Directorate – General for Internal Policies

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Impacts of shale gas and shale oil extraction on the Environment and on human health

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CONCLUSIONS AND RECOMMENDATIONS

Existing mining laws in Europe and related regulations affecting mining activities do not take care of the specific aspects of hydraulic fracturing. There are major differences between mining related regulations in European Member States. In many cases, mining rights are privileged over citizens' rights, and local political authorities ofen do not have an influence on possible projects or mining sites as these are granted by national or state governments and their authorities.

In a changing social and technical environment where climate change issues and the transition to a sustainable energy system are top priorities and where public participation at regional and local levels is being strengthened, national interests for mining activities and interests of regional and local governments as well as of the affected population need to be re-assessed.

A prerequisite of such an assessment should be a mandatory Life Cycle Analysis of new projects including an environmental impact analysis. Only a full cost/benefit analysis provides a proper base for a judgement about the relevance of individual projects and their justification.

The technology of hydraulic fracturing has a significant impact in the USA, which at present is the only country with several decades of experience and long-term statistical records. The technology for shale gas development has characteristics which partly show unavoidable environmental impacts, partly have a high risk if the technology is not used adequately and partly have a possible high risk for environmental damages and hazards to human health even when applied properly.

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One of the unavoidable impacts is huge land consumption and major landscape changes as the well density must be very high in order to fracture the source rocks at large scale for access to the stored gas. The individual well pads – in the USA up to 6 well pads per km² or even more are reported – must be prepared, developed and connected by roads which are accessible for heavy duty transport. Producing wells must be connected by gathering lines with low throughput, but also with purging units to separate waste water and chemicals, heavy metals or radioactive ingredients from the produced gas before it is pumped into the existing gas grid.

Possible risks due to inconvenient handling include accidents, e.g. blow out with frac-water spills, leakages from wastewater or from fracture fluid ponds or pipes, groundwater contamination due to improper handling or unprofessional cementing of the well casing. These risks can be reduced and probably avoided with adequate technical directives, cautious handling practise and supervision by public authorities. However, all these safety measures increase the project costs and slow down the development speed. Therefore, the risks of accidents increases with increasing economic pressure and the need for speeding up development. More wells per time need higher efforts for supervision and monitoring. Finally, some risk is inherent to uncontrolled fracturing which results in uncontrolled mobilization of fracture liquids or even of the natural gas itself. For instance, it is well known that small earthquakes can be induced by hydraulic fracturing which might mobilize gas or fluids through "naturally" created fractures.

Experience from the USA shows that in practise many accidents happen. Too often, companies are fined from official authorities for violations. These accidents are partly caused by leaky or malfunctioning equipment, partly caused by bad practises in order to save costs and time, partly due to unprofessional casing of the wells and partly due to groundwater contamination through undetected leaks.

At a time when sustainability is key to future operations it can be questioned whether the injection of toxic chemicals in the underground should be allowed, or whether it should be banned as such a practice would restrict or exclude any later use of the contaminated layer (e.g. for geothermal purposes) and as long-term effects are not investigated. In an active shale gas extraction area, about 0.1-0.5 litres of chemicals are injected per square meter.

Greenhouse gas emissions from natural gas are usually lower than from other fossil fuels at about 200 g CO2-equivalent per kWh. Due to the low gas recovery per well and fugitive methane losses, the higher efforts for development, and the low throughput of gathering lines and compressors the specific emissions of shale gas use are higher than from conventional gas fields. Nonetheless, assessments from US practice cannot simply be transferred to the European situation. A realistic assessment based on project data is still missing. The assessment performed in this study might be seen as a first step towards such an analysis.

The present EU-legislative framework requires an environmental impact assessment only when the production rate of the well in question exceeds 500.000 m³ per day. This limit is far too high and ignoring the reality of shale gas wells which typically produce in the order of several ten thousand m³ per day in the beginning. An environmental impact assessment with public participation should be mandatory for each well.

Regional authorities should possess the right to exclude sensitive areas (e.g. potable water protection zones, villages, arable land, etc.) from possible hydraulic fracturing activities. Moreover, regional authorities should be strengthened in their autonomy to decide about the banning or licencing of hydraulic fracturing in their territory.

The present privileges of oil and gas exploration and production must be reassessed in view of the following facts that

- European gas production has been in steep decline for several years and is expected to decline by another 30 per cent or more until 2035,

- European demand is expected to rise further until 2035,
- imports of natural gas will unavoidably increase further if these trends become reality,
- it is by no means guaranteed that additional imports in the order of 100 billion m³ per year or more can be realised.

The resources for unconventional gas in Europe are too small to have any substantial influence on these trends. This holds even more as the typical production profiles will allow extracting only a limited share of these resources. Environmental obligations will also increase project costs and delay their development. This will reduce the potential contribution further.

Whatever reasons for allowing hydraulic fracturing exist, the justification that it helps to reduce greenhouse gas emissions are rarely among them. On the contrary, it is very likely that investments in shale gas projects – if at all – might have a short-living impact on gas supply which could be counterproductive , as it would provide the impression of an ensured gas supply at a time when the signal to consumers should be to reduce this dependency by savings, efficiency measures and substitution.

RECOMMENDATIONS

- There is no comprehensive directive providing for a European mining law. **A publicly available, comprehensive and detailed analysis of the European regulatory framework concerning shale gas and tight oil extraction is not available and should be developed.**
- The current EU regulatory framework concerning hydraulic fracturing, which is the core element in shale gas and tight oil extraction, has a number of gaps. Most importantly, **the threshold for Environmental Impact Assessments to be carried out on hydraulic fracturing activities in hydrocarbon extraction is set far above any potential industrial activities of this kind, and thus should be lowered substantially.**
- The coverage of the water framework Directive should be re-assessed with special focus on fracturing activities and their possible impacts on surface water.
- In the framework of a Life Cycle Analysis (LCA), a thorough cost/benefit analysis could be a tool to assess the overall benefits for society and its citizens. A harmonized approach to be applied throughout EU27 should be developed, based on which responsible authorities can perform their LCA assessments and discuss them with the public.
- **It should be assessed whether the use of toxic chemicals for injection should be banned in general.** At least, all chemicals to be used should be disclosed publicly, the number of allowed chemicals should be restricted and its use should be monitored. Statistics about the injected quantities and number of projects should be collected at European level.
- **Regional authorities should be strengthened to take decisions on the permission of projects which involve hydraulic fracturing.** Public participation and LCA assessments should be mandatory in finding these decisions.
- **Where project permits are granted, the monitoring of surface water flows and air emissions should be mandatory.**

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- Statistics on accidents and complaints should be collected and analysed at European level. Where projects are permitted, an independent authority should collect and review complaints.
- Because of the complex nature of possible impacts and risks to the environment and to human health of hydraulic fracturing **consideration should be given to developing a new directive at European level regulating all issues in this area comprehensively**.