gas in the future energy mix."⁵⁸ The current analysis therefore can assist stakeholders and policymakers to engage in a discussion in an "area where economics, finances, environment and in particular public trust are essential."⁵⁹

Table 5 Risk categories relevant for shale gas development

Risk categories	
Short term – contractual related risks	
Fuel price risk	Price variability and uncertainty over future costs (e.g. Russian pipeline gas vs. shale gas).
Demand risk	Gas produced will not be needed as projected (e.g. impact of renewables, LNG, market pricing)
Performance risk	Wells do not produce as predicted (e.g. contracted supply or environmental issues cause stop in production).
Environmental compliance risk	The financial risk to which parties to an energy contract are exposed, stemming from both existing environmental regulations and uncertainty over possible future regulations.
Long term – Governance regime risks	
Financial risk	No or limited amount of money to finance investment into energy infrastructure.
Regulatory risk	Future laws, regulations, regulatory reviews will be altered.
Technological lock-in	To reduce uncertainty and to provide continuity to past investors regulatory institutions may change only incrementally. In doing so they continue to rely on approved older technologies and inhibit the emergence of newer technologies.
Administrative capacity risk	Constrained staffing levels in government institutions prevent a larger policy and regulatory response.
Investment risk	Investments are impacted due to uncertainty in the operational environment.

Source: Author (revised from LaBelle 2012)

The risk typology originally developed to assess the transition towards a low-carbon EU energy sector⁶⁰ and here adapted for the shale gas sector⁶¹ provides an effective means to assess the petitioners' concerns in Bulgaria and Poland.

⁵⁴ AEA Technology, *Support to the Identification of Potential Risks for the Environment and Human Health Arising from Hydrocarbons Operations Involving Hydraulic Fracturing in Europe*.

⁵⁵ AEA Technology, *Climate Impact of Potential Shale Gas Production in the EU*.

⁵⁶ Ibid. See analysis of John Broderick in the note Regulation of the Unconventional fossil fuels extraction - Climate Change Considerations.

⁵⁷ AEA Technology, *Support to the Identification of Potential Risks for the Environment and Human Health Arising from Hydrocarbons Operations Involving Hydraulic Fracturing in Europe*. Regarding this issues see also: "Impact of shale gas and shale oil extraction on the environment and on human health", European Parliament, 2011 and updated version, 2012 available at: <http://www.europarl.europa.eu/document/activities/cont/201107/20110715ATT24183/20110715ATT24183EN.pdf>

⁵⁸ AEA Technology, *Climate Impact of Potential Shale Gas Production in the EU*, iii.

⁵⁹ AEA Technology, *Support to the Identification of Potential Risks for the Environment and Human Health Arising from Hydrocarbons Operations Involving Hydraulic Fracturing in Europe*, iv.

⁶⁰ LaBelle, "Constructing Post-carbon Institutions: Assessing EU Carbon Reduction Efforts Through an Institutional Risk Governance Approach."

⁶¹ LaBelle, "The Risks for Shale Gas in Europe: Technology and Avoiding the Frackenstein Label."

The three category typology created for the petitions (institutional, environmental and technical, and financial) allows for a broader assessment which includes different actors and issues. This approach provides an effective means to answer petitioners' statements and places the concerns within the broader shale gas discussion in each country. It helps to answer the following fundamentally important questions: 'Are there any valid reasons shale gas should be used?' and, 'How can the environment be protected?'

Data collection

The data used in this study include a mixture of methods. 16 semi-structured interviews were conducted in Poland between September 19 and 21, 2012. The in-person interviews were focused on a cross-section of stakeholders that were able to comment on the concerns raised in the petition. In Poland, these included the Environmental, Foreign Affairs and Treasury; in addition to five companies active in the exploration of shale gas. Other interviews were undertaken with an academic, a former political adviser and organizations actively engaged in the shale gas debate. During the interviews many of the concerns of petitioners were raised and answers provided to pertinent questions. The intention behind this round of interviews was to better understand the specificities of the Polish shale gas debate. In addition, the 22nd Economic Forum in Krynica-Zdroj, Poland (September 4 to 6, 2012) included a number of high-ranking speakers who addressed the topic of shale gas in Poland. The Polish case study is also informed by a review of relevant, media, policy and academic reports along with government legislation. The Bulgarian analysis is informed by a literature review and consultation with Bulgarian energy and environmental experts.

Table 6 Partial list of interviewed organizations

<i>Government units, companies and organizations interviewed (some individuals remain anonymous)</i>
Talisman Energy Polska
United Oil Field Services
PKPP Lewiatan
NaftaGaz Poland
Technical University of Lodz
Ministry of Foreign Affairs
Ministry of Environment
Treasury Ministry

Table 7 Selected organizations from 22nd Economic Forum

<i>Selected Government units, companies and organizations engaged in discussion about shale gas at the 22nd Economic Forum, Krynica-Zdroj, Poland Sept. 4-6, 2012</i>
Central Mining Institute
Center for Social and Economic Research (CASS)
Ministry of Treasury, Poland
LOTOS Group
PGNiG SA
Ministry of Economy, Poland
Ministry of Environment, Poland
Polish Chamber of Commerce, Poland

The research in this project corresponds with the early stages of an EU 7th Framework Programme for Research (FP7) project entitled 'GR:EEN'. The GR:EEN FP7 project contains a comparative project focused on shale gas development in Poland and Bulgaria. It should be stated here that the design for the FP7 project was completed and formalized before the request by the petitions committee was received. Therefore, while there is overlap between countries and issues, the conclusions presented here do not reflect what may or may not be concluded in the original research project. In addition, what is presented here are only summarized findings gained through field research and literature reviews. Additional time and resources would be necessary to provide a more thorough analysis of the broad topic of shale gas (non)development. Nonetheless, the ability to draw from this field research and rely on an extensive literature review has been advantageous in addressing concerns expressed by petitioners.

1. POLAND

KEY FINDINGS

- Shale gas in Poland is a potential strategic domestic energy source
- Polish shale gas is becoming a 'state project' where different state institutions and state owned firms are actively involved in understanding shale gas extraction techniques and the environmental and economic impact
- The Polish state is investing in shale gas R&D to improve extraction process and lessen the environmental impact (The Ministry of Foreign Affairs and local authorities have participated in study tours to the US and Canada to learn about the impact of shale gas on communities).
- State financed R&D is focused on technical aspects of shale gas extraction
- Activities and findings by state ministries are not shared, currently there is limited cooperation. There is no official mechanism or channels for more open sharing of planned activities or concerns
- There is a lack of research focused on the economic and social impact of shale gas extraction in Poland
- The shale gas sector is viewed at least by the authorities as an innovative sector that can play a leading role in Poland's economic development, including technology exports
- Significant shale gas may not lie underneath Natura 2000 areas.
- Current time lag in reviewing shale gas exploration plans indicate caution by authorities as well as areas where improvement is necessary.
- Regulations could be adjusted as experienced is gained with shale gas exploration.
- Shale gas, for electricity generation, with future generation technology offers CO₂ avoided emissions of 51% to 64% over domestic coal. With current generation technology this increases to 70% to 78%. Shale gas may offer the potential to displace coal in the power sector.
- Shale gas can replace declining conventional gas on the Polish market, mitigate international price volatility and offers the ability to prevent a greater dependency on imported gas from Russia.
- The Polish gas market must develop to offer pricing signals for gas extraction – this will determine whether it is profitable to extract shale gas.

Shale gas in Poland is emerging as a potential energy source with lower carbon emissions than coal. Deploying the horizontal drilling and hydraulic fracturing technology that is used to extract shale gas has potential ramifications for the environment, society and the

economy. To date, a limited number of unconventional shale gas wells have been drilled with tests done using hydraulic fracturing. Poland is in a transition period with unconventional gas being regulated and overseen by established laws, regulations and state institutions which were established before considerations of non-conventional technology became relevant. However, social, environmental and economic concerns and issues give importance to the current discussion of whether there is adequate oversight of unconventional shale gas technology.

This report will address the concerns raised by the petitioners by briefly examining technical concerns, but at the same time more robustly engaging with petitioners' concerns about state institutions, the environment, and economic activity. **Underlining this analysis are two fields of risk:**

- 1. the potential risks inherent with extracting shale gas,**
- 2. how the use of shale gas mitigates other risks.**

The report is structured as follows: the current state of Poland's energy sector and infant shale gas industry is first summarized to lend context to the petitioners' stated concerns. Addressed next is how petitioners' concerns fit within the current legal and regulatory environment, which includes proposed changes which are under consideration by the Polish state. Finally, the concerns, activities and positions of actors in Poland are considered within a risk assessment originally developed to assess the European Union's efforts to decarbonize its power sector. This brief report on Poland is significantly limited by the depth and breadth of material that can be treated in the span of a few pages. The intent is to provide a concise summary through understanding a broad range of risks, the perceptions of actors involved and the issues raised by the petitioners within the Polish political, economic and social environment.

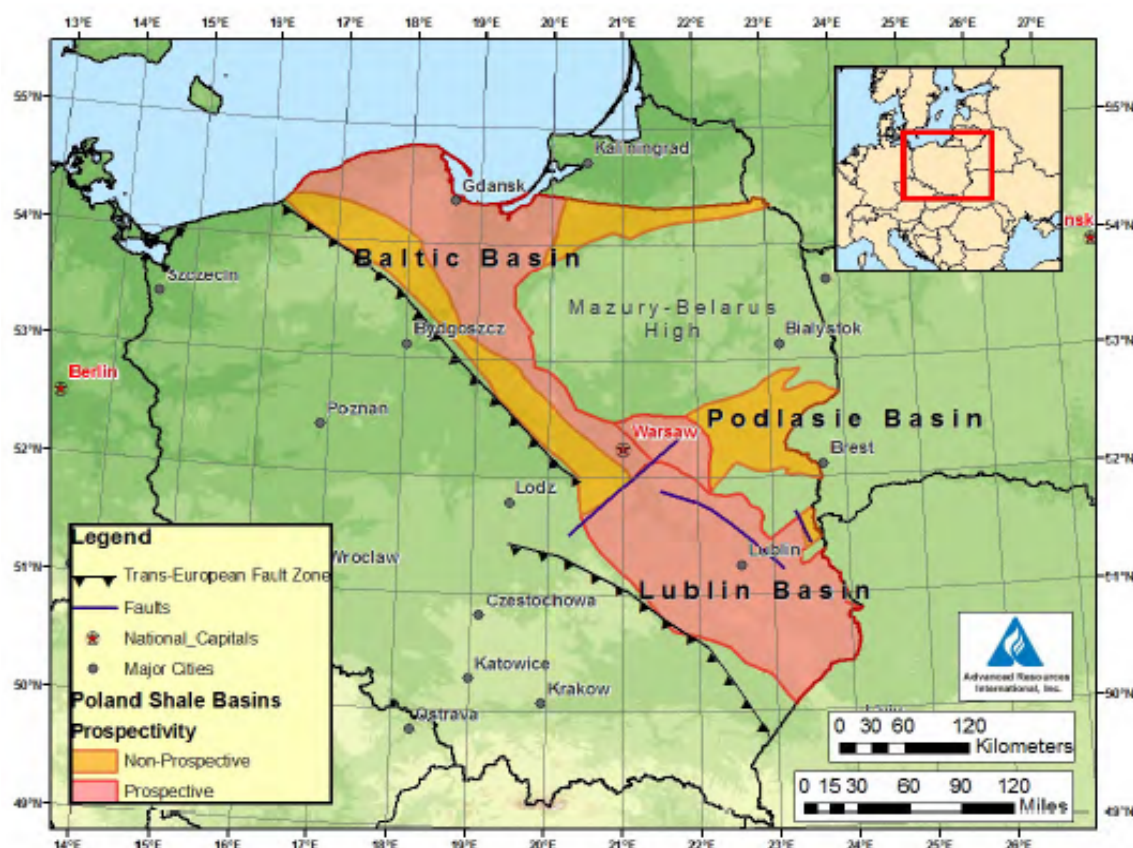
1.1. Current state of Polish shale gas industry

Shale gas deposits in Poland run on a Northwest to Southeast axis and traverse the center of the country. There are three basins: the Baltic in the North, the Lublin in the South, and the Podlasie in the East (Map 1). Because of the presence of organic rich shales the areas appear favorable for shale gas exploitation.⁶² The Polish Geologic Institute (in March, 2012) assessed that there is an estimated 346 – 768 Bcm, or 2.5 to 5.5 times more shale gas than conventional gas in Poland. This translates into 35 to 65 years of cumulative gas consumption in Poland or 120 to 200 years of current domestic gas production.⁶³

⁶² United States Energy Information Administration, "World Shale Gas Resources: An Initial Assessment of 14 Regions Outside the United States," IV-26.

⁶³ Polish Geological Institute-National Research Institute (PGI-NRI) in Warsaw, *Assessment of Shale Gas and Shale Oil Resources of the Lower Paleozoic Baltic-Podlasie-Lublin Basin in Poland*.

Map 1 Major Shale Gas Basins of Poland



(Source: United States Energy Information Administration, 2011, p V-1)⁶⁴

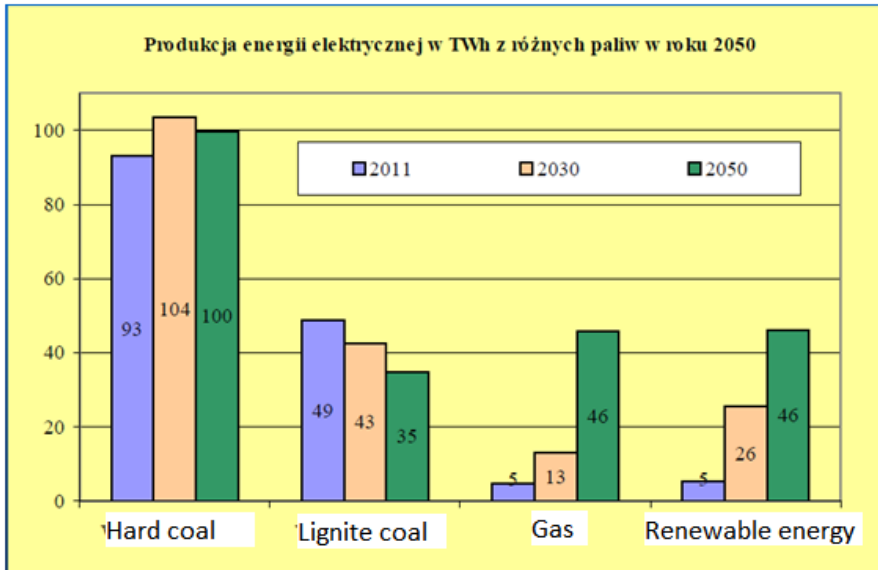
Electricity production in Poland is currently dominated by coal. To provide perspective about how Poland perceives its future energy mix, data collected and presented by Professor Mielczarski of the Technical University of Lodz, Poland, indicates that coal will remain the dominate form of electrical based power until 2050.⁶⁵ Support for this statement is lent by findings from another piece of research that finds that Poland’s future energy security is based on coal and “going away from coal may result in several serious economic and social consequences for [the] Polish economy.”⁶⁶ In addition, Poland has twice vetoed the EU Low Carbon Roadmap 2050 and also the EU Energy Roadmap 2050. The current political, professional and political dialogue in the country holds coal to be a key energy source. **Figure 1** and **Figure 3** illustrate Poland’s limited growth in use of renewable energy and increasing growth of use of gas to 20% - thereby indicating the currently projected upper limit of ‘lower carbon’ energy sources in Poland.

⁶⁴ United States Energy Information Administration, “World Shale Gas Resources: An Initial Assessment of 14 Regions Outside the United States.”

⁶⁵ Mielczarski, “Prognozy Produkcji Energii Elektrycznej i Zużycia Paliw.”

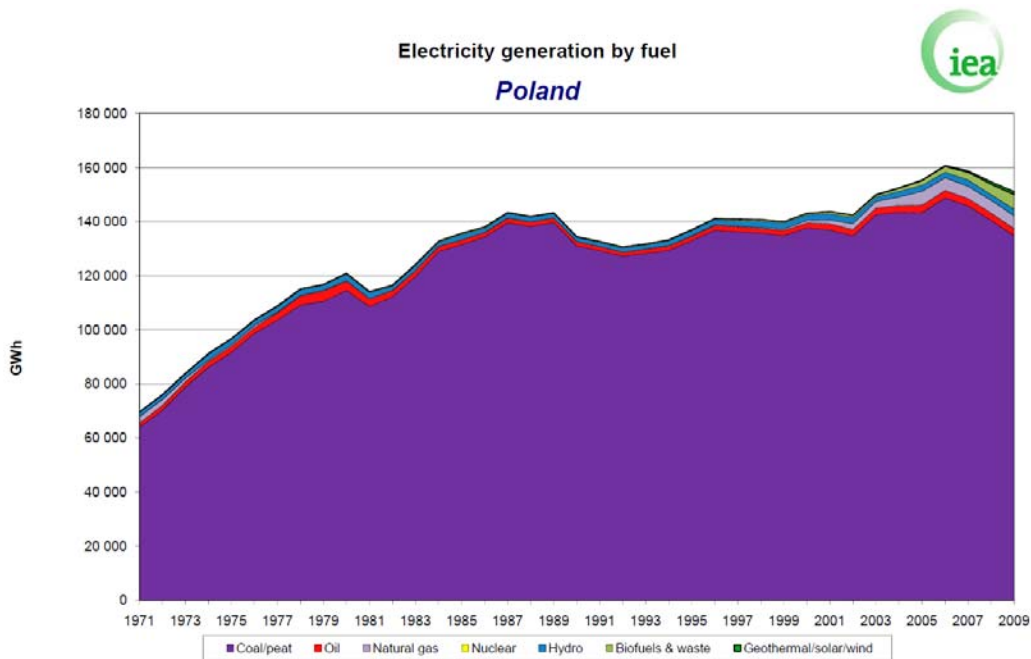
⁶⁶ Dubinski, *Future of Coal as an Energy Fuel*.

Figure 1 Electricity Production from Different Fuels in TWh to 2050



(Source: Mielczarski 2012)⁶⁷

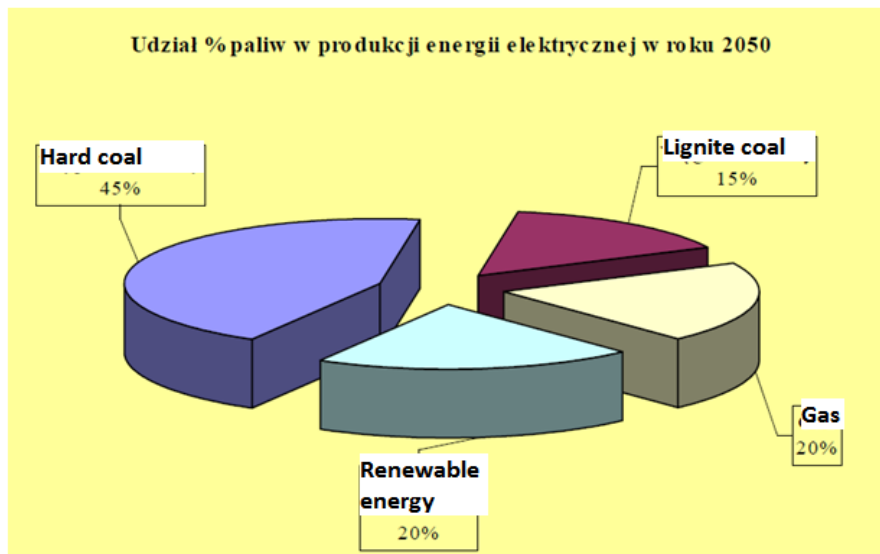
Figure 2 Electricity Generation by Fuel Type



Source: IEA 2011⁶⁸

⁶⁷ Mielczarski, "Prognozy Produkcji Energii Elektrycznej i Zużycia Paliw."

⁶⁸ International Energy Agency, "Electricity Generation by Fuel."

Figure 3 Fuel Mix for Electricity Production in 2050

(Source: Mielczarski 2012)⁶⁹

The impact that shale gas can have in the Polish energy mix on reducing GHG emissions is significant. First, compared to imported Russian gas (which currently comprises 70% of Poland's gas supply), GHG emissions from power plants using domestically-produced shale gas could be 2% - 10% lower. Compared to LNG, shale gas GHG emissions could be 7% - 10% lower.⁷⁰ Second, heavy reliance on coal to produce 90% of Poland's electricity create and will continue to create significant environmental and economic costs for the country, particularly if ETS allowances will need to be purchased in the third phase of the ETS. The economic impacts, if there is a high price for these allowances, will be significant due to the corresponding rise in electricity prices. According to a recent report by DG CLIMA that compared the lifecycle GHG emissions of shale gas and coal in power generation, shale gas has the potential to reduce GHG emissions by 41% - 49%.⁷¹ However, these assumptions are based on the use of Russian, South African and South American coal which Poland is consuming at an increasing rate. However, if the analysis is adapted for Polish coal, greater CO₂ emission reductions are predicted (as discussed below).

Third, dominating the shale gas discussion is the increased energy security that shale gas affords Poland when compared to imported Russian gas. This element should not be underestimated by observers. Control of Polish energy resources has a long history, so any discussion must take into account desires for Poland to supply, to the maximum level, its own demands for energy.

The rate of tax on mineral extraction in Poland is minimal. The tax rate is essentially .005% on 1000 m³. The exact figure is based on the volume of gas extracted and the nitrogen value in the gas. Revenue from taxation is shared by the local municipality (60%) and the National Fund for Environmental Protection and Water Management (NFOSiGW, 40%); no money goes directly into the state budget. The fact that the money goes to the local municipality is important, although this may change in the future. Sharing of revenue with local municipalities can assist in mitigating the local impact of shale gas development.

⁶⁹ Mielczarski, "Prognozy Produkcji Energii Elektrycznej i Zużycia Paliw."

⁷⁰ AEA Technology, *Climate Impact of Potential Shale Gas Production in the EU*, 67.

⁷¹ Ibid.

Poland, until 2014-2015, is perceived to be transitioning to larger scale extraction of shale gas. Exploratory drilling is currently underway and a phase of production may follow. The reported amount of hydraulic fracturing for shale gas that has occurred is still less than the 150 test wells that are needed in Poland to understand the country's geology and the amount of shale gas available. By September 2012, an estimated total of 27 unconventional exploratory wells had been drilled in Poland,⁷² with an expected 34 to be completed by the end of 2012; this is below the government's projection of 45 wells.⁷³ These drilling efforts have included the use of horizontal drilling techniques, with seven bores having been drilled using hydraulic fracturing methods for testing (not production).⁷⁴

1.2. Polish energy policy risk analysis

State institutions provide the regulatory oversight that protects the environment and citizens. Within the shale gas discussion, it is essential to understand how government agencies protect the environment and whether there are sufficient resources and clear regulatory regimes in place so all stakeholders are clear about the conditions for shale gas exploitation. What follows is an assessment of the risks associated with the provision of coherent and sufficient governance conditions which reduce risks for all actors. Identified at the start of each sub-section are the petitioners concerns. These concerns are then analyzed through a risk prism which is designed to highlight weaknesses or strengths.

- Institutional

Institutional – petitioners' concerns

- *Method of issuing concessions*
- *Redress of local stakeholders*

The institutional considerations expressed by the petitioners need to be assessed against the institutional environment in Poland. This does not necessarily require a comprehensive review of local, regional and national authorities. It rather focuses on a top-down perspective of the apparatus of state including how it oversees and affects the development of shale gas in Poland. A more thorough assessment should cover the competencies of local authorities.

The institutional concerns of petitioners can be clarified in two ways. **First, the method for issuing concessions for prospecting and exploration in Poland has been assessed and viewed as a means to protect the energy interests of the country.**⁷⁵ In addition, the method of filing claims against companies can be done through the Code of Administrative Procedure.⁷⁶ Second, the petitioners raise concerns about the competencies of state institutions and their ability to oversee and work with both social groups and firms regarding shale gas extraction methods and processes. This issue is covered next.

- Technological lock-in and administrative capacity risk

⁷² Cleantech Poland Research, "Unconventional Gas Wells Drilled to Date in Poland - Updated."

⁷³ "Issues with Regulation and Bureaucracy Are Cause for Investor Caution in Poland."

⁷⁴ Cleantech Poland, *Shale Gas Investment Guide/Poland*, 18–23.

⁷⁵ Baginski, "Shale Gas in Poland -- the Legal Framework for Granting Concessions for Prospecting and Exploration of Hydrocarbons."

⁷⁶ Poland, *Code of Administrative Procedure*.

There are two risks that can impact both the use of new (shale gas) extraction technology and how the state's administrative capacity can be adjusted to meet the new demands for effective oversight and the efficient management of applicants and licensing duties. These are the following:

Technological lock-in: To reduce uncertainty and to provide continuity to past investors regulatory institutions may change only incrementally, thereby relying on approved older technologies and inhibiting newer technologies.

Administrative capacity risk: Constrained staffing levels in government institutions prevent a larger policy and regulatory response.

The ability of administrative institutions to evolve as technology develops is essential. Petitioners' concerns reflect a significant degree of concern that authorities should oversee the environmental impact of shale gas drilling and hydraulic fracturing technology. The mention of the need to monitor pipes and storage facilities indicates a reservation that state agencies cannot properly oversee shale gas technology. Historically, the state has dealt with conventional gas extraction; therefore with established procedures in place, institutions are able to monitor the environmental impact of this method of extraction. Interviews with government agencies and companies, along with a documented study,⁷⁷ indicates further institutional adaptation *is* occurring to meet the need to oversee shale gas extraction techniques. **Stringent environmental assessments and the need for re-approval for altering drilling plans were cited as being clear examples of how the current system is providing oversight.** Within this risk assessment it can be expected that, if environmental damage occurs due to either constrained staffing levels or the inability to properly oversee shale gas technology, public perception may turn against shale gas and the use of conventional technologies will continue to be favoured in Poland.

The local characteristics of Poland's state institutions indicate they are adjusting to the realities and technical characteristics of shale gas extraction. **There are five state ministries involved in overseeing and learning about shale gas: Economic, Environment, Finance, Foreign Affairs and Treasury.** For example, the Ministry of Foreign Affairs is involved in assessing both the US shale gas experience and the security of supply implications. The Treasury Ministry oversees state-owned oil and gas companies that are active in the shale gas sector. However, to date, no single coordinating body is ensuring that these various units work together. Each of these ministries plays a different role in analysis and providing oversight of shale gas.

Interviewees expressed a strong desire for further technological improvements to be made that can address the many water-related issues surrounding shale gas technology. Substantial comments were received about the ability of Poland to increase exploration and production from shale gas. The lack of drilling rigs in Europe and the long lag time of certification of rigs from the US (6 – 12 months) means that the latest technologies in quickly evolving drilling technology will not be available. Use of the latest technologies can thus be partially delayed by bureaucratic inertia. However, it should be noted that new technological research is being led by the government through its recent launch of a PLN 500 million R&D program.⁷⁸ **The state is therefore vested in moving forward both technologically and institutionally the institution of best practices and fostering of new technologies to address evolving environmental and financial concerns.**

The operations of the different ministries were most frequently identified being as the greatest institutional barrier. Greater coordination and the clarification of financial matters and a faster licence approval process were cited as areas that could be improved. One company executive identified what he perceived to be understaffing at the Ministry of

⁷⁷ Polish Geological Institute-National Research Institute (PGI-NRI) in Warsaw, *Assessment of Shale Gas and Shale Oil Resources of the Lower Paleozoic Baltic-Podlasie-Lublin Basin in Poland.*

⁷⁸ The Warsaw Voice, "State Funding of PLN 500m Available for Shale Gas Research."

Environment (in comparison to the number of concessions handed out). Reviewing applications is an important function that can hinder or facilitate the review process or the making of alterations to current concessions. This process does not appear to affect the environmental review process, but it does affect the time that it takes for documents to be returned and/or decisions to be made. In various interviews it was expressed that, because of the exploratory nature of recent drilling activity, greater latitude, or quicker decision making on the part of authorities, was needed. **However, a contrasting perspective can be offered - current institutional arrangements and processes may indicate caution on the part of authorities.** Despite this contention, one government official did express the opinion that there is a learning curve for all involved.

- Environmental and Technical

Environmental and Technical – petitioners' concerns

- *Concessions issued for EU Natura 2000*
- *Destruction of roads and fields*
- *Monitoring of pipes for corrosion*
- *Use of explosive materials*
- *Borings contain heavy metals and radioactive elements*
- *Storage of borings in unauthorized locations with no oversight or monitoring*
- *Use of illegal poisons and not registering compounds in REACH*

The main thrust of the petitioners concerns concern environmental risks. These can be addressed through a systemic analysis of the individual risk elements. A substantial assessment of the risks indicates that environmental concerns are important to all actors. This combined with uncertainty about the future regulatory environment can hinder certain types of activities taking place and change the location of extraction activities. Shale gas extraction practices can be shaped by environmental concerns.

- Environmental concerns

Environmental compliance and performance risk: Financial risk stemming from existing and future environmental regulations

The environmental impact of shale gas exploration and exploitation is a significant concern of petitioners. The interviews conducted in Poland provided significant insight into how both shale gas drilling technology is used and how Natura 2000 areas may or may not be impacted when shale gas is extracted. These concerns are relevant to citizens who are concerned about the environment and also gas companies themselves. Current and future environmental regulations can directly impact the profitability of shale gas exploitation.

Interviews with gas company officials and geologists indicated a high level of awareness about Natura 2000 areas. From a company perspective, the need to avoid these areas because of restrictions was expressed. One Polish expert reported that the main shale gas areas that will be drilled are not located in Natura 2000 areas. The main shale gas areas are in lowland areas which are primarily horticultural in nature. Outside of these areas there is limited potential for production, so there is an official "choice to avoid Nature 2000 areas."

If drilling were to occur, then procedures would need to be in place to prevent damage to the protected elements of Natura 2000 areas. The legal environment in Poland has been

assessed and has been determined to comply with relevant EU directives in this regard (such as environmental impact assessments).⁷⁹ Interviewees stated that drilling sites outside protected areas could be chosen and, if necessary, horizontal drilling could be employed to extract any gas that is located underneath them.

Regardless of the technical solutions available, the environmental compliance risks are the top concern for both shale gas advocates and opponents. In theory, **any environmental damage caused by the shale gas industry can be expected to increase the risk that companies will suffer financial losses - with the potential outcome that all extraction activity will be halted.** This indicates the existence of **performance risks**, where operators are contractually obligated to provide supply but may not be able to meet their contractual obligations because of stoppages in work (if we obviously consider that the national authorities will ensure the full and efficient implementation of environmental law). Research conducted by Polish Geological Institute-National Research Institute (PGI-NRI)⁸⁰ indicates there are already established monitoring practices that show awareness of the environmental risks of shale gas exploitation.

- Carbon emissions and shale gas

Another substantial environmental consideration that must be considered concerns the CO₂ emissions generated from both coal and shale gas. If gas is to partially replace coal in the country's energy mix, then CO₂ savings must be considered. Research commissioned by DG CLIMA provides a comparison of these potential savings. Examining the lifecycle GHG emissions of shale gas and coal in power generation indicates that shale gas offers the potential for a 41% - 49% reduction in GHGs.⁸¹ However, these assumptions are based on Russian, South African and South American coal. Analysis done using Polish coal indicates greater reductions in emissions are possible.

However, domestically-produced coal produces more emissions per CO₂/kWh. In addition, the assumed power plant efficiency rate of 48% in the DG CLIMA study contrasts with the reality of Poland's aging plants which have an average efficiency of 25%-35%.⁸² Potential savings under current conditions are therefore substantially higher than those reported by the DG CLIMA study. **Compared to lignite coal, the CO₂ savings created by using shale gas are 74% - 78%, while compared to hard coal CO₂ avoided emissions of 70% - 74% may be expected. Using a future power plant efficiency rate of 48% (as assumed in the DG CLIMA⁸³ study) CO₂ savings using shale gas rather than lignite coal are 59% - 64%, while compared to hard coal savings are 51% - 58%** (see Annex I for analysis). Currently, only 2% of electricity is produced using gas in Poland. Shale gas is seen as a viable source of energy for new power plants. Projections for the Polish energy mix in 2050 indicate that gas could comprise 20% of the total energy mix, while lignite (the most CO₂ intensive source of energy) will still comprise 15% of the energy mix, with the use of renewable energy sources (RES) not rising above 20%.⁸⁴ The conclusion is that domestically-sourced shale gas (or pipeline gas) significantly reduce Poland's GHG emissions when compared to current and future methods of electricity production using Polish or imported coal. The replacement of coal by shale gas may assist Poland to reach (the previously vetoed by the Polish) GHG emission targets contained in the 2050 EU decarbonisation of the power sector; even if further reduction methods are necessary.

⁷⁹ Philippe & Partners, *Final Report on Unconventional Gas in Europe*.

⁸⁰ Polish Geological Institute-National Research Institute (PGI-NRI) in Warsaw, "Państwowy Instytut Geologiczny - PIB - Environmental Impact of Hydraulic Fracturing Treatment Performed on the ŁEBIEŃ LE-2H WELL."

⁸¹ AEA Technology, *Climate Impact of Potential Shale Gas Production in the EU*, 67.

⁸² Earth on the crossroads (Energetyka Konwencjonalna), *Conventional Energy (Ziemia Na Rozdrożu)*.

⁸³ AEA Technology, *Climate Impact of Potential Shale Gas Production in the EU*.

⁸⁴ Mielczarski, "Prognozy Produkcji Energii Elektrycznej i Zużycia Paliw."

- Local environmental and infrastructural impacts

The impact that the shale gas industry can have on local infrastructure and the environment (such as roads and fields) relates to the larger issue of the localized impact of the gas industry. **The greater the unmitigated environmental (or even social) impacts are, the greater the chance is that future regulations or popular discontent will impact operators.** Communities need to be made aware of the impact the gas industry will have. Experiences from the US do provide some information about what to expect and these have been both documented⁸⁵ and experienced by local Polish officials. **The Ministry of Foreign Affairs⁸⁶ has arranged study tours for local officials to the US and Canada to increase their understanding of the economic and environmental impacts of the shale gas industry.** The industry and government are undergoing a phase of learning while the exploration phase of shale gas is occurring. As documented, local impacts are being assessed⁸⁷ and revisions to laws and regulations may occur.

- Financial

Financial – petitioners' concerns

- *Reduction in economic activity for agro-tourism, farming and forestry*
- *Payment for water is not enough and for the large amounts extracted*
- *Higher tax on mineral extraction means higher prices for coal and gas for consumers*
- *No legal or financial guarantee from concession holders for ecological or social catastrophe No requirement to carry out land restoration or to compensate residents*

The financial and environmental concerns of the petitioners are expressed in relation to the environmental impacts that shale gas will have on the immediate environment, which may include decreases in income for business, citizens and the state. In the interviews conducted, and in further studies about the potential role of shale gas in the Polish economy⁸⁸ it is stated that significant investment could be encouraged by the existence of a shale gas industry. However, despite a projection that 500,000 new jobs could be created,⁸⁹ a transparent pricing regime and a predictable investment climate needs yet to be created along with built infrastructure.

The broader economic impact is assessed in a study sponsored by PKN Orlean and carried out by the CASE Scientific Foundation.⁹⁰[citation] Three different growth scenarios are developed for the shale gas sector: moderate; increased foreign investment and accelerated growth. The projection ranging out to 2025 foresees 27,000 direct jobs created in the accelerated scenario and 483,000 indirect jobs created. However, this would require the drilling of 305 wells annually and annual investment of USD 3.5 to 4 billion. This is all extremely optimistic at this point based on the minimum amount of wells drilled and the operating speed of both companies and the Polish government.

Petitioners stated concern about financial guarantees and environmental restoration. In Poland every mine (or drilling site) must have an emergency plan which describes the rules

⁸⁵ Christopherson and Rightor, "How Shale Gas Extraction Affects Drilling Localities: Lessons for Regional and City Policy Makers."

⁸⁶ Ministry of Foreign Affairs, "In-person Interview."

⁸⁷ Polish Geological Institute-National Research Institute (PGI-NRI) in Warsaw, "Państwowy Instytut Geologiczny - PIB - Environmental Impact of Hydraulic Fracturing Treatment Performed on the ŁEBIEŃ LE-2H WELL."

⁸⁸ Czyzewski, Bodnari, and Kozieja, *Gas (R)Evolution in Poland: Which Way to Success?*.

⁸⁹ Ibid.

⁹⁰ Ibid.

which should be followed in an emergency. The mining authority (WUG) oversees this. Other agencies are also involved: The General Directorate for Environmental Protection and the Chief Inspectorate for Environmental Protection regulate the environmental situation and can impose penalties or fines. The state mining authority is responsible for ensuring that land is restored and the Geological Mining Law (PGG) in Article 129 describes the closure process and reclamation work.

- Price risks

Fuel price risk: Price variability and uncertainty over future costs (e.g. Russian pipeline gas vs. shale gas).

An increase in the price of energy is a concern that must be considered whether shale gas is extracted or not. When it is considered that gas produces lower CO₂ emissions compared to coal, and that the Polish government may not increase its RES above 20% by 2050⁹¹ then gas must be considered a viable option for replacing coal for reasons of: a) its lower cost (if the ETS allowances are priced high to discourage coal use); b) its lower emissions and; c) the RES balance. Declining domestic production of conventional gas will result in Poland importing more gas from both the East and West. **The dominant position of Gazprom on the Polish market may lead to increases in and maintenance of high gas prices (this may also have broader economic consequences).** The use of either LNG or pipeline gas from Germany (or other neighboring countries) may impact gas prices in Poland – however, this impact will be minor compared to the dominance of Russian controlled gas. Therefore pricing levels will remain high. **Long-term contracts offer the chance for stable pricing (albeit possibly high prices), while short term contracts (available from non-Russian/CIS sources) offer the chance for more flexible pricing that may be lower, as is currently the case.** Domestically-sourced gas, as with the case now, offers a stable pricing structure. **Shale gas is perceived to be able to replace the conventional stability of gas prices.** This, however, is dependent on other factors such as extraction costs, market conditions and well performance. Further research is necessary to understand the impact of carbon pricing (ETS), Polish shale gas geology, extraction costs and how this may affect the price of shale gas versus coal in the electricity mix.

- Domestic demand for gas

Demand risk: Gas produced will not be needed as projected (e.g. the impact of renewables, LNG, market prices)

The demand for gas is assumed to exist in Poland for environmental reasons as gas could serve as a replacement for coal. Projected annual demand growth of 0.5%⁹² means the power sector will require more gas (**Figure 3**). Currently, gas is more expensive than coal, thus limiting demand. Carbon Capture and Storage (CCS) for coal can be considered a possibility but for technical reasons it is considered that using coal with CCS systems will cost more than gas. **Currently, the dominant position of coal on the Polish market and its low price means that gas cannot compete.** This has created two problems and indicates the need to develop a competitive gas market in Poland. First, there is a lack of a networked infrastructure for gas fired power plants to draw on. Second, the regulated price and current monopolistic gas market creates no pricing signals for producers of gas. Because of the physically and legally restricted market for gas, even if gas is produced from shale, problems could be experienced bringing it to market. **Interviewees and government officials expressed the view that market liberalization will occur along with planned investments into tangible infrastructure.** However, there are also security of supply concerns over possible Russian ownership of companies in Poland's

⁹¹ Mielczarski, "Prognozy Produkcji Energii Elektrycznej i Zużycia Paliw."

⁹² Mielczarski, "In-person Interview."

energy sector. How the market is opened to competing companies, within a liberalized market and balancing energy security concerns will be an important consideration.

Other sources of conventional gas that are potential alternatives to Polish shale gas are LNG and gas derived using interconnectors to neighbouring countries. However, the infrastructure and pricing (as discussed above) act to constrain higher levels of gas imports that could replace declining domestic production while meeting growing demands for a lower CO₂ energy source. Greater imports from Russia remain a possibility; however, further increasing these imports will increase dependency on Russia, thereby preventing a stronger negotiating position for Poland developing for lower priced gas and most likely limiting its use on the market for power production (see below for further analysis).

- Shale gas investments

Financial and Investment Risks: Lack of money and uncertainty hinder investments into energy infrastructure

The financial risks concerning shale gas, as stated by the petitioners, concern a proposed higher tax for mineral extraction which could affect the final energy price. This is an important consideration. As stated above, Poland has a very low tax on extraction. Currently this tax is .005%. **The one certainty about Poland's mineral tax regime is that this will change. The tax regime was defined with state-owned companies in mind, with profits or benefits flowing back to the state in one form or another.** Discussion is currently ongoing within state ministries about how a new tax and royalty regime could be established to encourage international investment into the sector; one which would also provide the state (and its citizens) with fair compensation in return for allowing the extraction of national resources.

There are two types of risk that apply to a potentially higher tax on energy resources as identified by the petitioner: **Financial risk**, which holds that there is limited amount of money to finance investments and **investment risk**, which is due to uncertainty about the operational environment. These risks have a direct impact on the environment. If there is no or only a low level of investment, shale gas extraction in Poland will not occur at a sufficient scale, reducing the scale of the industry (and its environmental impact).

Interviewees in both companies and state institutions are aware that the current uncertainty surrounding shale gas exploitation is slowing the scale and speed of investment and exploration into the industry. Many interviewees indicated that only the minimum amount of work was being performed to satisfy the conditions for exploration concessions. As one company official stated, "without international investors the Polish shale gas project will never happen." There are conflicting opinions about when a final decision will be made about the new tax regime. Regardless of whether decisions will be made by 2014 or 2015 or earlier, it was reported that greater knowledge about the size of Poland's shale gas potential was needed to provide a clearer picture of what is required to attract investment. The financial and investment risks, identified by the petitioners, are shared by other stakeholders and will influence the scale of shale gas extraction in Poland.

1.3. Recommendations and Suggestions

Underlining this analysis are two risk-related elements. First, the potential risks inherent with exploiting shale gas, and second, how shale gas mitigates other risks. By addressing the petitioners' concerns in this manner it was possible to present them within a broader assessment of the impact that shale gas exploration and exploitation has on the environment and society in general.

The findings of this risk analysis of concerns expressed by petitioners' highlights a range of recommendations and suggestions for further action and investigation.

Recommendations and suggestions:

- Polish shale gas is becoming a 'state project' sufficient independence must be given to state bodies through clearly defined roles to protect objectivity. This even applies to state owned firms which must make investment decisions in the interest of the shareholder
- The shale gas sector in the US did not engage in (Corporate) Social Responsibility methods until social tensions were too high; significant local and national stakeholder involvement should be formalized in Poland to avoid the same situation;
- International best practices for shale gas extraction must be applied, but also localized to the Polish institutional and environmental arrangement
- R&D projects financed by the state must *not* only go to R&D on technical equipment for shale gas extraction. Social and environmental sciences need funding as well. The impact of shale gas development – and its success or failure – rests with local communities. Understanding the short to long-term impact on residents and their surrounding infrastructure and environment, particularly in the early exploratory period, is essential for ramping up the shale gas sector. Society influences technological development
- How Natura 2000 areas are protected in relation to shale gas extraction needs to be clearly communicated; a voluntary agreement between shale gas companies about how sensitive areas are treated could alleviate tensions. This issue will not disappear, so a pro-active industry approach (based on Social Responsibility guidelines) needs to be developed
- Changes to Poland's energy tax and royalty regime must be clarified sooner rather than later. Investment risk is high until this issue is resolved
- The ramifications of the potential displacement of coal by shale gas across the EU must be studied; GHG emission benefits are likely to be significant
- Further study and concise summaries should be available to the public that address how each aspect of shale gas testing and extraction are overseen by state institutions
- Currently, information about shale gas technology and its impacts is largely provided by companies. Even companies themselves report that this is an inappropriate situation. The government – through independent institutions – must facilitate dialogue and research and disseminate information to citizens
- Research produced at the EU level has been designed to assess the technical and legal aspects of shale gas extraction; little consideration has been given to the impact on the markets that shale gas will have, either on specific countries or on the common European energy market – further work is necessary

- Effective procedures or 'walls' must be put in place to prevent state owned companies receiving less restrictive environmental conditions than would normally be justified by the Ministry of Environment. If shale gas becomes a 'state project', sufficient independence needs to be ensured for environmental regulators. To date this does not appear to be a problem; however, greater attention should be paid to this issue when (and if) the industry grows. Instilling a culture of regulatory independence early on can have important benefits later
- Further study is needed to see if shale gas displaces RES or coal on the Polish market. This examination needs to consider GHG emission allowance pricing levels and possible cost scenarios for shale gas extraction
- Study tours of the US and Canada should continue to be conducted so local authorities can be aware of the impact of medium to large scale shale gas extraction
- Administrative capacity risks are highlighted as both a barrier to ramping up shale gas extraction and for ensuring the environment and citizens are adequately protected. It is suggested that sufficient institutional and political effort is used to ensure proper staffing levels and training in order to be responsive to both the public's concerns and companies' technical needs.

2. BULGARIA

KEY FINDINGS

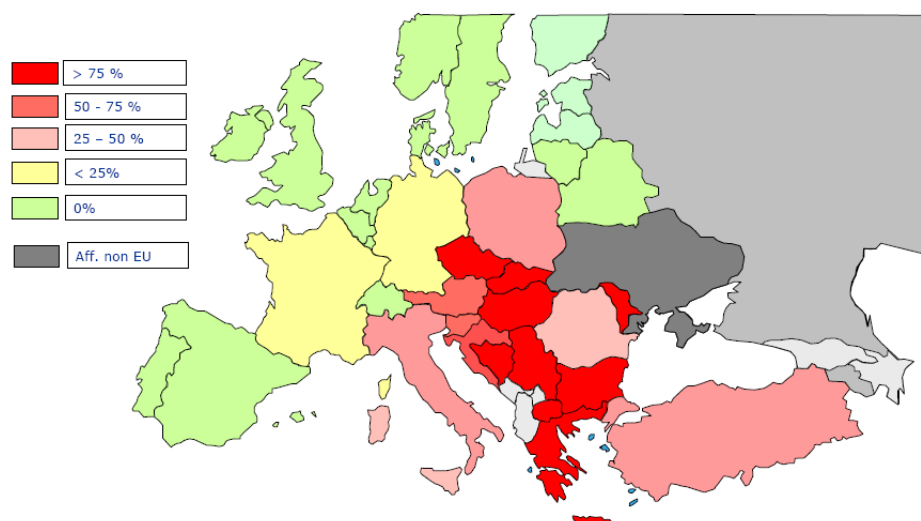
- Since January 2012, the use of hydraulic fracturing to extract Shale gas has been banned in Bulgaria
- Bulgaria is heavily dependent on Russia for most of its gas supply
- Gas contracted with from Russia provides a stable and predictable price for gas
- New gas interconnectors to neighbouring countries offer Bulgaria an additional option for gas diversification
- The discovery of a large gas field in the Black Sea could be significant and could alter Bulgaria's gas security of supply
- The exclusion of shale gas technology does not mean that Bulgaria is averse to new energy technologies
- A greater social discussion needs to occur over Bulgaria's future energy mix
- The planned pipelines of South Stream and Nabucco West offer diversification of supply routes, with only Nabucco West offering diversification of supply
- LNG terminals in the Southeast of Europe offer an additional gas diversification options

- Over the next 5 to 10 years greater sources of gas will become available to Bulgaria, without shale gas, the country will still have sufficient options to diversify away from Russia

2.1. Background

The January 2009 dispute over gas between Russia and the Ukraine culminated in the cutting of gas supplies to Europe for 22 days. The cessation by Gazprom of the gas supply for Ukrainian consumption started on January 1, 2009 and then action taken by the Ukraine in the form of diverting the 'off-take' gas supplies destined for Europe resulted in complete termination of supply to Europe on January 7, 2009. Gas was 100% cut off for 13 days to Bulgaria, Serbia, Bosnia and Herzegovina and FYR of Macedonia in the midst of a cold winter. That these countries held limited or no reserves underscores both the severity of the dispute and the lack of infrastructure and preparedness. Map 2 shows how each country was affected in Europe. Hungary and the Czech Republic were also significantly affected although the existence of alternative supply and supply routes through interconnectors helped to mitigate the full effects of the dispute on them.

Map 2 Reduction of Gas Supplies from Russia and the Ukraine in 2009 (%)

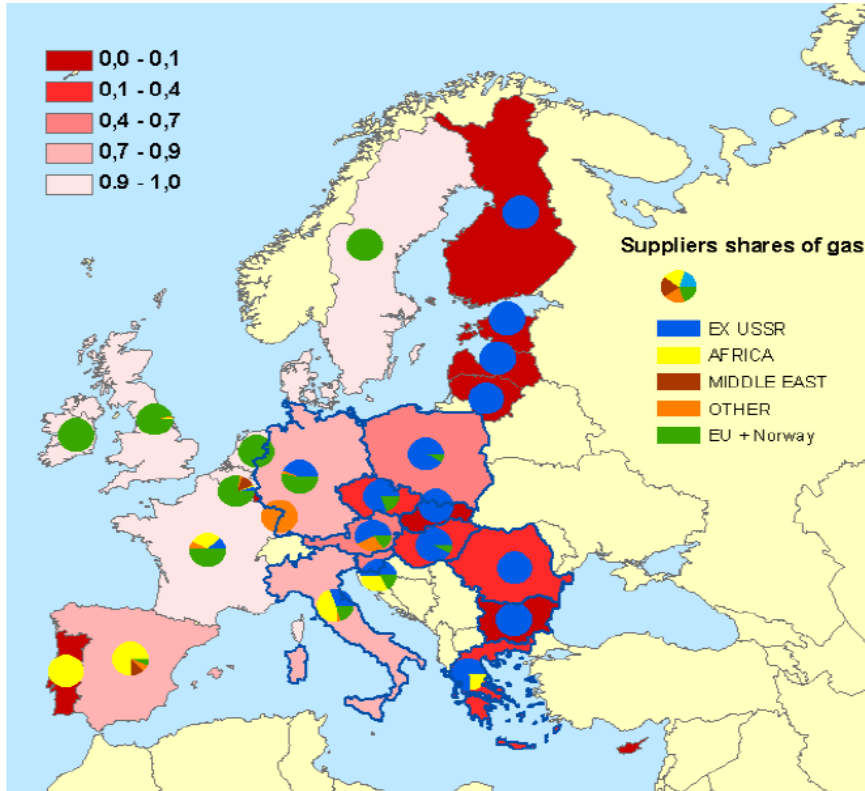


Source: DG TREN

The high dependency of Bulgaria⁹³ and other EU countries on external suppliers is highlighted in Map 3. This demonstrates the significant dependency that Bulgaria has on supplies from Russia and other Central Asian countries that contract with Gazprom for deliveries to Europe. In Bulgaria the only suppliers are former Soviet Union countries contracted through Gazprom. Table 10 in annex shows the gas suppliers for the country.

⁹³ Key facts about the Bulgarian energy mix are available in annex II.

Map 3 Gas Suppliers for European Union Countries



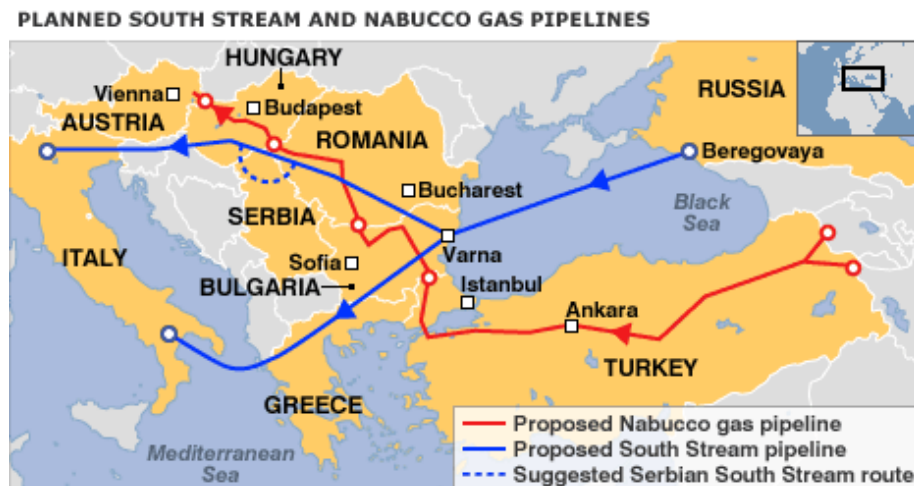
Source: European Commission – Institute for Energy⁹⁴

- Gas supply diversification options

There are long distant proposals for two gas pipelines which could run through Bulgaria: Nabucco West and South Stream (Map 4). **Nabucco West is composed of a consortium of European oil and gas companies.** The updated route will bring gas from the Caspian Sea to Austria (it will arrive to Bulgaria overland from Turkey). Nabucco West will largely rely on Bulgaria’s existing gas network to move gas through the country and make it available for domestic consumption. A decision will be made in 2013 whether Nabucco West will be built.

⁹⁴ European Commission Joint Research Center Institute for Energy, Energy Security Unit, “Energy Security Indicators.”

Map 4 Nabucco and South Stream gas Pipeline Routes



Source: BBC⁹⁵

South Stream is a Russian-planned gas pipeline that may transport Russian and Central Asian gas to Austria. It will be laid under the Black Sea from Russia and will come onshore in Bulgaria. Both South Stream and Nabucco West are seen as competitors of this option; only one may be built, or both. Either pipeline would offer Bulgaria an alternative source of gas.

More gas can come from boosting gas network interconnectors to Bulgaria's neighbours and throughout the Southeast European Region. **New interconnectors with Romania and Turkey are either under construction or are planned.** This will enable Bulgaria to weather any supply disruptions such as the 2009 event. Gas storage has also been increased in Bulgaria, smoothing any likely supply disruptions. The increased interconnector capacity can assist Bulgaria to diversify its gas supply. LNG terminals planned in Croatia and the proposed **AGRI LNG project that may transport gas across the Black Sea from Azerbaijan to Romania could increase supplies to Bulgaria.**

Finally, domestic off-shore production could take place from Bulgaria's continental shelf. Initial tests indicate that large quantities of gas could be extracted and be sufficient to provide the country with 25 – 30 years of independent gas supplies. A concession has been awarded to a consortium of Total, OMV and Repsol for gas and oil exploration.⁹⁶ However, reaching the gas is technically challenging as it is at a depth of 5,000 meters. Bulgaria's ability to diversify away from its significant dependence on Russia may become a reality over the course of the next 10 years due to one or more of the potential gas projects described above.

2.2. Bulgarian Energy Policy Risk Analysis

The scars of the 2009 gas dispute between Russia and the Ukraine when the flow of gas to Bulgaria was cut off may have faded but the event underscores the role of energy diversification. **Bulgaria remains wedded to Russian energy supplies and technology: rejecting shale gas as an alternative energy source raises both political and energy security issues.** The Bulgarian parliament in 2012 overwhelmingly rejected the use of shale gas technology by imposing a moratorium on exploration and

⁹⁵ "Gazprom to Control Serbia's Oil."

⁹⁶ Novinite.com - Sofia News Agency, "Black Sea Natural Gas to Make Bulgaria Energy Independent: Black Sea Natural Gas to Make Bulgaria Energy Independent -."

extraction. This decision was based on environmental grounds and backed by broad social agreement. **Because of this ban, addressing the concerns of the petitioner requires a shift in analysis to permit consideration what the *absence* of shale gas to the Bulgarian market means.** The following is a concise summary of the issues involved. The aim is to evaluate, as with Poland, the relevant risks associated with Bulgaria's energy supply sources. If shale gas is taken off the table as an energy source, then what are the risks associated with the diversification options of gas supply that remain?

A presentation of the gas diversification options and the risks associated with them is given in Figure 4. The risk categories are listed to demonstrate that each of the options and how their ownership or investment structures are established must be considered - both for their short term and long term benefits. **Ownership and investment are essential for getting any of the gas diversification projects off the ground. Privately-owned firms assess risk differently and will influence the speed and type of development that occurs.** For example, off-shore oil and gas development will need to be done by international oil and gas companies since Bulgarian firms do not possess the technology or expertise. Different financial incentives must therefore be offered, along with an assessment of the risk environment in Bulgaria. Each of the 6 categories used for the gas diversification projects reflects a different mix of companies and risks. An assessment of the risk categories and how they are applicable to Bulgaria is presented next.

The dependence of Bulgaria on imported gas, contracted through Russia's oil and gas group Gazprom, means diversification of supply sources would increase the country's security of supply. The total shut down of supplies in 2009 demonstrated the need to diversify. This analysis concentrates on the risks present with the diversification options.

- Short term - Contractual related risks

Bulgaria's reliance on Russian gas actually creates a risk regime that is stable in the short term. If the risks associated with contract fulfilment and environmental compliance *in Bulgaria* are considered, then piped gas is a good short term option (if the country does not find it imperative for other reasons to foster alternative supplies). In the case of Poland, for geopolitical and economic reasons energy diversification is more strongly desirable than for Bulgaria. Although Bulgaria is taking steps to diversify, the connection with Russia remains strong. Each of the risk categories defined in **Table 5** will be addressed in the Bulgarian analysis.

- Fuel price risk: **The price of gas in Bulgaria is predictable and constant.** However, the total reliance on Russia for gas imports, with no alternative available, means there is no price competition that enables Bulgaria to benefit from lower priced gas (compared to some domestic gas that is 40% cheaper). To date there has been little progress made to encourage significant diversification that would impact either the high level of dependency or price. Future supply diversification could offer Bulgaria the chance to receive more competitively priced gas. However, this would need to be at a sufficient volume to be competitive with Gazprom deliveries
- Demand risk: Demand and supply of gas in Bulgaria is matched appropriately
- Performance risk: **The biggest risk to Bulgaria from reliance on Russian gas is interruption of the contracted supplies.** The 2009 interruption indicates the risk inherent with having a single significant source of supply. Greater diversification of

gas supplies is needed in Bulgaria. The growing options for diversification (discussed above) can potentially provide relief from the current situation. The key to mitigating supply disruption is the existence of gas interconnectors which can be relied on to cover shortfalls in deliveries

- Environmental compliance risk: The direct environmental impact of current gas supplies contracted with Gazprom means there is little risk exposure to regulatory changes. While CO₂ emissions are higher for transported gas than domestically produced shale gas,⁹⁷ other environmental concerns do not need to be considered at this point in time. **However, the environmental compliance risk for future gas and oil extraction projects which are currently under consideration in the Black Sea must consider the environmental risks that they pose for the region.** Pipeline routes will also be subject to environmental scrutiny. The imposition of the shale gas moratorium essentially cut short the debate that needs to occur about Bulgaria's energy mix and the acceptable impact on society and nature. Therefore, future investors in energy projects should consider the role that society and the environment play in decision making in Bulgaria. **If environmental arguments are the prime reason for the cancellation of shale gas exploration efforts in the country, then it can be assumed that other projects will be subject to similar public scrutiny of their environmental impacts.** However, if politics dominate the decision making process then consideration must be given to better understanding this influential factor.

- Long term – Governance regime risks

- Financial risk: Project financing in Bulgaria for energy projects has a difficult history. Construction of the Belene Nuclear Power Plant was cancelled in 2012 and the high costs of financing Nabucco have already required European Investment Bank help.
- Regulatory risk: The energy regulatory environment in Bulgaria generally places pressure on investors. **Lower than expected approved market prices in the electricity sector have created disputes between energy regulators and private investors.**⁹⁸ The cancellation of Chevron's shale gas exploration permit also indicates the existence of a shifting regulatory regime.
- Technological lock-in: The exclusion of shale gas technology from Bulgaria means only traditional forms of extraction are possible. **However, it is hard to exclude the use of other new technologies from Bulgaria's energy mix.** Certainly, the use of nuclear power as a viable energy option and the deployment of solar and wind indicates that Bulgaria is a country willing to embrace new technologies. Therefore, even in the case of off-shore drilling in the Black Sea there are opportunities for the use of new technologies.
- Administrative capacity risk: This cannot be evaluated for future projects. Nonetheless, state administration would need to be sufficiently modernized to assist new project development.
- Investment risk: The increase in gas diversification options for Bulgaria could lead to significant options to choose from. **The exclusion of shale gas as a domestic source of gas, in the end, may not adversely affect the long term gas security of the country.** If the proposed projects, like Nabucco, South Stream and

⁹⁷ AEA Technology, *Climate Impact of Potential Shale Gas Production in the EU*.

⁹⁸ LaBelle, "E.ON Gets Fed up and Disposes of E.ON Bulgaria"; LaBelle and Jancauskas, "Electricity Post-Privatization: Initial Lessons Learned in South East Europe."

greater interconnector capacity are built then Bulgaria could become significantly diversified to offer price competition and increased security of supply.

2.3. Recommendations and Suggestions

The rejection of shale gas extraction in Bulgaria means the petitioners concerns are difficult to evaluate within their original context. The concise summary here is limited to the options available for Bulgaria and the types of risks associated with gas development projects. The social and environmental concerns that blocked shale gas development in Bulgaria may also influence other projects that may be proposed. For investors this is a relevant risk, while for citizens it is an opportunity to engage in a discussion about Bulgaria's energy mix. Overall, Bulgaria is well-positioned to take advantage of emerging gas projects and potential regional diversification options. In about 5 to 10 years, it is possible that significant conventional gas reserves will be readily available for the country. However, a more thorough assessment of the viability of each project, size of projects and intended markets would provide a better impact assessment for Bulgaria's domestic gas market.

Current suggestions and recommendations based on the above analysis include:

- Bulgaria must fully participate in new gas projects that offer diversified supply sources
- Potential shale gas reserves in Bulgaria could be significant. If current proposed gas projects do not come to fruition, a larger social dialogue should take place to discuss alternative gas sources, including shale gas
- Short term risks are minimal in Bulgaria. It is predicted that actors in the energy sector, because of competing diversification routes, would desire to avoid another event such as the one that happened in 2009 between Russia and the Ukraine. Therefore, long-term risks should be addressed in a planned and long-term strategic manner

GENERAL CONCLUSION

The development of shale gas in Poland and Bulgaria is proceeding along different paths. Justifications for its development in Poland differ from those used in Bulgaria. While the necessity exists for both countries to reduce the cost of gas and increase the security of supply, the two countries have chosen different ways to do so. The plethora of gas projects that could provide a sufficient level of diversification for Bulgaria mean that it does not need to develop a strong pro-shale gas position. Poland differs in its level of energy security due to its geographic proximity to Russia, its historical relations and its need to introduce cleaner energy sources. The dominance of coal in Poland's electricity mix must be reduced for environmental reasons. The economic benefits – *if shale gas can be extracted safely at reasonable prices* - represents a significant opportunity for the country to reduce its dependence on imported gas while increasing the proportion of cleaner electricity in the energy mix. The environmental concerns expressed over the use of hydraulic fracturing must be considered and addressed more pro-actively by authorities. Relevant information should be documented and distributed to the public and greater public involvement in programs should be promoted. These activities can play an important part in making shale gas more acceptable to communities, whose concerns must be addressed – if they accept this technology, and who must share the benefits of shale gas exploitation.

Finally, energy security concerns in former Communist countries must be accounted for at the EU level. Environmental concerns over energy technologies need to be considered and accommodated. Yet, even considering this fact, it is essential when dealing with current environmental and security issues to consider the need to diversify away from using Russian sourced gas which has a monopolistic position in the energy markets of many new EU Member States. Shale gas is changing the global gas market and understanding how this can affect European - particularly Eastern European - energy security must be part of the debate.

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ANNEX I POLAND

Polish energy sector facts

The Polish gas industry is largely dominated by PGNiG (Polish Oil & Gas Company), which is responsible for 98% of all gas production in Poland and owns most of the transmission network.

In 2004, the transmission service was separated from PIGNiG and is currently operated by the state-owned OGP GAZ-SYSTEM company. Since June 2006, GAZ-SYSTEM has a status of TSO.

The Energy Regulatory Office is an independent regulator (established in 1997), which grants licences for gas transmission and distribution, gas storage, domestic trade, import and export, liquefaction and regasification.

There are six regional distribution companies (DSOs). Although they are fully owned by PIGNiG, they have legal and organizational independence.

"The Polish Energy Policy until 2030 adopted in November 2009 was based on the goals of the European energy and climate package and points out six primary developments in the Polish energy sector: increase of energy efficiency, security of energy supplies, diversification of energy mix, increase of the use of renewable energy sources, competition on the energy market, smaller impact of the energy sector on the environment"⁹⁹

Poland vetoed the Low Carbon Roadmap 2050 (prepared by DG Climate Action) twice - in July 2011 for the first time and in July 2012 for the second time. In March 2012 Poland also vetoed the Energy Roadmap 2050 (prepared by DG Energy).¹⁰⁰

Source: Energy Delta Institute

Table 8 Unconventional Wells Drilled in Poland, by Company Responsible

<i>Unconventional Wells drilled in Poland by September 2012</i>		
Company	Concession Name	#
BNK Petroleum	Starogard	1
BNK Petroleum	Słupsk	1
BNK Petroleum	Sławno	1
BNK Petroleum	Bytów	1
BNK Petroleum	Trzebielino	1
Chevron	Frampol	1
Chevron	Grabowiec	1
Eni Spa	Malbork	1
ExxonMobil	Mińsk Mazowiecki	1
ExxonMobil	Chełm	1
3Legs Resources Plc.	Damnica	2
3Legs Resources Plc.	Lębork	2
3Legs Resources Plc.	Cedry	1

⁹⁹ Hinc, "Poland at the Energy Crossroads - Between Energy Security, Economic Growth and Low Carbon Economy."

¹⁰⁰ Ibid.

Marathon Oil	Wielkie Orzechów	1
PKN Orlen S.A.	Garwolin	1
PKN Orlen S.A.	Lubartów	1
PKN Orlen S.A.	Wierzbica	1
POLSKIE NAFTOWE I GAZOWNICTWO S.A.	GÓRNICTWO KARTUZY-SZEMUD	1
POLSKIE NAFTOWE I GAZOWNICTWO S.A.	GÓRNICTWO PIONKI-KAZIMIERZ	1
POLSKIE NAFTOWE I GAZOWNICTWO S.A.	GÓRNICTWO TOMASZÓW LUBELSKI	1
San Leon Energy Plc.	Góra	2
Talisman	Gdańsk W	1
Talisman	Braniewo	1
Talisman	Szczawno	1
	Total:	27

Source: Cleantech Poland Research 2012

Table 9 Lifecycle emissions from coal fired electricity generation (g CO₂eq/kWh)

Russia	South Africa	South America	Poland
828	768	714	980 – 1 230 (for lignite) 790 – 1080 g CO ₂ /kWh (for hard coal) ¹⁰¹

- Source: DG CLIMA 2012 (cf EcoInvent), p68 and Polish data from Energy Institute - Thermal Processes Institute 2008

ANNEX II BULGARIA

Key facts about the Bulgarian energy mix

Bulgaria depends on Russia for 100% of its petrol, 95% of natural gas [imports +local conventional production] and 100% of the nuclear fuel needed for its Kozloduy power station

Bulgaria may hold 300 billion to 1 trillion cubic meters of shale gas that could last for 100 to 250 years.¹⁰²

Natural gas has a share of about 12.4% in the gross energy consumption of Bulgaria. It is mainly used by industrial consumers and district heating companies in the countries, and only about 3% of households use it for direct consumption.

Since the 1970s natural gas in Bulgaria is predominantly (>97%) imported, and all the imports come from one source (the Russian Federation) through one pipeline (crossing the Ukraine) and according to contracts with subsidiaries of one company

¹⁰¹ Energy Institute, Thermal Processes Institute, *Current Technical Possibilities of Decreasing CO₂ Emissions in Coal-fired Power Plants (Obecne Możliwości Technologiczne Ograniczania Emisji CO₂ z Elektrowni Węglowych)*.

¹⁰² Assenova, "Bulgarian Government Withdraws Chevron's Shale Gas Permit."

(Gazprom). The rest of the consumed quantities (less than 5% in the last decade) come from local sources.¹⁰³

In 2010 about 37.7% of consumption was from the energy sector (mainly district heating companies); 27.9% - chemical industry; 16.8% - from gas distribution companies supplying end consumers of gas; 5.8% - glass and porcelain industry¹⁰⁴

The government withdrew Chevron’s Bulgarian exploration permit on January 18, 2012. This was after environmental groups held protests in Sofia and 12 other cities that stated their opposition to hydraulic fracturing.¹⁰⁵

In January 2012, the Bulgarian parliament voted for a moratorium on shale gas extraction using hydraulic fracturing techniques; 166 votes were for the moratorium and 6 against. The ban remains in place.

According to professor of Geology, Kristalina Stoykova, the technology has been used in the same region for many years. In fact, 200 drills for conventional gas and oil already pass through the underground water supplies of the Dobrudzha plane.¹⁰⁶

Bulgaria continues to diversify its energy mix: “we’re still trying to work for diversification in any area – any electricity generation, gas, oil, and so on and so forth. We have made great progress, in Bulgarian terms, of using renewable energy sources, also using coal. Bulgaria is very active. We are planning to start construction of the Gorna Arda hydroelectric power station,”¹⁰⁷ said Bulgarian Prime Minister Boyko Borissov.

Table 10 Market share of Bulgarian gas suppliers and intermediaries

Type of supplies	<i>mcm</i>		<i>share (%)</i>	
	2010	2009	2010	2009
1. Imported gas	2480	2475	97.87%	99.64%
1.1.Overgas Inc. AD	2069	2000	81.65%	80.52%
1.2.WIEE (Gazprom 50% owner)	360	429	14.21%	17.27%
1.3. DEPA (Greece)	0	3	0.00%	0.12%
1.4. Gazprom Export	51	43	2.01%	1.73%
2. Local sources	54	9	2.13%	0.36%

Source: Bulgargaz EAD 2010 (compiled by A. Georgiev)¹⁰⁸

¹⁰³ Georgiev, “E&I Country Risk Assessment Exercise.”

¹⁰⁴ Ibid.

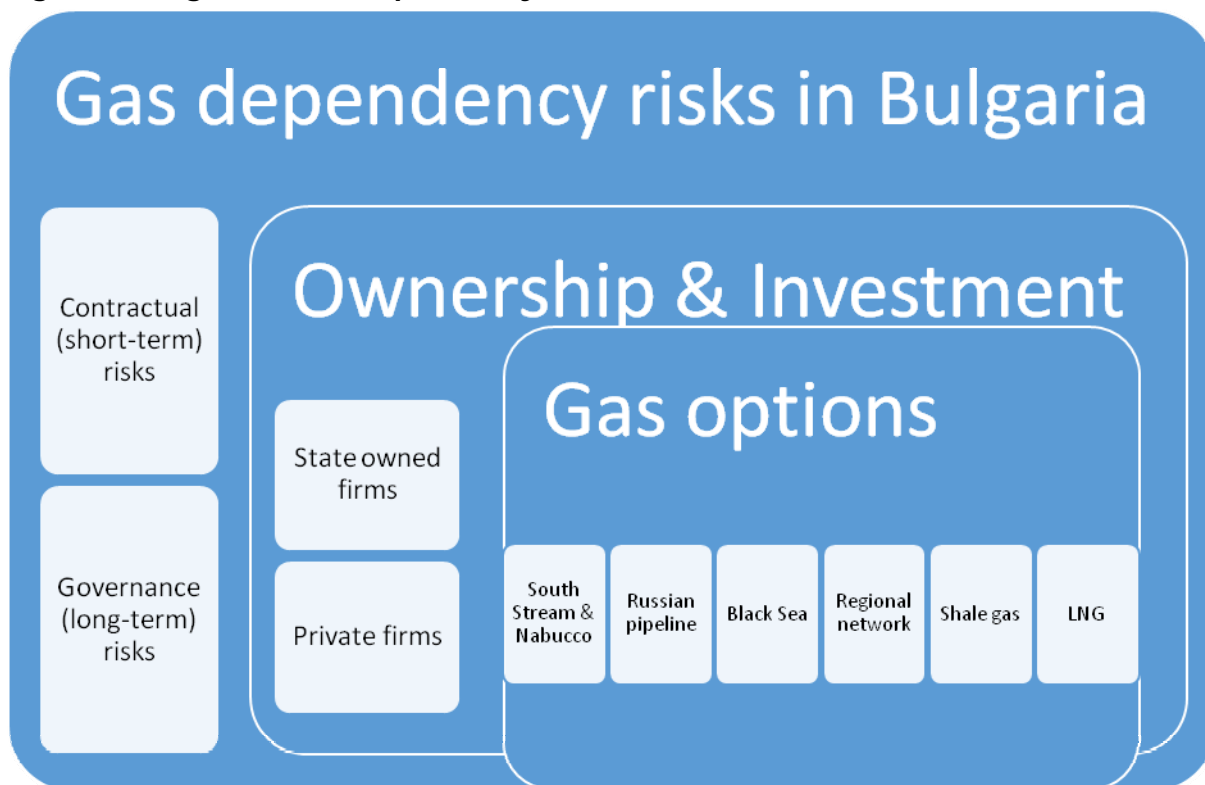
¹⁰⁵ Assenova, “Bulgarian Government Withdraws Chevron’s Shale Gas Permit.”

¹⁰⁶ Ibid.

¹⁰⁷ Borissov, “Remarks With Bulgarian Prime Minister Boyko Borissov After Their Meeting.”

¹⁰⁸ Georgiev, “E&I Country Risk Assessment Exercise.”

Figure 4 Bulgarian Gas Dependency and Risk Outline



ANNEX III

On the basis of the CO2 emissions data:

The savings ratio mentioned in the study (41-49%) underestimates the real potentials because of two reasons. First, the fuel produces more CO2 in Poland, which increases savings opportunities. Second, power plants are less efficient than assumed, which further increases potential savings.

The emissions with the study's assumptions (Russian - South African - South American coal, 48% efficiency) are X gCO2/kWh electricity. We know shale gas would bring this down to (0,51-0,59) X.

Taking into account the 2 differences we can calculate a value for the Polish case.

1) The average emission/kWh value for the Russian - South African - South American coal is 770 gCO2/kWh (just the average of the 3 values*). The mid-range values for Polish lignite and hard coal are 1105 and 935 gCO2/kWh, respectively. With only this difference, X would grow to $1105/770=1,435 X$ and $935/770=1,214 X$.

2) However, the other difference also matters: plant efficiency is 30% (mid-range) instead of 48%. We got the original X for electricity by multiplying the fuel emission value by $(1 / 0,48)**$, which is now replaced by a multiplication by $(1 / 0,3)$. $(1/0,3)/(1,0,48)=1,6$. So, emissions per kWh electricity grow by a factor of 1,6.

As a consequence, the value for lignite is $1,6*1,435=2,3 X$ and the value for hard coal is $1,6*1,214=1,94 X$. These have to be compared with the (0,51-0,59) X shale gas values.

For **lignite**: $(0,51-0,59)/2,3 = 0,22-0,26$, so the savings are **74-78%**.

For **hard coal**: $(0,51-0,59)/1,94 = 0,26-0,3$, so the savings are **70-74%**.

Under the same efficiency as in the DG CLIMA study – 48%

Then the calculation changes and without the 1,6 factor.

For lignite: $(0,51-0,59)/1,435=0,36-0,41$, so the savings are 59-64%.

For hard coal: $(0,51-0,59)/1,214=0,42-0,49$, so the savings are 51-58%.

* if the study calculates with a weighted average, this can change

** because electric energy is 48% of the heat, so emissions per unit of heat = 0,48*
emissions per unit of electricity

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DIRECTORATE GENERAL FOR INTERNAL POLICIES
POLICY DEPARTMENT C: CITIZENS' RIGHTS AND
CONSTITUTIONAL AFFAIRS

PETITIONS

**Regulation of the Unconventional fossil
fuels extraction - Climate Change
Considerations**

NOTE

Abstract

This report considers the second part of Petition 0895/2012e, namely the petitioner's concerns around the inclusion of natural gas as a "low carbon" fuel source within the Horizon 2020 research programme. We conclude that this is a legitimate complaint due to the conflict with Horizon 2020's broader objectives and with the EU's internal and external climate change commitments. All fossil fuels would be regarded similarly.

This document was requested by the European Parliament's Committee on Petitions.

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EXECUTIVE SUMMARY

This report considers the second part of Petition 0895/2012e submitted by Mrs. Rosemary Rechter, namely her concerns around the inclusion of natural gas as a “low carbon” fuel source within the Horizon 2020 research programme and the conflict this brings with Horizon 2020’s own objectives and with the EU’s wider commitments on climate change.

The first part of the petition specifically raises the issue of environmental impacts and regulation of gas production from shales by hydraulic fracturing and so this report also considers the climate change implications of gas produced in this way.

KEY FINDINGS

- Fossil fuels of all kinds are high carbon although the carbon content varies between them. It would be erroneous to regard any fossil fuel as “low carbon”.
- The inclusion of natural gas technology research and development that is not directly related to carbon capture and storage (CCS) is incompatible with the EU’s internal and external climate change commitments. More specifically, such research is incompatible with climate change and natural resource objectives expressed within the current Horizon 2020 proposals.
- The definition of gas as eligible for Horizon 2020 funding will by definition draw finances away from other energy technologies. There are well established public economic reasons to support research into novel technologies with public finances and to reduce the incentives to technologies that cause public harms.
- Infrastructure investment in shale gas production in the UK could be of a scale approximately equivalent to national renewable energy targets under the 20-20-20 package.
- In drawing the above conclusions no distinction is made between gas produced from conventional and unconventional reserves. The arguments also apply to all other novel sources of fossil fuels.

Background and Overview of the Petition

The production of 'unconventional' gas from shales, tight sandstones and coal beds promises to have a substantial impact on global energy systems in the coming decades. The existing technologies of horizontal drilling, 3d seismic surveying and hydraulic fracturing have been combined in the last decade to enable the production of natural gas from impermeable source rocks. At present, these methods are only used at scale within the United States (US) fossil fuel industry. In the last few years, wholesale prices have fallen substantially as gas produced from shales and other unconventional reserves has become available in high volumes (Rogers 2011). The gas industry and its supporters claim that this growth in indigenous gas supply is positive from both energy security and climate change perspectives as it displaces imported gas or indigenous coal, reducing greenhouse gas emissions (Kuhn & Umbach 2011; Lovelock 2012).

There is a wide geographical abundance of unconventional gas resources with significant resources identified in high energy demand economies, such as North America, China and within the European Union. Many energy policy makers, commentators and researchers are optimistic about importing the relevant production technologies from the US and exploiting these reserves. It is hoped that this will contribute to decarbonisation and increased energy security (e.g. Helm 2011; The Economist 2012).

Documents leaked to the British press suggest that the European Union is planning to explicitly include natural gas within the Horizon 2020 research programme (Harvey 2012). Horizon 2020 will be the primary European Union research funding mechanism between 2014 and 2020, disbursing €80bn for basic science, industrial innovation and efforts to address societal challenges such as ageing populations, food safety and climate change (European Commission 2011). An unpublished document is said to have been altered to include the sentence "The roadmap also shows that gas, in the short to medium term, can contribute to the transformation of the energy system." (Harvey 2012). It continues: "To achieve these ambitious reductions, significant investments need to be made in research, development, demonstration and market roll-out of efficient, safe and reliable low-carbon energy technologies, including gas, and services."

Whilst we cannot confirm this change in advance of the public release of the documents, we can address the petitioner's concern with the possible impact of such inclusions and alterations. The full text of the petition is recorded below, with the relevant paragraph highlighted in **bold text**:

"In the event of the extraction of shale gas by hydraulic fracking, we do not believe that the EU has sufficiently robust regulations in place to manage the serious risks attendant on this procedure. There is a clear need of specific On Shore exploration regulations. At present there are none; the industry is virtually self-regulating according to regulations adapted from off shore gas extraction and there is considerable confusion surrounding the responsibilities of the various agencies involved. Regulations need to cover cement quality (on site sampling and laboratory testing) , cement bond logs, annular pressure readings (instruments used, calibration, how recorded in SCADA etc.), examination of formation integrity tests as they are executed, seismic monitoring, surface methane detection (baseline and operational), post tremor actions, flow back water storage and disposal (Permit), recycling of flowback , flowback water quantity verification, sourcing water from mains (pressure issues) and testing of local boreholes/wells. Regular monitoring of such regulations must be independent and robust and will require funding. There should also be regulation in place to determine the appropriate distance from both business and

residential property that drilling may be permitted to take place, and factors such as noise , light and air pollution considered. Additionally, bonds should be established to provide for damage caused to water, roads, land and buildings that might be caused by this procedure.

In the Horizon 2020 project, gas is being considered as a low carbon form of energy, and the R&D funding originally intended only to support renewables has been altered to explicitly include fossil fuels. This alteration is likely to be disastrous for the renewables industry, and have catastrophic implications for the fight against Climate Change. This is in total conflict with the EU's own policy on Climate Change. We believe it is therefore urgently necessary to clarify what technologies should be considered to qualify as low carbon fuels, and to challenge the inclusion of gas within the Horizon 2020 project to avoid the situation where renewables compete with fossil fuels such as gas, both for research grants and private investment."

Aim

The aim of this report is to consider the evidence from climate and energy research to determine whether:

- i. It is legitimate to consider natural gas a « low carbon » energy technology within the context of the Horizon 2020 programme and the EU's existing policies on climate change.
- ii. Such an inclusion would have substantial negative impacts for both the renewables industry and efforts to mitigate anthropogenic climate change.
- iii. The production of shale gas through hydraulic fracturing should be considered differently to conventional sources of natural gas under such a classification.

Each issue will be covered in turn, with a distinction made between relevant factual matters and the authors' recommendations/judgement wherever possible.

1. IS IT LEGITIMATE TO CONSIDER NATURAL GAS A “LOW CARBON” ENERGY TECHNOLOGY WITHIN THE CONTEXT OF THE HORIZON 2020 PROGRAMME AND THE EU’S EXISTING POLICIES ON CLIMATE CHANGE.?

Natural gas is first and foremost a **fossil fuel hydrocarbon**. That is to say, it is predominantly composed of methane and a small proportion of longer chain alkanes (ethane, propane, and butane) formed by the anaerobic decomposition and transformation of ancient animal and vegetable matter within the Earth’s crust. When combusted in air it is **transformed to carbon dioxide (CO₂)** and water but with lower quantities of the former per unit of energy released than oil and coal. Further, its gaseous nature means that it can be **combusted in more efficient heating and electricity generating technologies** than other hydrocarbons. As such, in comparing the direct emissions of carbon dioxide per unit of useful energy, natural gas is typically *lower* carbon than other fossil fuels. Nevertheless, in relation to climate change, it is a high-carbon fuel, and self evidently should not be described as “low carbon”.

1.1. Criteria for “low carbon” technology

Unlike the term renewable energy, “low carbon” does not have a specific definition in the academic literature. At a basic level methane, CH₄, is 75% carbon by relative atomic mass. If combusted each molecule is converted to carbon dioxide in a 1:1 ratio, and if leaked directly to the atmosphere is a much more potent heat trapping gas than carbon dioxide.

A more sophisticated definition is to argue that the description “low carbon” implies that a technology materially contributes to achieving climate change mitigation and natural resource depletion policy goals; i.e. that the low carbon nature of the technology minimises both the accumulation of greenhouse gases in the atmosphere (GHGs) and the consumption of non-renewable energy resources.

The latter property is quite straightforward to determine. Fossil fuels are by definition formed by geological processes over millennia. Their consumption involves the depletion of reserves that do not regenerate on a timescale relevant to society. Natural gas and unconventional gas, of which shale gas is one type, is therefore not “low carbon” on this criterion. Methane may be created by the anaerobic digestion of organic matter, such as food and animal wastes, but this is typically termed biogas and neither cited in the petition nor specified in the alleged alterations to the Horizon 2020 texts.

The climate change mitigation criterion is not trivial but requires contextual definition. That is to say, energy technologies do not in isolation influence the climate. The existence of artefacts or knowledge generated through research does not alter the climate, positively or negatively, until it is taken up by society. Whether you would regard a particular technology as contributing to mitigation or not therefore depends upon its context and impact on society and what is determined to be the acceptable extent of climate change.

The contextual issues relevant in this case are therefore:

1. The climate policy objectives noted in the Horizon 2020 document and commitments made by the European Union.

2. The properties of the atmosphere at present i.e. what “physical commitment” has already been made to climate change.
3. The energy system of the European Union that Horizon 2020 would seek to influence.

Each of these will be considered in turn.

The introductory document “Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions. Horizon 2020 - The Framework Programme for Research and Innovation COM(2011) 808 final” alongside general objectives of excellent science and industrial leadership, the document sets out six specific societal challenges, of which two are directly relevant (p5):

- *Secure, clean and efficient energy;*
- *Smart, green and integrated transport*
- *Climate action, resource efficiency and raw materials;*

Sustainable development is cited as an “overarching objective” of Horizon 2020, with at least 60% of the total budget related to sustainable development whilst around 35% is to be climate related. The document identifies the relevant time horizon for research activities and impact with projects that will continue in the medium term and have impact beyond that (p14, emphasis added):

*Horizon 2020 is designed to last until the end of this decade. Its **projects will continue well into the next decade** and the impact of its funding should be felt beyond that. It is therefore truly an investment for the future.*

The more substantial and detailed document “Proposal for a Regulation Of The European Parliament And Of The Council establishing Horizon 2020 - The Framework Programme for Research and Innovation (2014-2020) COM(2011) 809 final 2011/0401 (COD)” also identifies climate and energy objectives throughout.

In the opening section, paragraph 10 (p7) establishes that the proposal has substantial climate and resource efficiency objectives, reflected in the budget, and clearly relating these two issues to each other and the other objectives (emphasis added):

*...In that Communication, the Commission also committed to mainstream climate change into Union spending programmes and to direct **at least 20 % of the Union budget** to climate-related objectives. Climate action and resource efficiency are mutually reinforcing objectives for achieving sustainable development. The specific objectives relating to both **should be complemented through the other specific objectives** of Horizon 2020. As a result it is expected that at least 60% of the overall Horizon 2020 budget should be related to sustainable development. It is also expected that **climate-related expenditure should exceed 35%** of the budget, including mutually compatible measures improving resource efficiency.*

Part III of the proposals goes into greater detail around the societal challenges. Section 3, “Secure, clean and efficient energy” has the specific objective (p65):

...to make the transition to a reliable, sustainable and competitive energy system, in the face of increasingly scarce resources, increasing energy needs and climate change.

It continues by reiterating the Union's general energy and emissions objectives (p65):

The Union intends to reduce greenhouse gas emissions by 20 % below 1990 levels by 2020, with a further reduction to 80-95 % by 2050. In addition, renewables should cover 20 % of final energy consumption in 2020 coupled with a 20 % energy efficiency target...

And identifying sectoral end point targets (p65):

*...The roadmap to a competitive low-carbon economy in 2050²⁷ shows that the targeted reductions in greenhouse gas emissions will have to be met largely within the territory of the Union. This would entail **reducing CO2 emissions by over 90 % by 2050 in the power sector**, by over 80 % in industry, by at least 60 % in transport and by about **90 % in the residential sector and services**.*

These are relevant as the power sector and residential sector would likely be the largest consumers of gas in future, and indicates the scale of reductions anticipated. The Broad Lines of the Activities (Section 3.3) designates aspects of the energy system to be investigated but without mentioning gas as a fuel source or specific emissions targets. Carbon capture and storage is mentioned alongside renewables within the theme of Low-cost, low-carbon electricity (3.3b).

Section 4, "Smart, Green and Integrated Transport" notes that transport must contribute to the economy whilst breaking its dependency on oil (p68) and realising substantial GHG reductions. These are clarified in Section 4.2 (p69, emphasis added) stating that:

*Research and innovation, driven by policy objectives and focused on the key challenges, shall contribute substantially to **achieve the Union's targets of limiting global temperature increase to 2°C, cutting 60 % of CO2 emissions from transport**, drastically reduce congestion and accident costs, and virtually eradicating road deaths by 2050.*

The final directly relevant societal challenge, titled "Climate Action, Resource Efficiency and Raw Materials", has specific objectives on resource depletion and the extent of climate change (Section 5.1, p70).

*The specific objective is to achieve a resource efficient and climate change resilient economy and a sustainable supply of raw materials, in order to meet the needs of a growing global population within the **sustainable limits of the planet's natural resources**. Activities will contribute to increasing European competitiveness and improving well being, whilst assuring environmental integrity and sustainability, **keeping average global warming below 2 °C and enabling ecosystems and society to adapt to climate change**.*

In conclusion, as proposed Horizon 2020 specifies a climate change objective of avoiding an average global temperature increase of greater than 2°C. Associated with this are long term sectoral emissions reductions targets for 2050. These are the same headline objectives as made in the suite of binding "20-20-20" targets on renewables, energy efficiency and emissions targets (Directives 2009/29/EC and 2009/28/EC, and Decision 406/2009/EC).

The Union and individual member states have also made commitments under the Copenhagen Accord (2009), reiterated at the subsequent Conference of the Parties at Cancun and Durban, to action:

*...to hold the increase in global temperature **below 2 degrees Celsius**, and take action to meet this objective **consistent with science and on the basis of equity**.*

What matters to society is the extent of climate change impacts, not the budgets, nor the relative intensity of fuels, nor quantities of emissions. Carbon dioxide and other long lived well mixed greenhouse gases (GHG) are regarded as 'stock pollutants' because of their lifetimes in the atmosphere. Climate science indicates that the **cumulative quantity of emissions** released over time is the best indicator of the final extent of global temperature change, not the emissions within any given year, be that the present day, 2050 or further in the future (Allen et al. 2009). In UK legislation, this cumulative characteristic is recognized in the carbon budgeting provisions of The Climate Change Act (2008).

The determination of "low carbon" should therefore be made on the basis of these ultimate objectives and with scientific guidance on the relationship between these objectives, the historical emissions stock and future emissions trajectory and the energy system that Horizon 2020 would influence.

Given a particular temperature target, the next step is to estimate the quantities of carbon dioxide that are likely to cause that particular increase. Climate models with different starting parameters suggest that 1 to 1.5 trillion tonnes of carbon dioxide emitted over the period 2000 to 2050 yields a 50% probability of exceeding 2 degrees (M. Meinshausen et al. 2009). Work by Anderson and Bows (2011) has drawn on a range of such estimates from different climate models. Latest carbon dioxide emissions data describes a rapid increase since 2000 and by deducting emissions to the present day from the total budget, the remaining 'safe atmospheric space' can be deduced. This can then be allocated between nations, industries or consumers and related to rates of change of energy systems.

Such scenarios of future emissions indicate that **carbon dioxide emissions from fossil fuel combustion must tend to zero before 2050**, even if global emissions peak in 2020. This is because greenhouse gas emissions as a whole may not be able to fall entirely to zero; food production involves the release of substantial quantities of GHGs through fertilisers and land conversion that are unlikely to be entirely eliminated (Kevin Anderson & Bows 2008). If one takes the position that industrialised economies like the EU must take the lead, given they have both the greatest resources available and the most historical responsibility, then they would have to **decarbonise their energy systems much sooner, i.e. during the 2030s**.

In the UK, the Committee on Climate Change's economic modelling has shown the **importance of the power sector** in delivering this objective. The CCC has advised "that any path to an 80% reduction by 2050 requires that electricity generation is almost entirely decarbonised by 2030" with even lower emissions required beyond 2030 necessitating biomass feedstocks in thermal power stations, not fossil fuels (Committee on Climate Change 2008). In numerical terms, this means a maximum of **50g of carbon dioxide per kilowatt hour of electricity generated**. This is achievable as renewable and nuclear supply technologies with very low associated emissions are available now and are compatible with existing infrastructure. There is also the possibility of increasing the efficiency of transport and heating through the deployment of new electric vehicle and heat

pump technologies respectively. However this grid intensity objective **would not be achievable through the unabated combustion of natural gas** which has a typical emissions intensity of 400 to 450gCO₂/kWh.

In principle, it may be argued that natural gas could be burned safely in the short term as an alternative to coal, however in practice this is not the case. Gas fired power stations typically have a lifespan of over 25 years. Therefore, unless allied with carbon capture and storage (CCS) technologies, as yet unproven at a commercial scale, all new powerstations intended to burn gas would need to cease generating within five to fifteen years of construction, and at the latest be decommissioned by 2030. Scenarios indicate that if there is a second "dash for gas" in the UK, emissions from the grid could still be 302gCO₂/kWh in 2030 necessitating 95% deployment of CCS to meet the UK's fourth period emissions budgets, 2023-2027 (Green Alliance 2011).

Finally, it may be argued that the EU ETS would cap emissions from future large scale gas combustion and would limit the impact of the source as a whole. If this line of argument is followed then it is hard to see why coal and oil may not be similarly considered. Another simple objection is that gas burned in the domestic sector is not captured by the EU ETS. However, the most significant difficulty is that at present, the EU ETS is over supplied with emissions permits primarily as a result of the economic downturn. Although this policy instrument was intended to drive decarbonisation of the power sector, the price of tradable allowances (EUAs) has been persistently low and is expected to remain so throughout the third phase (2013 to 2020) as the excess from the second phase will be carried over. Presently there appears to be little or no abatement occurring in Europe as a result of the ETS (Morris 2012).

1.2. Authors' Recommendations

To determine whether it is appropriate to consider a *lower* carbon fossil fuel, "low carbon" we have considered the nature of energy systems and a number of properties of the climate and greenhouse gases.

Research into biogas, i.e. methane generated from renewable sources, would in our opinion be considered low carbon, however natural gas (fossil methane) cannot be regarded as a renewable or low carbon resource.

It is clear from climate science and emissions accounting that achieving the EU's 2°C commitments and proposed Horizon 2020s climate objectives will require rapid decarbonisation in Europe. We note that the long term emissions reductions targets cited in the Horizon 2020 are not especially relevant to the ultimate extent of climate change. Decarbonisation will need to happen on much shorter timescales because of the cumulative nature of the pollution.

Given the time required for research, development and deployment it is difficult to envisage how funding for natural gas technology, aside from the delivery of timely CCS to scale, could contribute to these objectives. By the time useful conclusions could be drawn and delivered, unabated gas combustion ought to be obsolete in the power and domestic sectors.

The IEA reported that a high gas use scenario in their World Energy Outlook supplement "Are We Entering a Golden Age of Gas?" (2011) would likely result in 3.5°C warming, well

beyond what is generally regarded as dangerous climate change. The IEA Chief Economist Fatih Birol therefore concluded that *"We are not saying that it will be a golden age for humanity -- we are saying it will be a golden age for gas"* (Harrabin 2012). We find it hard to disagree with such a judgement; gas is not a safe substitute for genuinely low carbon technology, even in the short term.

Some of the analysis presented above has been worked out in detail for the UK energy system. It is our judgement that similar conclusions also hold for the European Union as a whole.

2. WOULD SUCH AN INCLUSION HAVE SUBSTANTIAL NEGATIVE IMPACTS FOR BOTH THE RENEWABLES INDUSTRY AND EFFORTS TO MITIGATE ANTHROPOGENIC CLIMATE CHANGE?

The major policy rationale for the use of public funds to support research, development and deployment is to correct market failure. It is argued that market economies under produce public goods, such as research, without corrective action and achieve lower economic output and social welfare. In the case under consideration there is also an environmental market failure; the impacts of climate change are borne collectively but the benefits from freely polluting accrue to organisations and individuals.

Although not directly considering funding for research, development and deployment, the UK's The House of Commons Energy and Climate Change Committee (2011) concluded that a substantial move to exploit novel shale gas reserves could attract investment that might otherwise go to renewable energy. They noted that *"...shale gas has the potential to shift the balance in the energy markets that the Department has tried to create away from low carbon electricity generation"*.

To estimate the potential scale of such a diversion we have assessed the capital costs of drilling shale gas wells to supply 10% of current UK gas consumption and the equivalent Combined Cycle Gas Turbine (CCGT) power stations that would be required to burn it (Broderick et al. 2011). This capital cost was then compared to the build cost of wind power to see what capacity the same level of investment would deliver. Given the need for climate mitigation, the costs of gas CCGT with carbon capture and storage (CCS) was also considered. This has an energy penalty in operation and substantially increases capital costs. In the absence of large scale demonstration plants there are considerable uncertainties in the cost and efficiency parameters of CCS.

The analysis looked only at capital costs, not operating costs, which favoured gas substantially. Wind has much lower operating costs as a percentage of total costs¹⁰⁹. Costs of transmission and distribution infrastructure for both gas and electricity were also excluded. Assuming a straight substitution relationship between renewable energy and gas power generating capacity and supplied by shale reserves – i.e. that any money invested in gas and shale no longer available to invest in renewable energy – it is possible to illustrate the degree to which a move towards shale gas could displace renewable energy. In total

¹⁰⁹ For example, if we look at the levelised costs (with 10% discount rate) for gas CCGT (Parsons Brinkerhoff, 2011) we find that the operating costs (including fuel costs) account for 88% of the total cost/MWh. In contrast, Arup (2011) indicates that for wind, operating costs make up only 6% of total costs.

this was found to be £19bn to £31bn, depending upon the discount rate applied to future investment.

8GW of CCGT plus gas well infrastructure could therefore displace 12.5GW of wind capacity, equivalent to over 4000 large onshore turbines, assuming a 10% commercial discount rate for the shale infrastructure. The same investment could also provide 7.0GW of capacity offshore, equivalent to 1400 large turbines. Operating without CCS over this period would place much greater pressure on other parts of the economy to decarbonise, or risk gas powerstations without CCS becoming 'stranded assets'.

With a 3.5% discount rate, more appropriate for such public policy calculations, the potential displacement increases to approximately 21GW of installed onshore wind capacity or approximately 12GW offshore. Either would be expected to generate approximately equivalent quantities of electricity as the gas option even given the lower load factor of wind turbines.

2.1. Authors' Recommendations

Internationally, the Europe Union is being looked to for technological, financial and policy leadership on climate change mitigation. In this context it seems inconsistent that a highly profitable industry such as the fossil fuel industry, and its consumers who impose external costs on other parts of society and the economy, should be subsidised with collective resources.

Given that a "short to medium term" role for gas combustion is cited in the leaked document alterations, it also seems questionable as to what benefit public investment in research would deliver. We have made the case in the section above that there is only safe emissions space for substantial unabated gas combustion in Europe in the next 10-15 years. Public spending on such technologies would be wasted money if climate policies were adhered to. We have also identified that necessary capital investment for unconventional gas production and combustion for electricity is on a scale relevant to the UK's renewable energy targets under the 20-20-20 package and Renewable Energy Road Map. If such a financial displacement occurred and was echoed in research, development and deployment the consequences for climate change mitigation would be significant.

3. SHOULD THE PRODUCTION OF SHALE GAS THROUGH HYDRAULIC FRACTURING BE CONSIDERED DIFFERENTLY UNDER SUCH A CLASSIFICATION?

Given that shale gas is yet to be exploited commercially outside the US, limitations on the availability of equipment and expertise mean that it is very unlikely it could provide other than a marginal contribution to UK or European supply by 2020 (Geny 2010).

However, there remain concerns about the possibility of additional climate change impacts from gas produced by hydraulic fracturing. This is a contentious topic in the academic literature. Up to this point we have discussed solely the CO₂ emissions from combustion of gas. Life cycle analysis studies also include *inter alia* energy required to produce and distribute the gas, for instance embodied in water transported to the well pad, and releases of methane itself to the atmosphere both deliberately and inadvertently during the full fuel cycle. Methane is a more potent GHG than CO₂ but with a shorter atmospheric life span. It therefore has the ability to substantially influence the conclusions drawn by a given study.

A conversion factor is required to relate the climate change impact of fugitive methane emissions to the carbon dioxide emissions from other activities. A number of metrics are available to compare the consequences of releasing different greenhouse gases to the atmosphere. A gas's contribution to global warming depends upon its absorption of infrared radiation, its longevity and its ability to influence other atmospheric components physically and chemically. The most widely used metric is the Global Warming Potential (GWP) which is the ratio of the change in radiation balance from a pulse release of a given gas, integrated over a specified future time period, against the same change for a release of the same mass of carbon dioxide. GWP is frequently used in climate policy as a way of comparing well mixed, long lived greenhouse gases like carbon dioxide, nitrous oxide and methane. Typically a one hundred year time period is used for the calculation and revised estimates of GWPs are prepared as atmospheric science progresses. Whilst, these conversion factors are not inherent properties of the gas, their selection can have significant impacts on the conclusions drawn by research.

There has been some dispute in the scientific literature of the appropriate GWP to use when comparing conventional with unconventional gas production techniques. There is also a shortage of independent primary research on the actual quantities of such emissions, and many studies use the same underlying empirical data that is recognised to be limited in scope and applicability. Our previous research provides a fuller discussion of this topic (Broderick et al. 2011) that is built upon by recent review prepared for the European Commission DG Clima (AEA 2012). A comparative statistical approach has also concluded that it is difficult to distinguish between the life cycle emissions impact of different gas production and distribution methods (Weber & Clavin 2012).

3.1. Authors' Recommendations

Returning to the arguments made in Section 1, a precise and accurate value of the life cycle GHG impact, either per unit of shale gas produced or per unit of electricity from shale gas, is not necessary to conclude that shale gas is not low carbon. The absolute necessity of decarbonisation means that technologies with orders of magnitude lower emissions are

required to provide energy to EU households and industry in the short to medium term. We do not distinguish between gas production methods in drawing our preceding conclusions.

A final point worth noting is that efforts to increase the supply of fossil fuels, directly through infrastructure investment and indirectly through research, serve to add more fossil fuel to energy hungry world markets. Projections of demand for energy of all sorts suggest this will be the case for the foreseeable future (BP 2012). In the absence of a meaningful cap on global carbon emissions, the exploitation of new gas reserves is likely to increase total emissions even if some fuel types, e.g. coal, are displaced from national energy systems.

For this not to be the case, production of displaced fuels must be reduced globally and remain suppressed indefinitely. The availability of shale gas, or for that matter new renewable generating capacity, does not guarantee this in and of itself. From our understanding of climate science and emissions accounting, it is clear that the production of fossil fuels of all sorts needs to be curtailed in the absence of strict, coordinated and well supported international emissions caps.

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DIRECTORATE GENERAL FOR INTERNAL POLICIES
POLICY DEPARTMENT C: CITIZENS' RIGHTS AND
CONSTITUTIONAL AFFAIRS

PETITIONS

**Analysis of the petition from Germany on
shale gas extraction**

NOTE

Abstract

The rationale of the Petition and its claims are presented, and scientific responses to the claims are provided.

This document was requested by the European Parliament's Committee on Petitions.

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LIST OF ABBREVIATIONS

GHG Greenhouse Gas

CAS Chemical Abstracts Service

ELD Environmental Liability Directive

HNS Fund Hazardous and Noxious Substances Fund

PETITION AGAINST FRACKING AND THE REINJECTION OF WASTE WATERS

Rational of the Petition

General Risks: Conventional production of natural gas has health impacts on human beings, animals and the environment. These risks are even larger for unconventional gas production by hydraulic fracturing, according present knowledge: Risks result from possible contamination of ground and drinking water either by the fracturing process itself or by the reinjection of waste water into geological formations for disposal.

Restriction of German mining Law: The existing rules of the German mining law ('Bergrecht') which exempt gas wells below a production rate of 500.000 m³ per day from an environmental impact assessment are not adequate and must be adapted.

Risk of water contamination by fracking fluids: Companies claim that fracturing fluids are not toxic. But this statement is only based on the dilution of the toxic chemicals with huge amounts of water. However, not only the relative but also the absolute amount of toxic fluids is relevant. Recent research within the "Info-Dialog-Process", which was financed by the natural gas industry, comes to the conclusion that only a dilution to concentrations of below 100 ppm (dilution of 1:10,000) to 12 ppm (dilution of 1:85,000) gives some certainty for environmental irrelevance of the toxicity of used chemicals at absolute volumes of up to 4 million liters of fluid.

Total Area consumption: The area consumption is huge due to the low flow rates of stimulated gas wells. This consumption is stated to cover 2 km²per well pad, while each well pad might contain 4-10 or even up to 20 wells. According to the expected development of 50-60 new wells per year this would result in 3 – 25 new well pads with a total area consumption of between 6 and 50 hectares.

Additional surface area will be consumed for the development of the infrastructure, notably roads and gas pipelines. This will destroy the touristic attractiveness of some landscapes.

Water requirement: 500 – 4000 m³ per first frack per well would require 25 – 200 million liters of water per year which is comparable to the water consumption of 600 – 4500 inhabitants at an average 44 m³ per capita annual water consumption.

The reinjection of waste water results in risks of ground water contamination.

Stability of materials: In general, the wells are sealed against ground water reservoirs. But analysis of Zurich American Insurance Company exhibits the risk of deformation of pipes under pressure, use of inadequate materials, perforation of steel casing due to high pressure, failure of internal casings etc.

Current accidents: Even today in the German State of Niedersachsen (Lower Saxony) benzene and heavy metal contamination from leaking waste water pipes have happened at various locations after hydraulic fracturing. This casts doubts on the statements of the regional authorities that hydraulic fracturing in the past has not resulted in problems. Knowledge from past accidents was not used, hints from experts concerning inadequate equipment were not followed or taken into account.

Greenhouse gases: The climate balance of unconventional gas production is much worse than from conventional gas production. There are reports that the high energy demand for unconventional production might put GHG emissions close to bituminous coal.

Alternatives to unconventional gas drilling: The development of unconventional gas production is not a measure to achieve supply security as its contribution to total gas supply in Germany is and will be much too small.

There are, however, much more sensible and effective alternatives: Annually, about 130 billion m³ of natural gas are flared. This amount would be enough to supply one third of total EU gas demand if captured and transported to the consumers.

Claims of the Petition

1. All gas drilling and hydraulic fracturing activities in the German State of Lower Saxony should stop immediately. The State Parliament ('Landtag') should call on the State Government as well as the State authority for mining, energy and geology ('LBEG') to stop any exploration and production activity and to reject further offers in view of the public interest.
2. The German mining law should be modified by including the requirement for an environmental impact assessment for all unconventional gas activities including exploration, appraisal and production drillings. The Landtag should call on the state government to initiate a federal initiative for the modernization of the German mining law as this law does not adequately cover risks from hydraulic fracturing.
3. Subsidies for companies in terms of reduction of or exemption from paying mining royalties should be stopped immediately. The new rules of the Lower Saxony's act ('Verordnung') of 1. January 2011 on field and production royalties should be abolished immediately.
4. Any decision on the approval of hydraulic fracturing must put safety for humans, nature and environment at top priority.
5. The procedure for granting licenses for exploration and exploitation must be made transparent through publication, including the consent of the local population, of local authorities and other agencies for public interest.
6. It must be ensured that no substance will be used which has the potential to contaminate the ground water.
7. It must be ensured that the full list of chemicals used and their concentration in the fracking fluid must be made public in advance of any activity.
8. Hydraulic fracturing techniques must be generally prohibited in areas used for drinking water collection ('Trinkwassereinzugsgebiete'), water protection areas and precautionary land for drinking water abstraction as well as in areas which have the risk of flooding. The State government must ensure that for starting any drilling activity for exploration or production a water approval is granted ('wasserrechtliches Genehmigungsverfahren').
9. It must be ensured that the disposal of fracturing waste water is without any risk to the environment.
10. The reinjection of waste water into the underground must be stopped.
11. In any case when new risks or problems concerning hydraulic fracturing become known, granted permits and licenses for hydraulic fracturing must be stopped.
12. It must be ensured that for damages which are directly or indirectly caused by hydraulic fracturing the 'polluter pays' principle holds. The burden of proof must be put on the originator. In case of doubt it must be assumed that the damage is due to the fracturing process.

Scientific responses to the claims

Ad 1. A moratorium and a need for site-specific assessments for a quantification of the risks.

The German State of Northrhine-Westfalia, which is neighbouring Lower Saxony, has established a moratorium on hydraulic fracturing activities and explorations for unconventional gas until more scientific knowledge is available on the environmental and health risks of such activities. Detailed studies have been commissioned by the Northrhine-Westfalian government which on the basis of 900 pages of scientific analyses come to the conclusion that site-specific assessments have to be carried out in order to allow for an understanding and possibly for a quantification of the risks associated to hydraulic fracturing and unconventional gas activities (NRW, 2012). This could be seen as a scientific support to the claim for requiring environmental impact assessments for unconventional gas activities (see ad 2.).

Ad 2. The German mining law in line with EU provisions; environmental and health protection suggest mandatory environmental impact assessment.

According to the German mining law natural gas wells with an expected daily production rate lower than 500,000 m³ are exempted from an environmental impact assessment. This is in line with the European Environmental Impact Assessment Directive (85/337/EEC and three amendments codified in 2011/92/EU). Political views on whether or not this limit should be abolished or modified are controversial. See in ad 1. the conclusion of the scientific analyses commissioned by the German State of Northrhine-Westfalia.

Ad 3. and 4 Political decisions

It is a political decision to define royalties for the extraction of natural resources. There is no scientific basis for an opinion on this issue. According to the International Energy Agency (IEA, 2011) "exploration for unconventional gas is taking place in Europe [...], but unconventional gas supply in the region [OECD Europe including Norway] is still small at the end of the period [2035]." "This means that regional supply goes from servicing one-half of demand to around one-third by 2035." (IEA, 2011). Thus, **shale gas extraction will not have a significant impact on the gas import dependence of the European Union as its foreseeable production rates will be very low compared to the daily import quantities.** Consequently, there is no reason for exempting gas drilling companies from royalties in case this exemption is based on the argument of an important contribution to energy self sufficiency or security of supply.

It is also a political decision to define priority criteria for the approval of unconventional gas activities. (see also the legal analysis provided by Marta Ballesteros and Florent Pelsy p.5)

Ad 5. A lack of transparency

The lack of transparency in the approval of licenses in the past in Germany and the way hydraulic fracturing was introduced in Germany without adequately informing the public has created strong public opposition and mistrust. Scientific studies in Germany observe significant deficits in the publication of chemicals used for hydraulic fracturing and the concentrations in which they are applied (see for example UBA, 2012). This is the minimum information required to assess the toxicity of fracking fluids, and thus to allow public authorities to take adequate action.

Ad 6 and 7. No zero risk of contamination of the ground water: adequate regulatory action needed.

Companies claim to handle all hazardous substances with care, protecting the ground water levels from possible contamination with hazardous fluids. In practice, the risk of contamination is not zero, and increasing through bad practice and negligence as can be observed in the USA (see for example Altmann et al., 2011). Thus, it must be ensured through regulatory measures that even under financial and time pressure operators obey the limits set by technical, regulatory and legal standards and use best management practice and best available technologies. Adequate regulatory action against breaches of standards include reviewing the extraction license. It should be noted that operators use service companies to carry out the hydraulic fracturing activities including the decisions on the fracking fluid. In a case in Lower Saxony, Germany, described by UBA (2012), the operator of a well and the service company contracted by the operator disagreed after various fracks were carried out on whether a certain chemical was used or not; reliable information was not available. Furthermore, only part of the chemicals included in fracking fluids are identified in a unique fashion. A list of 151 chemicals used for fracking in Germany was provided by ExxonMobil to an independent expert group for toxicological

analysis (Schmitt-Jansen et al., 2012). Of these, only 83 (55% of the chemicals listed) were

correctly identified by their CAS¹¹⁰ numbers. UBA (2012) comes to a similar conclusion after a similar classification exercise. 28 fracking fluids analysed contained 112 substances, of which 76 were identified with their CAS numbers; 36 could not be unambiguously identified.

Ad 8. A recommendation from the German Federal Environment Agency

This recommendation is similar to a recent recommendation from the German Federal Environment Agency ('Umweltbundesamt'), which recommends the exclusion of drinking water preservation areas as well as drinking water collection areas ('Trinkwassereinzugsgebiet') from unconventional gas activities (UBA, 2012).

Ad 9. and 10. Reinjection of flow back fluids into geological formations should be halted until scientific evidence of the absence of risk of contamination.

According to (UBA, 2012), reinjection of waste water from fracking operations into the underground is current practice in Germany, notably Lower Saxony. "Nonetheless, possible risks towards water bodies are not assessed sufficiently and risks cannot be excluded according to the authors. The hydro dynamics of the deep ground water and the environmental impacts of reinjection are to be assessed in a site-specific manner."¹¹¹ (UBA, 2012). Analysis of geological formation waters and reliable mass balances of flow back fluids, which are a mixture of fracking fluids and formation waters, are lacking. Systematic measurements of transformation and decomposition products in flowback fluids have not been carried out. It follows from this assessment that the scientific basis is lacking to ensure that ground water bodies are not at risk of contamination through the reinjection of waste waters from fracking activities. Before such scientific evidence is available, it is suggested that reinjection of flow back fluids into geological formations is halted.

¹¹⁰ The Chemical Abstracts Service (CAS) registry number is a unique identifier for chemical substances.

¹¹¹ Translation by Matthias Altmann.

Ad 11.

This is both a political and a regulatory issue. Regarding the EU legal framework, see the analysis of M. Ballesteros and F. Pelsy p.5)

Ad 12. The relation of unconventional gas activities to the Environmental Liability Directive should be analysed in more detail.

This issue is equivalent to the discussions related to the European Commission 'Proposal for a Regulation on safety of offshore oil and gas prospecting, exploration and production'¹¹². A workshop organized by the European Parliament's ITRE Committee on Industry, Research and Energy on 'Safety of offshore oil and gas activities' on 9 July 2012 intensively discussed issues related to the liability for the remediation of environmental damage and the protection of most vulnerable environments (Trucco & Altmann, 2012). "Edward Brans, lawyer at Pels Rijcken & Drooglever Fortuijn and a specialist on environmental liability, [...] analysed how in the proposed Regulation the scope of the Environmental Liability Directive (ELD) 2004/35/EC was extended to marine waters, where liability is channelled to the licensee. [...] The speaker acknowledged that legislators needed to keep in mind that the ELD was currently poorly implemented by MS [Member States] and stakeholders. Remediation procedures, particularly for clean-up, are rarely applied and there was no provision for financial security. He then argued that this was a critical issue, since it was not possible to hold parties responsible if they did not have the financial capacity to remediate the damage. With respect to the proposal text, the speaker showed that it contained neither clear liability provisions nor channelling of liability with respect to traditional damage. Likewise, the proposal did not provide for a risk-sharing pool as already established in various contexts at the EU and global levels. He gave the example of the 2010 HNS Fund (Hazardous and Noxious Substances), whose aim was to limit liability and provide a fund through which part of the claim can be recovered." (Trucco & Altmann, 2012) The applicability of the Environmental Liability Directive is discussed in detail in (AEA, 2012). However, the poor implementation by Member States emphasized by Mr. Brans (see above) is not discussed by AEA (2012). It is therefore suggested that the relation of unconventional gas activities to the Environmental Liability Directive is analyzed in more detail, notably with respect to shortcomings in Member State implementation and possible consequences thereof. Fund schemes similar to the HNS Fund (Hazardous and Noxious Substances) should be evaluated for unconventional gas activities.

¹¹² (COM(2011)688) of 27.10.2011.

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