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COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

on the exploration and production of hydrocarbons (such as shale gas) using high volume hydraulic fracturing in the EU

(Text with EEA relevance)

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1. INTRODUCTION

In a fast-evolving energy landscape characterised by the need to decarbonise our energy system, increasing global competition for resources and rising energy prices and price differentials with some of our main competitors, European economies and citizens require energy which is sustainable, affordable and with a secure and reliable supply. These objectives are the drivers of EU energy policy.

However, today and in the near future, the EU is still facing a number of energy challenges including an increasing import dependency and related risks to security of supply, the completion of the internal energy market and the impact of energy prices on competitiveness. These challenges are particularly reflected in natural gas, which currently accounts for one quarter of the EU's primary energy consumption and could contribute to the reduction of greenhouse gas emissions in the short to medium term, should it replace more carbon intensive fossil fuels. However, for the last two decades, the production from conventional reservoirs has steadily declined. The EU's natural gas import dependency has risen up to 67% in 2011 and is projected to continue increasing, putting the EU in greater direct competition with global demand for natural gas. Some Member States rely on a single supplier and often on a single supply route for 80-100% of their gas consumption.

High reliance on imports and low diversification of energy resources, among other factors[1], have contributed to increasing prices in the EU, in particular compared to some of our main competitors. Whilst still being lower than prices on some Asian markets, natural gas prices are three to four times higher than in the US. This puts pressure on EU energy-intensive industries using gas or possible by-products as feedstock.

Technological progress has enabled access to unconventional fossil that were previously technically too complex or too costly to extract. In the US, unconventional gas currently accounts for 60% of the domestic gas production with shale gas featuring the highest growth rates. This significant increase in indigenous natural gas production has resulted in lower gas prices in the US –and temporarily influenced prices of Liquefied Natural Gas imports into the EU - and made available cheaper US coal supplies for export, notably into the EU, where coal prices have plummeted by more than a third since 2011.

Potential reserves of natural gas from shale formations have triggered high expectations also in parts of the EU: shale gas can be a possible substitute for more carbon-intensive fossil fuels, an indigenous source of natural gas reducing dependency on non-EU energy suppliers,

[1] Communication of the Commission to the European Parliament, Council, Economic and Social Committee, and Committee of the Regions : Energy prices and costs in Europe, COM (2014) 21 final of 22.01.2014

as well as a possible driver of jobs, economic growth and additional source of public revenues. Accordingly, some Member States are actively pursuing shale gas exploration.

At the same time, the risks -several of them with cross-border features- associated with the high volume hydraulic fracturing technique, also commonly referred to as "fracking", trigger concerns about public health and environmental effects. An important part of the population also perceives an insufficient level of precaution, transparency and public consultation in relation to shale gas activities. Some Member States have decided to ban hydraulic fracturing or establish moratoria.

In this context, requests have been raised for EU action to ensure the safe and secure extraction of unconventional fuels. The European Parliament adopted two resolutions in November 2012 respectively on environmental impacts[2] as well as on industrial, energy and other aspects of shale gas and shale oil[3]. In October 2013, the Committee of the Regions issued an opinion[4] providing the perspective of local and regional authorities on unconventional hydrocarbons. Most respondents to a public consultation carried out by the Commission from December 2012 to March 2013 asked for additional EU action related to unconventional hydrocarbons (e.g shale gas) developments in the EU[5]. In May 2013 the European Council called for the development of indigenous energy sources to reduce the EU's external energy dependency and stimulate economic growth while stressing the need to ensure their safe, sustainable and cost-effective extraction and respecting Member States choices of energy mix.[6]

In response, the Commission agreed to develop a framework for safe and secure unconventional hydrocarbon extraction in the EU following the objectives:

- to ensure that opportunities to diversify energy supplies and improve competitiveness can be safely and effectively taken up in those Member states that choose to do so,
- to provide clarity and predictability for both market operators and citizens, including for exploration projects,
- to fully consider greenhouse gas emissions and management of climate and environmental risks, including to health, in line with public expectations.

Since 2012 the Commission has released a series of studies on unconventional fossil fuels, in particular shale gas, addressing especially potential energy market and climate impacts, potential risks for environment and human health, regulatory provisions applicable in selected Member States and the registration under REACH[7] of certain substances potentially used in hydraulic fracturing[8].

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2 http://www.europarl.europa.eu/sides/getDoc.do?type=TA&reference=P7-TA-2012-0443&language=EN

3 http://www.europarl.europa.eu/sides/getDoc.do?type=TA&reference=P7-TA-2012-0444&language=EN

4 http://cor.europa.eu/en/news/Pages/fracking-environmental-impact.aspx

5 http://ec.europa.eu/environment/integration/energy/pdf/Shale%20gas%20consultation_report.pdf

6 http://register.consilium.europa.eu/doc/srv?l=EN&t=PDF&gc=true&sc=false&f=ST%2075%202013%20REV%201&r=http%3A%2F%2Fregister.consilium.europa.eu%2Fpd%2Fen%2F13%2Fst00%2Fst00075-re01.en13.pdf

7 Regulation 1907/2006/EC on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

8 http://ec.europa.eu/environment/integration/energy/uff_studies_en.htm

This Communication outlines the potential new opportunities and challenges stemming from shale gas extraction in Europe. It accompanies a Recommendation providing minimum principles for the exploration and production of hydrocarbons by means of high volume hydraulic fracturing[9]. The objective of this Recommendation is to enable safe and secure development of these resources, and to foster a level playing field for this industry in all EU Member States that choose to develop them.

2. SHALE GAS POTENTIAL IN THE EU

Unconventional hydrocarbon reserves in the EU are deemed to be significant. Based on currently available information, natural gas production from shale formations seems to have the highest potential in Europe compared to other unconventional fossil fuels: technically recoverable shale gas resources have been estimated to approximately 16 trillion cubic meters (tcm), which is much higher than for tight gas (3 tcm) or coal bed methane (2 tcm)[10]. However, there is still significant uncertainty on the economically recoverable portion of these resources. As exploration projects develop, further knowledge on the economically recoverable resources from shale formations and other unconventional sources of gas and oil will be gained.

There has been no commercial production of shale gas in the EU yet, although a few pilot production tests have already been conducted. Commercial production could start in 2015-2017 in the most advanced Member States.

While the EU will not become self-sufficient in natural gas, natural gas production from shale formations could, at least partially, compensate the decline in the EU's conventional gas production and avoid an increase in the EU's reliance on gas imports. Indeed it would be, in a best case scenario, able to contribute almost half of the EU's total gas production and meet about around 10 % of the EU gas demand by 2035[11]. It could offer Member States with a high import dependency the possibility to diversify their energy sources and enhance their security of supply. This obviously needs to be seen in the context of a potential overall share of unconventional gas of approximately 3% of the overall EU energy mix by 2030 in a best case scenario[12].

The direct price effect on European regional gas markets is likely to remain moderate, especially if compared to the evolution in the US. This is due to expected relatively low volumes and higher production costs and the fact that prices are still largely set through long term oil-indexed contracts. But even a moderate decrease or avoided increase in gas prices – for instance through an increased or maintained negotiation position towards non-EU gas

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9 Commission Recommendation on minimum principles for the exploration and production of hydrocarbons (such as shale gas) using high-volume hydraulic fracturing (2014/70/EU), OJ L 39/72, 08.02.2014

10 Estimates for OECD Europe from International Energy Agency (IEA) Golden Rules 2012. Estimates vary depending on sources. See also "Unconventional gas: potential energy market impacts in the European Union", JRC 2012.

11 IEA 2012

12 IEA 2012, Unconventional gas production in Europe in 2035 is reported at 27% of 285 bcm, hence 77 bcm. At the same date, Europe is reported to consume 692 bcm of gas. Hence, European unconventional gas production would represent some 11% of its gas consumption in a best case scenario. Applied to the projected share of gas in the energy mix of at most 30% (IEA), unconventional gas would therefore represent some 3% of the EU energy mix in 2035.

suppliers - would be beneficial for Member States, in particular for those highly reliant on imports, and for consumers and businesses, especially energy intensive industries.

Shale gas activities also have the potential to bring direct or indirect economic benefits to EU Member States, regions and local communities as well as enterprises and citizens, for instance through regional investments in infrastructure, direct and indirect employment opportunities, and public income via taxes, fees and royalties.

Under certain conditions, shale gas also has the potential to bring climate benefits if it substitutes more carbon intensive fossil fuels and does not replace renewable energy sources. Greenhouse gas emissions from shale gas production in Europe could, while being estimated to 1-5% higher per unit of electricity generated compared to conventional natural gas extracted in the EU (provided emissions are properly controlled), be 41% to 49% lower than emissions from coal-based electricity generation, 2% to 10% lower than emissions from electricity generated from conventional pipeline gas produced outside Europe, and 7% to 10% lower than electricity generated from LNG imported into Europe[13]. However, to realise this benefit compared to natural gas imports, greenhouse gas emissions associated with the extraction process, notably methane, need to be properly mitigated.

3. ENVIRONMENTAL RISKS AND PUBLIC CONCERNS

Experts agree that shale gas extraction generally leads to a larger environmental footprint compared to conventional gas development[14]. This is due to the fact that it requires a more intensive well stimulation technique, it mainly takes place on-shore and it would cover much wider areas. In addition, as productivity of shale gas wells is generally lower than conventional wells, more wells need to be drilled. Some of these risks and impacts could have cross border implications, for example in case of water and air pollution.

In the current state of technological development, shale gas extraction requires the combined use of high volume hydraulic fracturing and directional (especially horizontal) drilling. So far, experience in Europe has been focused essentially on low volume hydraulic fracturing in some conventional and tight gas reservoirs, mostly in vertical wells, constituting only a small part of past EU oil and gas operations. Drawing on the North American experience where the high volume hydraulic fracturing has been broadly used, operators are now testing further this practice in the EU.

Especially hydraulic fracturing, a process by which fracturing fluid – a mixture consisting typically of water, sand and chemical additives (generally between 0.5% and 2% of the total fracturing fluid)- is injected under high pressure to break the rock, open and enlarge fractures to enable the hydrocarbons to flow into the well, has raised a wide range of environmental concerns. Between 25-90 % of the initially injected fracturing fluids are expected to remain underground, depending on geological conditions.

One of the main environmental concerns is the risk of contamination of ground and surface waters. In most Member States, groundwater is an important source of drinking water or other

[13] AEA 2012 study "Climate impact of potential shale gas production in the EU" commissioned by the Directorate-General for Climate Action of the European Commission, based on a hypothetical case study using US primary data and a 100 year global warming potential of methane. The study stresses the need to collect further data.

[14] IEA 2012

purposes. The contamination risk is notably linked to the chemicals used in the hydraulic fracturing process. Groundwater contamination can occur in case of leaks, through e.g. improper well design or casing, uncontrolled induced fractures or existing faults or abandoned wells. These risks can be identified and mitigated by a careful site selection based on underground risk characterisation and by the proper insulation of the well from the surrounding geological formations. Surface water contamination can occur if the high volume of wastewater produced is not properly managed and treated. Such wastewater typically contains the chemical additives injected as part of the fracturing fluid as well as possibly highly saline water and naturally occurring heavy metals and radioactive materials from the shale formations. Instances of water contamination by gas have been reported in the US in cases where the well was improperly insulated from the geological formations.

Another water-related risk concerns the impact on water demand, especially in areas where water is scarce. Extraction of natural gas from shale formations through high volume hydraulic fracturing requires larger quantities of water[15] than the extraction of gas from conventional reservoirs, and part of the water is not recovered. The extraction of water for drilling and hydraulic fracturing can put additional stress on aquifers in areas where water is scarce and already competes with other uses (e.g. industry, agriculture, drinking water). This can also impact local ecosystems, thereby affecting biodiversity. Water management plans can help ensuring that water is used efficiently. Where this is environmentally sound and in accordance with existing EU legislation, re-use of flowback water returning to the surface after hydraulic fracturing can contribute to reducing the demand for fresh water.

The quality of soil may also be negatively affected by leaks and spillage, if fracturing fluids and wastewater are not adequately handled.

Unless captured and mitigated, fugitive methane emissions can occur during shale gas exploration or production, which would have a negative impact on local air quality and the climate. Air emissions can also result from increased transport[16] and from on-site equipment. Good practices exist to prevent and mitigate air emissions and should systematically be used.

With current technologies, a large number of wells and related infrastructure are needed for shale gas extraction. This may have impacts on land fragmentation and local road traffic, both of which can have consequences for local communities and biodiversity. This risk needs to be addressed also in case of competing uses of land in a given region e.g. for agriculture or tourism. Other issues that have been identified relate to the risk of induced seismicity.

These environmental risks, also entailing health risks[17], have led to varying degrees of public concern, which not infrequently result in outright opposition to shale gas projects.

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15 When assessed on a per unit of energy produced, this is 2000 to 10 000 times more than conventional gas, IEA Golden Rules report, 2012. Water consumption per shale gas well varies depending on geological specificities but typically amounts on average to about 15 000 m3 per well.

16 E.g of water, chemicals, sand for hydraulic fracturing and wastewater resulting thereof.

17 Assessment of health impacts is only starting, due to the novelty of the practice at the current scale. However, main concerns relate to the direct impacts in terms of air emissions and indirect impacts in terms of potential water pollution by chemicals, some being recognised as carcinogens. Water contamination can in turn lead to contamination of live animals, food and feed. Worksite health hazards include silica hazards, handling of chemicals, exposure to diesel particulate and exhaust gases from equipment as well as high noise levels.

In addition, there is a public perception of insufficient level of precaution, transparency and consultation applied to shale gas activities. About 60% of individual respondents to the Commission consultation[18] stressed the lack of transparency and public information among the main challenges of the sector development. In particular, they identified the asymmetry of information between the operators and competent authorities or the general public as a problem, especially with respect to the composition of fracturing fluids and the geological conditions in which fracking is to take place.

Over the past years, the Commission has received a large[19] number of queries from the general public or its representatives. These queries express concerns and doubts about the effectiveness of the current EU legislative framework, notably as regards the EU legislation on mining waste, environmental impact assessment or air and water protection.

As for many other industrial activities with environmental effects, local populations tend to oppose developments that are too close to their homes ("Not in My Backyard effect")[20]. In several Member States, citizens' actions have prevented shale gas exploration projects from going forward.

A range of good technical and regulatory practices has emerged and with their systematic application to exploration and production of shale gas, possible negative impacts and risks can be managed and mitigated. But as long as these environmental and health risks are not adequately addressed, as long as legal uncertainties remain and there is a lack of transparency, public concerns will persist. A number of experts[21] consider that the lack of public acceptance represents a barrier to further shale gas development[22]. The oil and gas industry itself has highlighted this as a key issue already encountered at the exploration stage[23].

Therefore addressing these risks and the public concern about safety of the operations is of paramount importance to be able to reap potential benefits.

4. ENSURING PROTECTION OF THE ENVIRONMENT, CLIMATE AND PUBLIC HEALTH

Both general EU legislation and specific pieces of EU environmental legislation[24] apply to shale gas activities from planning until cessation.

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18 Unweighted rate, rising to about 80 % in the weighted case.

19 Over a hundred of parliamentary questions and letters, more than 3800 e-mails and more than ten petitions were received by the Commission, some of which signed by some 15 000 citizens.

20 According to the Flash Euro-barometer survey conducted on the basis of interviews of over 25 000 European citizens in September 2012, three quarters of the respondents would be concerned if a shale gas project were to be located in their neighbourhood, with 40% being very concerned.

21 E.g. International Energy Agency Golden rules report 2012; US Department of Energy 90 days report

22 Public acceptance was among the three main challenges identified by respondents in the EC public consultation.

23 E.g JRC IET workshop on shale gas, March 2013

24 See section 3.2 of the Impact assessment, SWD(2014) 21 final of 22.01.2014. The applicable legislation includes the Environmental Impact Assessment (EIA) Directive (2011/92/EU), Mining Waste Directive (2006/21/EC), Water Framework Directive (2000/60/EC), REACH Regulation (1907/2006/EC), Biocides Regulation (528/2012/EU), Seveso II and III (under certain conditions) (96/82/EC and 2012/18/EU), Habitats (1992/43/EEC) and Birds (2009/147/EC) Directives and Environmental Liability Directive (for activities listed under Annex III) (2004/35/EC).

However, as shale gas exploration activities are progressing, Member States have started interpreting the EU environmental legislation in different ways and some are developing specific national rules, including bans and moratoria.

This has resulted in differing requirements from one Member State to another. For instance, some Member States conduct a strategic environmental assessment prior to licensing to take into account the cumulative effects of shale gas projects and require a systematic environmental impact assessment when hydraulic fracturing is intended to be used whereas others do not. Another area with apparent divergent interpretation is the water and mining waste legislation.

This is leading to a fragmented and increasingly complex operating framework within the EU which hinders the proper functioning of the internal market. The different approaches by public authorities may lead to a lack of level playing field and give rise to recurrent concerns regarding the suitability of the environmental safeguards and precaution measures. A risk that national interpretations are legally challenged further affects the predictability for investors.

Since the EU environmental legislation was developed at a time when high volume hydraulic fracturing was not used in Europe, certain environmental aspects associated with the exploration and production of fossil fuels involving this practice are not comprehensively addressed in current EU legislation. This in particular concerns issues such as strategic environmental assessment and planning, underground risk assessment, well integrity, integrated and consistent requirements in terms of baseline and operational monitoring, capture of methane emissions and disclosure of fracturing fluid composition on a well by well basis.

5. TOWARDS AN EU FRAMEWORK

Experts including from the International Energy Agency and other reputed organisations have confirmed the need for robust and clear rules to accompany shale gas developments to ensure that negative impacts can be reduced and risks can be managed.

In 2011, the Commission services issued a guidance summarising the main pieces of applicable EU environmental legislation [25] and a specific guidance on the applicability of the Environmental Impact Assessment (EIA) Directive (2011/92/EU) to shale gas projects[26].

However a number of national and local authorities are still calling for additional urgent EU action in this area. The general public is also asking for clear information on what is required for safe shale gas extraction.

Existing guidance was therefore not considered sufficient to provide clarity and predictability for public authorities, market operators and citizens. This is why the Commission adopted a Recommendation which outlines minimum principles which, if fully applied, would contribute to enabling shale gas activities while ensuring that climate and environmental safeguards are in place. This Recommendation is complementary to the existing EU acquis and builds on previous work conducted by the Commission services. It neither implies that Member States are under any obligation to pursue the exploration or exploitation of shale gas activities if they choose not to nor that Member States are prevented from maintaining or

[25] http://ec.europa.eu/environment/integration/energy/uff_news_en.htm

[26] http://ec.europa.eu/environment/integration/energy/pdf/guidance_note.pdf

introducing more detailed measures matching the specific national, regional or local conditions.

In particular, the Recommendation invites Member States, when applying or adapting their legislation applicable to hydrocarbons involving high volume hydraulic fracturing, to ensure that:

- a strategic environmental assessment is carried out prior to granting licenses for hydrocarbon exploration and/or production which are expected to lead to operations involving high-volume hydraulic fracturing in order to analyse and plan how to prevent, manage and mitigate cumulative impacts, possible conflicts with other uses of natural resources or the underground;
- a site specific risk characterisation and assessment is carried out, related to both the underground and the surface, to determine whether an area is suitable for safe and secure exploration or production of hydrocarbons involving high volume hydraulic fracturing. It would inter alia identify risks of underground exposure pathways such as induced fractures, existing faults or abandoned wells;
- baseline reporting (e.g. of water, air, seismicity) takes place, in order to provide a reference for subsequent monitoring or in case of an incident;
- the public is informed of the composition of the fluid used for hydraulic fracturing on a well by well basis as well as on waste water composition, baseline data and monitoring results. This is needed to ensure that the authorities and the general public have factual information on potential risks and their sources. Improved transparency should also facilitate public acceptance;
- the well is properly insulated from the surrounding geological formations, in particular to avoid contamination of groundwater;
- venting (release of gases into the atmosphere) is limited to most exceptional operational safety cases, flaring (controlled burning of gases) is minimised, and gas is captured for its subsequent use (e.g. on-site or through pipelines). This is needed to mitigate negative effects of emissions on the climate, as well as on local air quality.

It is also recommended that Member States ensure that companies apply best available techniques (BAT), where applicable and good industry practices to prevent, manage and reduce the impacts and risks associated with exploration and production projects. Industry should strive for maximum transparency in their operations and constantly improve technologies and operating practices. In order to draw up BAT reference documents, the Commission will organise an exchange of information between Member States, the industries concerned and non-governmental organisations promoting environmental protection.

In addition, the Commission is reviewing the existing reference document (BREF) on extractive waste under the Mining Waste Directive so as to cover notably the management of waste from hydrocarbon exploration and production involving high volume hydraulic fracturing, in order to ensure that waste is appropriately handled and treated and the risk of water, air and soil pollution is minimised. It will also propose to the European Chemicals Agency to make certain changes in the existing database of registered chemicals under REACH so as to improve and facilitate the search of information on registered substances used for hydraulic fracturing purposes. This will be subject to consultation with stakeholders.

It is also necessary to continue increasing our knowledge on unconventional hydrocarbon extraction technologies and practices also in order to further reduce potential health and environmental impacts and risks. In this context, it is also essential that information is open and transparent to the public. To facilitate this process, the Commission will establish a European Science and Technology Network on Unconventional Hydrocarbon Extraction, bringing together practitioners from industry, research, academia as well as civil society. The Network will collect, analyse and review results from exploration projects as well as assess the development of technologies used in unconventional gas and oil projects. Further research in the field on understanding, preventing and mitigating environmental impacts and risks of shale gas exploration and exploitation is also announced in the 2014-2015 work programme of Horizon 2020. The latter also announces a grant aimed at supporting the development and implementation of evidence base for research and innovation policies in the area of unconventional gas and oil.

In order to ensure adequate risk management and to avoid administrative burden for operators, Member States should ensure that permitting authorities have sufficient resources and knowledge of the process and that the permitting procedure is appropriately coordinated. They must consult citizens and stakeholders early on, before operations are starting. Member States and their competent authorities are also encouraged to exchange good regulatory practices and other knowledge. The Commission will facilitate such exchange through the Technical Working Group of Member States on environmental aspects of unconventional fossil fuels.

The Commission will closely monitor the implementation of the Recommendation through a publicly available comparison of the situation in Member States in the form of a scoreboard**.** This is designed to increase transparency and assess progress in each Member State on applying the principles set in the Recommendation.

Member States and national competent authorities should inform the public on key issues related to the operations in order to enhance transparency and restore public trust. Member States are invited to give effect to the principles set out in the Recommendation 6 months after its publication and to inform the Commission on measures they have taken in response to the Recommendation.

The Commission will review the extent to which this approach is effective in implementing the principles set out in the Recommendation and in providing predictability and clarity to citizens, operators and public authorities. It will report to the Parliament and the Council within 18 months after publication in the Official Journal. It will decide whether it is necessary to put forward legislative proposals.

6. CONCLUSIONS

Member States are responsible for deciding on their energy mix while giving due regard to the need to preserve and improve the quality of the environment. It is therefore for the Member States to decide whether to explore or produce natural gas from shale formations or other unconventional hydrocarbon resources. However, those that do so will have to make sure that proper conditions are in place for doing that. Among these conditions and in order to help address public's concerns, they will need to take measures to prevent, manage and reduce the risks associated with such activities.

Building on the existing EU legislation and on available and further improving practices and technologies, the Commission calls upon Member States which are currently exploring or plan to explore and produce their unconventional hydrocarbon resources such as shale gas to properly implement and apply existing EU legislation and in doing so, or in adapting their implementing legislation to the needs and specificities of unconventional hydrocarbon resources to follow the accompanying Recommendation to make sure that proper conditions for their safe and secure development are in place, also taking into account possible effects on neighbouring countries.

With this Recommendation, the Commission aims at supporting Member States in ensuring that the environment is safeguarded, resources are used efficiently and the public is informed, while enabling potential energy security and competitiveness benefits to be reaped in those Member States who wish so.

Finally, it should be recalled that the EU's long-term objective is to become a resource-efficient low-carbon economy. In the short to medium term, natural gas and the availability of new sources of indigenous fossil fuels, such as natural gas from shale formations, can play a role in the transformation of the energy sector provided it substitutes more carbon intensive fossil fuels. In any case, the long term objective of decarbonising our energy system will require continued improvement of energy efficiency, energy savings and increased uptake of low carbon technologies, in particular renewable energies.