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The exploration and exploitation of non-conventional hydrocarbons in Europe

Report[1]
Committee on Social Affairs, Health and Sustainable Development
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Summary

Non-conventional hydrocarbons, such as shale gas and oil, have shaken the global energy market. The exploration and exploitation of these resources mainly refers to hydraulic fracturing ("fracking"), a technique which raises a number of concerns related to public health and environmental protection.

The report seeks to assess the economic, geostrategic and environmental dimensions of the potential development of these resources in Europe. It highlights the negative implications of such development for a clean water supply and public health, as well as the harmful effect on climate goals.

The report therefore recommends to those countries which seek to diversify their energy supply to turn to cleaner alternatives – investing in renewable energies and reducing energy consumption. Pending a possible ban on fracking, the Parliamentary Assembly should recommend limiting and controlling the exploration and exploitation of non-conventional hydrocarbons by adopting strict environmental regulations.

1. Reference to committee: Doc. 13567, Reference 4075 of 3 October 2014.

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A. Draft resolution[2]

1. Non-conventional hydrocarbons, such as shale gas and oil, have shaken the global energy market. The exploration and exploitation of these resources mainly refers to hydraulic fracturing ("fracking"), a technique for tapping underground natural gas by injecting high-pressure water and chemicals to break rocks, with a view to liberating the gas and oil they contain. This controversial procedure raises a number of concerns related to public health and environmental protection.

2. The weak economic viability of hydraulic fracturing in Europe, coupled with public acceptance issues, should discourage exploitation of unconventional fossil fuels. However, since hydraulic fracturing is authorised in some European countries, a thorough assessment of its feasibility and implications remains a task of urgent practical importance.

3. The fight against climate change and water scarcity is vital for the survival of humankind. By signing the Paris Agreement on combating climate change, States committed to keeping the increase in global average temperature below 2°C above pre-industrial levels and aim at 1.5%. States should therefore not adopt energy policies which could impede the achievement of this goal. The Parliamentary Assembly strongly supports the efforts of States to comply with their international obligations in this field. Non-conventional hydrocarbon production is more harmful to climate change than coal, so will require a greater reduction in fossil fuel production elsewhere. Council of Europe member States should focus on developing sustainable alternatives.

4. Oil producers have increased production in response to Unites States shale gas exploitation, which has reduced oil prices and returns on investments in renewables. However, as 75% of identified fossil fuels cannot be used without a climate change catastrophe, member States should prioritise long-term investment in renewables irrespective of short-term oil prices.

5. Recalling its Resolution 1977 (2014) on energy diversification as a fundamental contribution to sustainable development, the Assembly recommends that member States diversify their energy supplies and prioritise the use of cleaner and safer energy resources focusing on renewables, including solar, wind, hydraulic, geothermal, biomass and marine power. Fiscal initiatives and planning law in member States should favour renewables and member States should also prioritise policies promoting energy efficiency and reducing energy consumption. Member States have the opportunity to take global leadership in renewable technology and co-operation to help the developing world to grow with its fair share of energy in a sustainable way. Member States should encourage the transfer of renewable energy technologies to developing countries to avoid associated climate change. This can include extending networks of solar forests across southern Europe and northern Africa and pioneering carbon capture.

6. The Assembly is deeply concerned about threats to the environment and public health related to the exploration and exploitation of shale gas and oil, in particular in relation to water contamination, air quality and local environmental harm. In light of the above considerations, the Assembly urges all member States to clarify and strengthen their legislation in this field, including bans on fracking in favour of cleaner energy alternatives.

7. Pending a possible ban on fracking, the Assembly recommends limiting and controlling the exploration and exploitation of non-conventional hydrocarbons by adopting strict environmental regulations which:

7.1. impose a compulsory environmental impact assessment for any fracking project, including the impact on air and water quality and climate change;

7.2. ensure that the industrial companies involved comply with all air and water quality regulations and oblige companies to disclose the nature and amount of chemicals used during the process of fracking;

7.3. restrict overall upstream fugitive emissions to below 1%, with those at the fracking site no higher than 0.1% of natural gas production; ensure that "green completions" are mandatory, namely all wells have to be capped and the methane captured with no venting or burning (flaring); put in place comprehensive monitoring of shale gas and oil operations through environmental agencies, taking into consideration the need for more accurate top-down measurements of methane releases;

7.4. ensure the efficient criminal prosecution of companies failing to comply with all the above-mentioned regulations, including compensation for environmental damage;

2. Draft resolution adopted by the committee on 11 October 2016.

7.5. encourage the oil and gas industry to follow the best up-to-date drilling practices and to adopt safer and more environmentally friendly techniques; ensure funding of independent high-quality research on the risks of exploration and exploitation of non-conventional hydrocarbons to inform regulation;

7.6. ensure transparency, by providing full information on fracking projects to citizens, and ensuring their involvement in decision-making processes when it comes to energy projects in their communities; protect areas with great environmental and cultural value from drilling operations which may have a visual or other impact on the landscape.

8. The Assembly recommends that member States:

8.1. promote research and investment in energy efficiency and the development of greener and safer energy sources such as renewable energies, offering energy security and limiting environmental and health hazards;

8.2. accelerate efforts to draw up a trans-European plan, with a view to ironing out the fluctuations in energy supply linked to the regional use of solitary renewable energy sources such as solar or wind power.

9. The Assembly recommends that free trade deals involving member States, including the Transatlantic Trade and Investment Partnership (TTIP) and the Comprehensive Economic Trade Agreement (CETA), help countries to fulfil their obligations under the United Nations Conference on Climate Change 2015 (COP21) and to freely and fairly safeguard their environments.

B. Explanatory memorandum by Mr Geraint Davies, rapporteur

1. Introduction

1. Europe is somewhat envious of the United States success story in the energy field. Low energy prices, new jobs and tax revenue, increased energy security – these are the top benefits of the unconventional energy boom in the United States. Whereas a dash for shale oil and gas gave a spectacular boost to the US economy and sent very powerful ripples through the global energy market, it is also impacting Europe through a lower energy import bill and geopolitical developments – but also in terms of reduced investments in renewable energy sources.

2. Can and should Europe join the development of non-conventional hydrocarbons? This is a polarising question that has sparked a heated debate across the continent. On the one hand, these energy resources have been branded as a game changer that can help satisfy growing energy needs worldwide, stimulate economic growth and increase domestic energy security. On the other hand, voices have been raised about the negative impact of the extraction process on the environment. Tapping unconventional fossil fuels on top of the traditional ones may also aggravate global warming.

3. The exploitation of non-conventional resources remains a high-intensity and complex process. Hence, when discussing future prospects for this industry in Europe, all aspects of the process need to be examined and regulatory needs should be properly assessed.[3] To this end, we must bear in mind that some of the environmental and public health impacts may take years, even decades, to come to light.[4]

4. There is hence a pressing need for Europe to debate the issue and see what are the policy and technological options for making sound strategic choices in the field of unconventional fossil fuels. In order to encourage an informed and objective discussion, this report considers and weighs the benefits and risks, as well as looking at the lessons to be drawn from the US experience. This report seeks realistic answers to questions about the prospects, (pre)conditions and legislative challenges for tapping unconventional fossil fuels in Europe in a way that takes into account the needs of the present generation without compromising those of the future generations.

2. Fossil fuels and sustainable development

5. In September 2015, the United Nations adopted new Sustainable Development Goals, which are supposed to guide the international community's action for the next fifteen years. In order to ensure universal access to affordable, reliable and modern energy services, it is recommended to substantially increase the share of renewable energy in the global energy mix. By 2030, the world must enhance international co-operation in order to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.[5]

6. By the same token, the new global warming target of 2°C was adopted by international consensus in December 2015 and signed in April 2016 in Paris.[6] According to the Intergovernmental Panel on Climate Change (IPCC), global warming of more than 2°C would have serious consequences, such as an increase in the number of extreme climate events. However, the Paris Summit also included a non-binding limit of 1.5°C.

7. According to the IPCC, the world can only burn one trillion tonnes of carbon equivalent, if we are to stay within the 2°C limit. We have already burnt 550 billion tonnes since the start of the industrial revolution. Of the remaining 450 billion tonnes, 20% is accounted for by other greenhouse gases, leaving a budget of just 360 billion tonnes of carbon, or 1 320 tonnes of carbon dioxide. If the annual global carbon dioxide emissions continue at the same intensity as today, in order to have just a probability bigger than 66%[7] of limiting temperature rise to 2°C above pre-industrial levels, the world will have completely exhausted this budget

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3. See the report on the environmental impacts of shale gas and shale oil extraction activities, 2011/2308(INI), European Parliament, Committee on the Environment, Public Health and Food Security, p. 27, paragraph I.
4. Council of Canadian Academies, Environmental Impacts of Shale Gas Extraction in Canada, Ottawa (ON): The Expert Panel on Harnessing Science and Technology to Understand the Environmental Impacts of Shale Gas Extraction, 2014, p. XVII.
5. United Nations Sustainable Development Knowledge Platform, https://sustainabledevelopment.un.org/.
6. See UNFCCC, COP21, Paris, 30 November-11 December 2015, "Adoption of the Paris Agreement", Article 2, paragraph 1.*a*.
7. ICPP Fifth Assessment Report (AR5), "Climate Change 2014: Synthesis Report", p. 63.

before the end of 2045.[8] It is estimated that the world has more than a trillion tonnes of carbon in conventional fossil fuel reserves alone, which is three times the amount that could be safely burnt for a two-thirds chance of staying within 2°C of warming. The 2°C limit requires that 80% of coal, 50% of gas and one third of oil remain below ground.[9] If the lower target of 1.5°C is to have just a 50% probability of achievement then the world's remaining carbon budget from 2016 is only 140 billion tonnes, which will be exhausted by 2030 at the current level of emissions.

8. From the sustainable development perspective, developing unconventional sources such as shale oil, shale gas or tar sands is useless, as increased production will have to be met by a greater reduction in conventional fossil fuel production elsewhere. Therefore, for Europe to fulfil its climate change obligations, it must reduce fossil fuel consumption and refocus its production efforts on sustainable alternatives.

9. Our collective international environmental obligations entail a responsibility upon Council of Europe member States to apply the highest environmental, legal and technological standards and to introduce strong measures to protect public health and the environment. In addition, they imply that the exploration and exploitation of unconventional fossil fuels (in particular shale gas and oil) should be scaled back in favour of research and development into cleaner alternatives.

10. Nevertheless, even though renewables also offer energy security without the attendant health and environmental risks of burning fossil fuels, the impetus to develop national fossil fuel resources should not be underestimated. In Europe, shale gas production is often claimed to be a way to diversify the energy supply and decrease reliance on imports. European dependency on gas, from Russia, is expected to exceed 70% in the coming years. The current crisis in eastern Europe might have significant repercussions for energy security.[10]

3. Background information on non-conventional hydrocarbons

11. Exploration and exploitation of non-conventional hydrocarbons in Europe refers mainly to hydraulic fracturing ("fracking") of oil and gas (shale gas mostly, as well as coal-bed gas and tight gas) using horizontal drilling, but also to specific techniques such as electric, thermal or propane fracking. As far as their nature is concerned, conventional and unconventional gas and oil are exactly the same. What makes the difference is the method of extraction.

12. Hydraulic fracturing produces fractures in the rock formation, which stimulate the flow of natural gas or oil, increasing the volumes that can be recovered. Wells may be drilled vertically hundreds to thousands of meters below the land surface and may include horizontal or directional sections extending thousands of meters. Fractures are created by pumping large quantities of fluids at high pressure down a well-bore and into the target rock formation. Hydraulic fracturing fluid commonly consists of water, proppant and chemical additives that open and enlarge fractures within the rock formation. The proppants – sand, ceramic pellets or other small incompressible particles – hold open the newly created fractures.

13. Once the injection process is completed, the internal pressure of the rock formation causes fluid to return to the surface through the well-bore. This fluid is composed of both "flowback" and "produced water", and may contain the injected chemicals plus several naturally occurring materials such as brines, metals, radionuclides, and hydrocarbons. The flowback and produced water is typically stored on site in tanks or pits before treatment, disposal or recycling.[11]

14. Shale gas, that is to say natural gas trapped within shale formations, is typically found in underground layers anything from a few meters to tens of meters thick and at maximum depths of 6 to 7 kilometres. Worldwide technically recoverable shale gas reserves are sizeable and estimated to be approximately 200 trillion cubic metres (tcm), of which 16 tcm are located in Europe – the largest reserves are estimated to exist in China, the United States, Argentina and Mexico.

15. Shale gas is not a new discovery; people have had knowledge of its existence for a very long time. What is new is the technology for accessing it at a relatively low cost, but a cost that varies depending upon the legal safeguards that have been put in place as well as geological conditions. The question is not whether

8. "Infographic: The Global Carbon Budget", World Resources Institute, www.wri.org/resources/.
9. C. McGlade and P. Ekins, "The geographical distribution of fossil fuels unused when limiting global warming to 2°C", UCL Institute for Sustainable Resources, 7 January 2015.
10. IASS fact sheet 1/2015, Institute for Advanced Sustainability Studies (IASS), Potsdam, June 2015.
11. "The Process of Hydraulic Fracturing", US Environmental protection agency, https://www.epa.gov/hydraulicfracturing/process-hydraulic-fracturing.

or not there are shale gas deposits, but where these can be accessed at a low direct cost and without environmental disasters. Whatever the size of the reserves, the amount of the extraction depends on political, geological and geographical factors, environmental implications and public acceptance.

16. According to current geological knowledge, shale gas reserves are widespread across Europe, with Gas in Place (GIP)[12] estimates equal to 37.6 tcm for England, 13 tcm for Germany, 2 tcm for Spain, and approximately 5 tcm for Poland. Technically recoverable reserves are a matter of some dispute; in Poland, for example, fracking companies gave up after 2 years due to unfavourable geological conditions. However, company estimates are on the generous side and usually range between 10% and 20% of GIP. Sizeable reserves are present in France, Ukraine, Bulgaria and Romania, although national studies confirming this potential have not yet been conducted. In some shale reservoirs, shale oil is also present.[13]

17. Some countries, for instance the United Kingdom, advocate burning gas instead of coal for the reason that gas produces less carbon dioxide (CO_2) per unit of energy. However, this observation ignores the events "upstream": namely the processes needed to locate, extract, store, transport and deliver gas to its destination. Gas consists almost entirely of methane, a powerful greenhouse gas with a global warming potential (GWP) 86 times greater than an equivalent mass of CO_2, over a 20-year time frame.[14] Over 100 years, the GWP of methane is 36, an IPCC estimate from their 2013 report that has been increased by 44% since the United Kingdom Department of Energy and Climate Change (DECC) last examined the problem (using outdated GWP estimates from IPCC 2007).

18. Releases of methane from upstream operations can be deliberate (due for example to venting) or can be accidental. They are referred to as fugitive emissions. There is a large difference in fugitive emissions between conventional and unconventional methods of gas extraction. A large reservoir of natural gas may require only a handful of platforms to extract the underlying resources, which typically are under pressure and therefore relatively simple to release and capture. By contrast, unconventional sources such as shale gas are present as bubbles of gas within shale rock formations. Extraction is extremely challenging, and requires the injection of sand, water, chemicals and lubricants under pressure and thousands of well-heads may be required to locate and extract significant quantities of gas. The potential for leaks, whether accidental or deliberate, is correspondingly greater.[15] The same goes for the extraction of shale oil; fugitive emissions of methane from shale oil operators may be even worse than for shale gas as the shale oil operators have no financial interest in capturing the methane released by their activities.

19. Evidence suggests that shale gas is at least twice as harmful as coal from a climate change perspective.[16] Simulation modelling demonstrates that any benefit to the climate from burning gas in place of coal is lost if fugitive emissions exceed 2% of gas production. In the United States, shale activity releases fugitive methane emissions that represent 6% to 8% of the total production (from well to delivery).[17] This is confirmed by top-down data (TD data) from aircraft and satellites which provides a more accurate measure of methane releases from shale operations. US satellite data indicates bigger releases over exploratory fields (over 10%) than over established fields, so "green completions" (ensuring that wells are capped and methane is captured and nothing is burned or vented) are vital even in early stages of exploration. Bottom-up data generally underestimate the amount of methane being released by fracking in the United States, which is up to 10 times more than conventional methods of gas extraction. Conventional gas is associated with methane losses of around 1%, which means that the advantage of burning gas over coal is 25% and not 50%. However, liquefying natural gas is an energy-intensive process that adds 20%-25% to the carbon footprint. This indicates that liquefied natural gas is equivalent to burning coal in terms of its impact on global warming.

12. Total volume of natural gas in an underground rock formation.
13. IASS fact sheet 1/2015, op. cit.
14. Climate change 2013, The Physical Science basis, Working Group I contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, p. 714.
15. *Times of Oman*, January 2016.
16. Dr Robin Russell-Jones, "Fugitive methane will cancel out the benefits of shifting from coal to gas", March 2016.
17. Robert W. Howarth, Renee Santoro and Anthony Ingraffea, "Methane and the greenhouse-gas footprint of natural gas from shale formations", letter, 12 November 2010.

4. The economic, environmental, public health, technological and energy security implications

4.1. The economic, technological, energy security and geostrategic dimensions

20. Historically, the political instability in the Middle East always led to higher oil prices, as the conflicts interrupted drilling operations and oil shipments. However, this is the first time that oil prices have not increased despite extreme instability in the region, including the tensions between Iran and Saudi Arabia. This is due to the response of oil operators in Saudi Arabia to the American fracking boom which could lead to the energy independence of the United States. Increased oil production is reducing global oil prices which, in turn is reducing the profitability of fracking. This has profound political, financial and environmental implications. In particular, the impact of lower oil prices is to encourage greater fossil fuel use and to lower investment in renewables, which increases the pressure on climate change. Therefore, the growth of fracking is adding to fossil fuel consumption and hindering development of sustainable energy. In particular, investments in renewables are wrongly assessed and rejected against current low energy costs based on oil production that is unsustainable if we are to fulfil our Paris COP21 obligations.

21. In the European Union, conventional gas production has been declining since 1990 and imports of natural gas, essentially from Russia, Norway, Algeria and Qatar, represent two thirds of consumption. European unconventional gas resources are insufficient for competing with cheap imports. For many European countries, it does not make economic sense to carry out hydraulic fracturing.

22. It is estimated that carrying out fracking in the United States is approximately two times cheaper than in Europe, partly because geological conditions in Europe are more complex, but mainly because the fracking industry in the United States was granted exemptions from the Clean Water and Clean Air Acts. Furthermore, the shale gas and oil revolution is likely to be short-lived since the life-cycle of shale gas or oil wells ranges from five to seven years. According to the French energy company Total, the extraction of shale gas and oil requires deep drilling of 10 to 100 times more wells in comparison to conventional oil and gas. This requires constant important financial investments.[18]

23. It is hard to see any worthwhile economic benefits from fracking in Europe, except for the shale operators, and even then they will only make a profit if they are heavily subsidised by governments initially. The International Monetary Fund (IMF) has recently calculated the cost of energy subsidies to the world community at $5.3 trillion annually (6.5% of global gross domestic product (GDP)).[19] The British Government has offered generous tax breaks to fracking companies, bypassed local planning laws, and passed an Infrastructure Bill[20] so that fracking companies could perform their operations under land without the owners' permission, and also near to National Parks. In contrast, British tax breaks for renewables have been reduced for solar power and planning regulations have become more restrictive for on-shore wind farms. Nevertheless, there are huge risks for those investing in fracking as they run the risk of losing all of their investment if it is decided that fracking is incompatible with European Union, United Kingdom or the United Nation's climate change commitments.

24. It took around 30 years for shale operators in the United States to produce shale gas and shale oil in significant quantities. During this time, they were largely unregulated, which means that the relatively low cost of their product has been achieved at the expense of fugitive emissions into the atmosphere, which aggravates climate change, and as yet unquantified effects upon the health of the local population through noise, intrusion on property, local air quality, possible contamination of water supplies and the dumping of contaminated water.

25. Moreover, Europe and the United States have completely different land ownership legislation and conditions. On the one hand, the United States is sparsely populated. The owner owns the soil as well as the subsoil of the land which is a big incentive to exploit its resources. On the other hand, most of Europe is densely populated and negotiations are more complicated; the State often has to intervene as an intermediate between the land owner and the company which wants to exploit land resources.[21]

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18. See the Assembly report on "Energy diversification as a fundamental contribution to sustainable development", Doc. 13366 and Resolution 1977 (2014).
19. David Coady, Ian Parry, Louis Sears and Baoping Shang, IMF Survey WP/15/105, "How large are global energy subsidies?", p. 5.
20. Infrastructure Act 2015, chapter 7, part 6, "Other provision about onshore petroleum", section 50, 4A "Onshore hydraulic fracturing: safeguards".
21. "The Era of Gas – How to use this new potential?", PKN ORLEN SA, Warsaw, 2011, p. 12.

26. There is no reason to believe that the techniques developed for shale formations in the United States will be applicable in Europe. For instance, shale operators gave up trying to extract shale gas in Poland[22] due to hostile geological factors: the deposits were too deep and too hard to extract.

27. According to the International Energy Agency (IEA), European energy security cannot be guaranteed on the basis of the US unconventional gas experience, because there are too many uncertainties. It would take years (between five and fifteen years) to develop commercially viable shale oil and gas in Europe with prices expected to be twice those in the United States because of local geology, stricter environmental controls, public acceptance issues and less well developed drilling capacities.

4.2. The social, environmental, and public health dimensions

28. One of the main concerns about fracking is the impact on climate change outlined above. The need to stop burning coal is obvious; shale gas is at least two times worse than coal from a climate change perspective. Without a global carbon cap, additional gas would add to the pollution of fossil fuels, driving emissions higher and making climate change harder to mitigate. Even with a global carbon cap, further fossil fuel exploitation will bring down the price of gas and thus will increase consumption of fossil fuels. According to the Intergovernmental Panel on Climate Change, the life cycle of CO_2 from shale gas is twice as short as that of coal or oil but it is still longer than that of green energy (wind and solar).

29. In addition, fracking does not contribute towards the EU Horizon 2020 goal to encourage the development of low carbon energy. The EU goals for climate and energy are by 2020 to cut greenhouse gas emissions by 20% below the 1990 level, to cover 20% of energy needs from renewable resources and to shrink energy consumption by 20%. The EU Energy Roadmap 2050 adopted in 2011 seeks to further cut emissions to 80%-95% below the 1990 level.

30. The second most important concern is without doubt the different environmental implications of fracking, such as water and air pollution, alongside consequences for land use and biodiversity. Large quantities of water and waste products need to be shipped in or out of a fracking site and each fracking well requires up to 6 million gallons of water and produces around 3 million gallons of waste. In the absence of pipelines, this has to be brought in and out by lorries, causing further impact on local communities. Because of lax regulation, fracking companies commonly dispose of contaminated fracking water in the cheapest, easiest ways they can find, regardless of the consequences for communities, water treatment facilities and the environment.

31. Hydraulic fracturing has the potential to contaminate both surface and ground drinking water with methane and drilling chemicals.[23] However, the joint United Kingdom report by the Royal Society and the Royal Academy of Engineering concluded that fracking could be done safely if appropriate safeguards are in place. We should note that this report did not consider the effect of industrial-scale fracking on climate change. In order to frack, an enormous amount of water is mixed with various toxic chemical compounds to create frack fluid. This frack fluid is further contaminated by the heavy metals and radioactive elements that exist naturally in the shale. A significant portion of the frack fluid returns to the surface. Without proper oversight, the waste fluid can be dumped in rivers and streams. Underground water supplies can theoretically be contaminated by fracking, through the migration of gas and frack fluid underground.[24]

32. Some of the chemicals used for fracking are highly toxic and can cause cancer, like Benzene, Toluene, 2-butoxyethanol (a main ingredient in anti-freeze and oil dispersants), and heavy metals. The Endocrine Disruptor Exchange (TEDX) has identified 353 chemicals used in fracking, many of which can cause cancer and other serious health problems, even in small doses. At present, there are no regulations obliging fracking companies to disclose the chemical additives they use during the process.

33. Groundwater becomes contaminated by hydraulic fracturing in a number of ways, including leakage from liquid storage areas, leakage from injection wells, leakage during hydro-fracking along faults or in abandoned wells, seepage into the ground when wastewater and residuals are applied to land (for example used for irrigation or on roads for dust suppression or de-icing), and other means.

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22. Exxon Mobil Company stopped exploration in 2012, Marathon – in 2013, Total – in 2014 and Chevron – in 2015.
23. U.S. EPA. Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources (External Review Draft). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-15/047, 2015.
24. Greenpeace, www.greenpeace.org/.

34. Land is being polluted by acid rain, by leaks of used water full of chemicals which infiltrates the ground and by tornadoes/storms which spread the chemicals in the environment. There is also a land impact from deforestation and clearing forests for fracking sites.

35. Adverse effects of fracking on both wild and domestic animals have been noted (loss of habitat, obstacles on the route of migration of endangered species and deaths from drinking and breathing polluted water and air).[25]

36. Other risks include earthquakes, explosions and fires. Noise pollution (from the trucks which transport used water) and visual "pollution" (from the important number of wells being built due to the short life span of a fracking well) are among other hazards.

37. There is little evidence of specific health effects to be assigned to shale operations per se, but this may emerge over time. However, any population exposed to shale operations should be monitored both before and after fracking activities have ceased. It is difficult to determine how many of the alleged or observed health effects are actually due to fracking chemicals per se and how many are related to extraneous activities. Some of the claimed health impacts are physical (acute and long-term neurological complaints, upper respiratory issues, headaches, fatigue and nausea), and some are psychological (mistrust of industrial companies and governmental authorities, stress, etc.).

38. It is important to note that it is rather hard to meet people who have participated in scientific studies that prove health effects, as many of them have signed confidentiality agreements with the fracking companies. Nevertheless, there exist a number of studies which show meaningful concerns for human health. A recent study "Towards an understanding of the environmental and public health impacts of shale gas development: an analysis of the peer reviewed scientific literature, 2009-2015" (April 2016) provides an overview of scientific research in the field. The analysis of the body of scientific literature published between 2009 and 2015 indicates that 26 studies (84%) contain findings that relate public health hazards, elevated risks or adverse health outcomes with unconventional natural gas development and only 5 studies (16%) contain findings that indicate no significant public health hazards, elevated risks or adverse health outcomes.[26]

39. Studies show that fracking contributes to air pollution as a source of particulates. Evidence shows that it may have effects on pregnant women, foetal health and outcomes in children exposed *in utero* to diesel emissions, in particular, lower IQ (some studies indicate around 4 IQ points, similar to that seen with lead in petrol) and mental disorders in primary school children including ADHD, anxiety and depression. Decreased birth weight near wellheads may be explained by the diesel emitted around fracking sites rather than fugitive emissions or contamination of the water supply by fracking chemicals.[27]

40. As was mentioned above, the fracking industry employs a huge variety of chemicals in order to lubricate and facilitate their operations. Some of these chemicals are "grade I carcinogens". In addition, fracking releases radioactive substances trapped in rock formations such as radon gas, so waste products from fracking need to be handled in specific waste disposal facilities adapted to radioactive waste. This means that all chemicals used by fracking companies should include a health-effects profile with appropriate justification for the use of chemicals with carcinogenic potential.

41. Apart from environmental and health impacts, fracking also causes property damage and value loss. Disadvantaged people are more likely to be exposed to pollution from fracking.

5. Lessons to be drawn from the United States experience

42. Most experience with fracking has been gained in the United States where extraction technologies have been developed since 1970. Shale gas accounts for 67% of the country's natural gas extraction.[28]

43. In the United States, the extraction industry was granted exemptions from the most important environment regulations. Therefore, the US Environment Protection Agency (EPA) was not mandated to undertake routine monitoring of shale gas or shale oil operations. As a result, there has been a fierce debate

25. Michelle Bamberger and Robert E. Oswald, "Long-term impacts of unconventional drilling operations on human and animal health, Part A: Toxic/Hazardous Substances and Environmental Engineering", *Journal of Environmental Science and Health*.
26. www.psehealthyenergy.org/site/view/1233.
27. According to a University of Pittsburgh Graduate School of Public Health analysis of southwestern Pennsylvania birth records, www.mirm.pitt.edu/documents/pdf/Pitt-Lower-Birth-Weight-Associated-with.pdf.
28. US Department of Energy, "How is shale gas produced?", April 2013.

as to the magnitude of methane released by fracking in the United States. Part of the problem is that EPA estimates are based on very limited monitoring, mainly around fracking sites, which is likely to miss larger releases from compressors, storage depots, antiquated pipelines and poorly operated facilities. Additionally, no official survey in the United States has taken into account the huge releases of methane from the Aliso Canyon blowout in California, which released prodigious quantities of methane from a gas storage depot equivalent to the entire annual releases of a field such as the Barnett Shale.

44. The US experience clearly demonstrates the consequences of allowing a fossil fuel industry to regulate itself. The oil and gas industry is protected by laws passed in Congress which allows it not to respect federal environmental regulations (such as the Clean Air Act, the Clean Water Act and the Safe Drinking Water Act). Thus, fracking is mostly governed by State regulations. The oil and gas industry silences individuals through non-disclosure clauses to avoid them talking about potential environmental and health issues caused by fracking.

45. There is a general lack of transparency regarding the chemicals used by the industry and there are no or few environmental and health impact assessments of fracking.[29] The New York State environmental impact assessment led to a ban of fracking in the State of New York.[30] There is no regulation on quotas of organic components emissions, waste management, or on the chemicals used for fracking. A very recent study from Harvard documented a 30% increase in methane emissions over the United States since 2002, which accounts for between 30% and 60% of the increase in atmospheric methane seen globally over the same period.[31] Shale operations are the most likely explanation for these observations.

46. In the United States, fracking, and especially related leaks, increase water and climate change problems, thus creating major public health issues regarding drinking water and air quality. On-site surveys signalled a 6% to 9% rate of well failures and had established a list of 243 cases in which shale-exploring companies had contaminated private drinking water resources over 2008-2014. Fines in cases of accidental pollution are not sufficient to be dissuasive and violators of regulations are often not even fined.[32] In addition, the burden of proof in case of pollution lies on the inhabitants and not on the oil and gas industry.

47. Fracking companies have used Investor State Dispute Settlements powers in free trade agreements through arbitration courts to sue countries for using environmental protection as a constraint on industry profit. In particular, Lone Pine sued the Canadian Government for $250 million for the fracking moratorium in Quebec and TransCanada is suing the US Government for $15 billion over the halting of the Canada–US sand-oil pipeline. Therefore, it is important that EU trade deals, in particular with the United States (the Transatlantic Trade and Investment Partnership (TTIP) and the Trade in Services Agreement (TISA)) and Canada (the Comprehensive Economic Trade Agreement (CETA)) are drafted in a way which enables European countries to freely and fairly safeguard their environments from the negative effects of fracking.

6. The situation in Europe

48. In Europe there is still little experience in the field of hydraulic fracturing. Nevertheless, it can be considered as an emerging trend since many believe that it could resolve two pressing issues: increasing energy demand and dependence on gas imports. As described above, fracking is associated with a number of hazards; adequate regulation and enforcement frameworks could help to mitigate these risks.

49. In the document “Conclusions on Energy” (4 February 2011), the Council of the European Union proposed that “in order to further enhance its security of supply, Europe's potential for sustainable extraction and use of conventional and unconventional (shale gas and oil shale) fossil fuel resources should be assessed”.[33] On 25 September 2012, the European Parliament published a report on the environmental impacts of shale gas and shale oil extraction activities (2011/2308(INI)). Under the Environmental Impact Assessment Directive (EIA Directive),[34] projects for the extraction of natural gas exceeding 500 cubic meters/day are subject to a mandatory Environmental Impact Assessment. However, the average amount of shale gas gathered through fracking mostly remains under this limit.

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29. “Environmental Impacts of Shale Gas Extraction in Canada”, 2014, op. cit.
30. Thomas Kaplandec, “Citing Health Risks, Cuomo Bans Fracking in New York State”, *New York Times*, 17 December 2014.
31. A. J. Turner, D. J. Jacob, J. Benmergui, S. C. Wofsy, J. D. Maasakkers, A. Butz, O. Hasekamp and S.C. Biraud, “A large increase in U.S. methane emissions over the past decade inferred from satellite data and surface observations”, research letter, 2 March 2016, http://onlinelibrary.wiley.com/.
32. Maurice Hinchey, “Fracking Industry Needs to Follow Laws, Too”, 28 November 2011.
33. European Council Conclusions on Energy, 4 February 2011, p. 3.

50. The environmental and health threats from fracking gave rise to a debate in the European Parliament on whether to enact a mandatory EIA for fracking projects. In October 2013, the European Parliament passed an amendment to the EIA Directive under which fracking shall be subject to a mandatory EIA, regardless of the amount extracted. However, the Council did not approve the proposed amendment. Therefore, the most recent amendment of the EIA Directive does not change the fracking legislation. Consequently, on 22 January 2014, the European Commission made a recommendation[35] on minimum principles required when the States apply their regulations on fracking. Such recommendations are not binding and member States do not have to follow the Commission's proposals. A few months ago, a motion for a resolution in the European Parliament on energy security was rejected due to a reference to an unconventional gas.[36]

51. For the time being, fracking is banned in Bulgaria, France, Germany, the Netherlands and Scotland. It is authorised in Denmark, England, Hungary, Lithuania, Poland, Sweden and Ukraine. Austria applies restrictive laws. Six EU countries are considering fracking, including Germany.

52. In the United Kingdom, the drilling company Cuadrilla Resources claimed to have found vast reserves at its site near Blackpool. The company claimed that the Blackpool site alone has 5 trillion cubic meters of gas (ten times more than the US estimates for the whole of the United Kingdom). Its operation was put on hold after causing seismic tremors in 2011. A moratorium on fracking lasted 18 months. A report by the British Government's advisers published in April 2012 gave the green light to the fracking project despite acknowledging the link between the process and the earthquakes. In 2015, the government was in favour of fracking, while local authorities were reluctant to grant the necessary authorisations. In Scotland, there is a moratorium on fracking and Wales makes it impossible for permits to be obtained due to strict planning regulations.

53. According to the US Energy Information Administration 2011 report, Poland had 187 trillion cubic feet of technically recoverable shale gas resources.[37] However, the 2012 Polish Geological Institute study showed that the above report was too optimistic, as Poland's recoverable shale gas resources did not seem to exceed 768 billion cubic meters (which is approximately 85%-95% less than the US EIA predicted). Following several protests and bad performance of the wells due to geological reasons, the foreign investors decided to quit. The optimistic 2011 announcement by Poland's then-prime minister that drilling would begin in 2014, was followed by a modest announcement by Poland's environment ministry about the need to be more patient. The multinationals which had invested in Poland pulled out one by one with Chevron being the last one to quit in 2015. None of the wells drilled by the end of 2015 could be exploited commercially. At the present moment, fracking in Poland has been put on hold.

54. In France, fracking was forbidden by a 2011 law. In 2014, an expert report was completed on the experimentation of an operating technology based on fluoropropane as a cleaner alternative to fracking. However, the government never agreed to implement it.

55. In Germany, reports by the Federal Institute for Geosciences and Natural Resources (BGR) claim that, especially in the north, shale gas supplies are significantly larger than those of conventional gas. In 2014, the German Government announced a law banning commercial shale gas production, which can be considered as a *de facto* moratorium. In April 2015, a legislative package was adopted for the limitation of exploitation of conventional and non-conventional fuels.

56. In Bulgaria, a moratorium has been implemented. In Austria, there are restrictive laws and *de facto* no fracking can take place.

57. Therefore, we may conclude that the modest position which the European Commission takes, and the strong and divergent approaches of the European countries concerning their shale gas regulations, shows that Europe is largely divided in the face of the shale gas revolution.

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34. Directive 2011/92/EU of the European Parliament and of the Council on the assessment of the effects of certain public and private projects on the environment, 13 December 2011.
35. Recommendation 2014/70/EU of the European Commission on minimum principles for the exploration and production of hydrocarbons (such as shale gas) using high-volume hydraulic fracturing.
36. www.foodandwatereurope.org/pressreleases/majority-meps-vote-for-immediate-fracking-moratorium/.
37. See "World Shale Resource Assessments" by the US Energy Information Administration, released in 2011 and updated on a regular basis.

7. Conclusions and recommendations

58. In the last decade, the hydraulic fracturing technique has been used in the United States to commercially exploit shale gas. In Europe, while proponents of this technique highlight possible benefits in terms of energy security, prices, employment and revenue, others point to negative experiences and environmental and public health risks.

59. The fossil industry is now working to a very limited carbon budget, so it would be better not to waste financial resources exploring new reserves of fossil fuels which cannot possibly be developed if the world is to remain on course for a global warming target of 2°C, let alone 1.5°C. Thus, member States should refrain from adopting energy policies which would impede the achievement of the goal to minimise the impacts of climate change.

60. Instead, resources and time should be focused on the development of renewables becoming the central part of the energy mix, including solar, wind, hydraulic, geothermal, biomass and marine power, as well as decreasing energy consumption and being more energy sufficient. Energy consumption must be decoupled from economic and demographic growth, and an integrated approach to energy diversification must be adopted including households, transport and industry.[38] It is important to accelerate efforts for a pan-European plan so that renewable energy such as solar power or wind power in different countries can help iron out the fluctuations in energy supply which result from the regional use of a solitary renewable energy source.

61. The choice for Europe is whether to be sidetracked into more fossil fuel exploitation or to take global leadership in renewable technology and co-operation. If the developing world is to have its fair share of energy consumption then developed economies must help provide it with renewable energy technologies to avoid associated climate change, for example by extending networks of solar forests across southern Europe and northern Africa and pioneering carbon capture. Time and resources are limited, so the best focus for sustainability must be adopted.

62. In the meantime, emerging satellite data on the climate change impact of US fracking and environmental concerns should lead to a suspension of fracking by application of the precautionary principle. In the face of serious or irreversible damage, lack of full scientific evidence must not be used as a reason for postponing cost-effective measures to prevent environmental degradation. Independent research concerning the risks of exploration and exploitation of non-conventional hydrocarbons should be initiated.

63. Unconventional oil and gas are unlikely to be a game changer in Europe, mainly due to their weak economic viability and environmental impact. There is a need for each country and region to properly weigh up local specificities, needs and opportunities in terms of energy supplies over the short and the long term. For those countries which would like to pursue or launch the practice, they must first ensure that the scale of permitted fracking is consistent with their greenhouse gas emission targets agreed at the COP21 in Paris.

64. To sum up, I believe that the Assembly should urge all Council of Europe member States to clarify and strengthen their legislation in favour of cleaner energy alternatives. Pending a possible ban on fracking, member States should limit and control the exploration and exploitation of non-conventional hydrocarbons by adopting strict environmental regulations.

65. In addition, to protect public health and the local environment, several basic conditions should be fulfilled:

– adopting regulations ensuring transparency, a compulsory Environmental Impact Assessment for any fracking project and the obligation for industrial companies to comply with all environmental regulations;

– transparency regarding the chemicals used during the process (what chemicals are being used, and in what quantity);

– efficient criminal prosecution of individuals and companies not following the regulations, including compensation for environmental damage;

– obligation for companies to introduce more safe and environmentally friendly drilling techniques.

38. See Doc. 13366, op. cit.

66. There is scope to develop better drilling techniques which could render fracking a more environmentally friendly practice. Instead of being released into the atmosphere, some methane and CO_2 could be captured and sold on the markets to reduce the amount of gas released in the environment. This technique is called the "green completion". Unfortunately, it is not commonly used as it is time-consuming.

67. Member States should protect areas with great environmental and cultural value, such as national parks, from drilling operations.

68. EU trade deals, including the Transatlantic Trade and Investment Partnership and the Comprehensive Economic Trade Agreement, should be drafted in a way which enables European countries to freely and fairly safeguard the environment and to fulfil their COP21 obligations, without special provisions for investors, including those in unconventional hydrocarbon extraction, to trump environmental responsibilities.