BRIEFING PAPER

JUNE 2013

WWF position on shale gas in the EU

Keep Pandora's Box firmly shut

WWF opposes the exploitation of shale gas in Europe. There is no convincing science-based evidence that development of shale gas in the EU and its Member States would be compatible with short and long term decarbonisation of EU energy supply or with a move to help stay well below 2 degrees of global warming. The economic benefits of shale gas have been overstated, which could inhibit moves toward sustainable energy. Furthermore, we are concerned about the various demonstrated and potential negative impacts which may pose unacceptable risks to people and the environment at local level.

WWF believes that the EU can transition to a fully sustainable renewable energy system by 2050 without the exploitation of unconventional gas in the EU during the transition away from the current energy system. Our publication 'Putting the EU on track for 100% renewable energy' (2012) documents how that vision can be achieved. It builds on 'The Energy Report' (2011), which outlines a vision for 100% renewable energy globally by 2050.

GAS PLAYS A USEFUL BUT DECLINING ROLE AS WE DECARBONISE

In moving to a deeply decarbonised energy system, we need to reduce our dependence on fossil fuels continuously rather than allowing new fossil fuel sources into the market. There is a transition period wherein gas plays an important, but circumscribed role.

The European Commission's 2050 energy roadmap scenarios (which reach lower renewable energy levels than WWF's scenarios) all show that levels of gas demand should decline over the coming four decades. We are therefore very concerned that by opening up Pandora's box for new gas, we are preparing the way for long-term lock in, when in fact we need to be developing an exit strategy for fossil fuels

We need to leave fossil fuels in the ground if we want to avoid dangerous climate change

Global conventional gas reserves, defined as presently economically viable and technologically exploitable, are now 210 trillion cubic meters (tcm), or about 64 times present global production. This reserve base, resulting from recent development of new exploration technologies and higher gas prices in the global market, has been growing tremendously, having risen from about 130 tcm in 1991[i].

The International Energy Agency states that presently there are 421 tcm of conventional and 331 tcm of unconventional and technically recoverable fossil gas[ii]. It is estimated that viable fossil gas reserves may represent about 250 years of present consumption[iii]. If burnt, this reserve represents about 1550 Gt CO2 – far above the total amount of CO2 emissions (900 Gt) permitted worldwide in a carbon budget for the 2010-2050 period that would allow us to have just a 50/50 chance of staying below the 2-degree Celsius limit[iv].

Recently, the IEA sent a strong warning to the global community stating that rather than expanding the fossil reserve base, the world needs to leave about two thirds of the presently existing commercially viable reserves in the ground in order to stay below the 2 degree limit. Those "reserves" still *exclude* to a large extent those "unconventional" shale gas and shale oil "resources" that increasingly enter the reserve base resulting from technological progress [v]. There is no evidence, or legal process to ensure, that extracting shale gas will result in other fossil fuels such as coal being left in the ground.

Assuming CCS use is a high risk strategy that will lead to an overshoot of 2 degrees

The use of fossil fuels is only theoretically compatible with a low-carbon trajectory if emissions are captured and stored.

The European Commission's energy roadmap 2050 scenarios envisage between €800 billion and €1.5 trillion in new or replacement fossil fuel generation being built to 2050; under-delivery of CCS would force a choice between polluting beyond acceptable limits or decommissioning these assets.

Whilst WWF is supportive of the demonstration of CCS technology in the power sector (directed towards use with sustainable biomass) and industry, the current poor state of development of CCS, its high cost, and the long delay to full implementation means that relying on CCS for any significant amount of decarbonisation is a very high-risk approach.

Two divergent IEA scenarios are informative here: the one that is compatible with staying below 450ppm and two degree warming envisages 90 GT of CCS by 2050 – rising from close to zero now, and therefore questionable as to feasibility. By contrast, the 'Golden Age' dash for- gas scenario, which avoids CCS, is consistent with 650 ppm, resulting in a probable temperature rise of more than 3.5 degrees. These present a false dichotomy between an uncertain abatement technology or a certain overshoot of ecological limits. The alternative to both of these risky approaches is to shift to sustainable energy early.

Methane leakage worsens the GHG balance of shale gas

There is also a great deal of concern about the possible methane emissions associated with shale gas. Recent studies indicated emissions as high as 9%[vi]. The evidence is still being compiled, and leakage rates may be on average well lower. Still, it is estimated that leakage levels above 3.2% would nullify any emission advantage over coal[vii].

Some have also argued to consider the short-term impact of methane emissions, which has a global warming potential 72 times greater than CO_2 over a

20 year span – three times the 100 year average level. AEA's study of shale gas for the European Commission[viii] states that '*This figure can be argued to be more relevant to the evaluation of the significance of methane emissions in the next two or three decades which will be the most critical to determine whether the world can still reach the objective of limiting the long-term increase in average surface temperatures to 2 degrees Celsius*"[ix].

Even if there were zero leakage, combustion of natural gas is still high-carbon compared to renewable energy. The emerging picture of leakage only serves to make the role of gas more problematic.

The economic benefits and low-price potential of shale gas have been overstated

It is unlikely that the low prices in the United States will last (indeed, prices have nearly doubled since the low in 2012[x]) or that they will be duplicated in Europe. A study by Deutsche Bank suggested that "*those waiting for a shale-gas "revolution" outside the US will likely be disappointed, in terms of both price and the speed at which high-volume production can be achieved*[xi]". The IEA published the indicative costs of shale gas developments in Europe and suggested that the costs will be up to three times higher per unit of gas than in the US and similar to those of conventional gas[xii].

At the European level, the IEA indicated that even in the scenario with the most EU shale gas exploitation (and where emissions are consistent with global temperature rises of 3.5 degrees) "*the upward trend in net gas imports into the EU continues throughout the projection period* (to 2035)[xiii]". The implications are clear – even in the most 'optimistic' shale gas scenario, the EU will still increase its imported gas dependency. This argues for stronger development of alternatives to fossil fuels which are domestically produced – i.e. sustainable forms of renewable energy, used efficiently.

The gas glut in the US has hit the profits of shale gas operators, with a number recently announcing their intention to write down the value of their shale gas assets[xiv]. Even in 2009, when US gas prices were significantly higher, a study found that "*half of the horizontal wells drilled were unprofitable, even at 2009 gas price of $6 per MBtu*[xv].

Most forecasts agree that the EU breakeven price will be higher than in the US and that there are considerable question marks as to whether gas prices will be lower than they would have otherwise been. Gas prices are forecast to continue to rise steadily to 2035 even if projections from the IEA and others reflect the current view that these rises may be more moderate than originally projected[xvi]. This is of course against the backdrop that future gas forecasts can never be relied upon and that failing to reduce the EU's overall reliance on gas on the assumption that gas prices will be low is a highly risky strategy.

SHALE GAS INVESTMENT COULD LOCK THE EU INTO GAS INFRASTRUCTURE AND FREEZE OUT RENEWABLES

Once billions of euros have been invested in new gas infrastructure, it would be naïve to assume, particularly in the absence strong and binding global, EU and national climate legislation for the post-2020 period, that it would be simple to retire these assets early enough for the EU to stay on track for a consistent and economically viable decarbonisation pathway. This is especially the case as new gas plants will have an expected operational lifetime of some 25 to 35 years

Europe's infrastructure for conventional gas is also growing, including upgrades to existing connections to Russia, new pipelines (South Stream, North Stream), intra-EU connections, and domestic hubs for LNG. If new domestic shale gas resources add to that gas infrastructure glut in Europe, the EU's long-term lock-in to new high carbon-based infrastructure will be unavoidable.

In today's capital-constrained markets, introducing competition for energy finance will be problematic. It would be particularly perverse if EU member states would envisage tax breaks and other financial support measures for shale gas. This would not only compete with lower-carbon alternatives, it would contradict Europe's G20 commitment to phasing out fossil fuel subsidies.

Serious local environmental impacts have been documented

In places where shale gas is already being commercially exploited, serious concerns have arisen about environmental impacts. Whilst some, but not all, environmental risks are likely to be reduced through stringent regulation, where fracking is undertaken at scale the cumulative probability of accidents or negligence will inevitably increase (it has been estimated that meeting 2-3% of European gas demand in 2030 with EU shale gas would require drilling 500-800 wells per year to maintain production levels[xvii], which is on an unprecedented scale in Europe).

From the available evidence the most significant environmental risks appear to be the following:

Freshwater availability: the present practice of shale gas exploration needs up to 100 m^3 of water (which is used in the fracking mixture pumped down the well), per well, per Terajoule (TJ) produced. This is up to 100,000 times more freshwater than needed for conventional gas[xviii]. According to an IEA report, "In areas of water scarcity, the extraction of water for drilling and hydraulic fracturing …….can have broad and serious environmental effects. It can lower the water table, affect biodiversity and harm the local ecosystem. It can also reduce the availability of water for use by local communities and ……in agriculture"[xix]. It is worth noting that in its World Energy Outlook 2012 report, the IEA projects that water needs for energy production will grow at twice the rate of energy demand in the period running up to 2035.

Well Integrity: some academic studies have suggested that the issue of well integrity, meaning the effective sealing of the well from the surrounding environment, which may include groundwater zones, is of significant concern. Studies have shown that well integrity issues may affect around 5% or more of wells drilled[xx]. Poor well design or construction can lead to subsurface groundwater contamination arising from aquifer penetration by the well, the flow of fluids into, or from rock formations, or the migration of combustible natural gas to water supplies. During the drilling stage, contamination can arise as a result of ineffective site management, well blowout or component failure.

Surface and groundwater contamination: according to the EC study[xxi], there is a high risk of surface and groundwater contamination at various stages of the well construction, hydraulic fracturing and gas production processes, and after well abandonment. Runoff and erosion during early site construction, particularly from storm water, may lead to silt accumulation in surface waters and contaminants entering water bodies, streams and groundwater. This is a problem common to all large-scale mining and extraction activities. However, unconventional gas extraction carries a higher risk because it requires high-volume processes per installation and the risks increase with multiple installations.

Disposal of flow back fluids: large volumes of fracking fluids which were originally pumped down the well re-emerge after the well has been fracked. These fluids will contain the original chemicals added to the fracturing plus substances present in the shale rock formation itself. These may include naturally occurring radioactive materials, salt and trace elements[xxii]. There is significant potential for environmental contamination at surface level if the substances are not properly contained or treatment facilities are inadequate.

Air pollution: air pollution is also likely to arise as a result of shale gas extraction. According to an EU study potential sources include "diesel fumes from fracturing liquid pumps and emissions of hazardous pollutants, ozone precursors and odours due to gas leakage during completion" and "emissions of hazardous pollutants from gases and hydraulic fracturing fluids dissolved in waste water during well completion or re-completion[xxiii]"
There are a number of other risks and environmental impacts likely to result from shale gas drilling. These include land fragmentation, noise, visual impacts, traffic movements and other loss of amenities to local populations.

European Environmental law is not fit for purpose to regulate shale gas

WWF urges policymakers to consider the gaps in current policies, which were formulated prior to the introduction of unconventional fossil fuel extraction technologies. A thorough evaluation, followed by likely amendment, of the Environmental Impact Assessment Directive, the European Waste Directive, and the Environmental Liability Directive is still necessary. In addition, the EU Effort Sharing Decision and the EU Emissions Trading Scheme should be examined in light of the serious concerns about the proper greenhouse gas accounting of methane emissions. EU water legislation (especially the Water Framework Directive and the Groundwater Directive) and Mining Waste Directive (which requires treatment of flow back water) provide a regulatory framework for water protection and need to be properly implemented and applied by EU Member States.

i BP, Statistical Review of World Energy 2012
ii IEA, Golden Rules for Golden Age of Gas, 2012
iii IEA, World Energy Outlook, 2011
iv The IEA estimates a carbon budget of approximately 900 GT to stay below 450 ppm CO_2e.
v IEA, World Energy Outlook, 2012
vi http://www.nature.com/news/methane-leaks-erode-green-credentials-of-natural-gas-1.12123
vii Alvarez, R. A., Pacala, S. W. Winebrake, J. J., Chameides, W. L. & Hamburg, S. P. Proc. Natl Acad. Sci. USA 109, 6435–6440 (2012).
viii AEA 'Climate impact of potential shale gas production in the EU,' Report for DG Clima, 30 July 2012.
ix http://ec.europa.eu/clima/policies/eccp/docs/120815_final_report_en.pdf
x Point Carbon, 2 May 2013: http://www.pointcarbon.com/news/1.2333221?&ref=searchlist
xi Hsueh M, Lewis M (2011) European Gas: A first look at EU shale gas prospects
xii IEA, Golden rules for a Golden Age of Gas, 2012
xiii IEA, Golden rules for a Golden Age of Gas, 2012
xiv The Independent, 'Fracking floors energy giants,' 19 August 2012.
xv IEA, Golden rules for a Golden Age of Gas, 2012
xvi JRC, 'Unconventional Gas: potential energy market impacts in the European Union' 2012.
xvii Dr. Werner Zittel, 'Shale Gas – European Perspectives'; European Parliament presentation, 14th May 2013.
xviii IEA, Golden rules for a Golden Age of Gas, 2012
xix IEA, Golden rules for a Golden Age of Gas, 2012
xx Watson and Bachu. Evaluation of the Potential for Gas and CO2 Leakage Along Wellbores. *SPE Drilling and Completion, March 2009.* Society of Petroleum Engineers.
xxi EC study on shale gas environmental impacts http://ec.europa.eu/environment/integration/energy/pdf/fracking%20study.pdf
xxii http://ec.europa.eu/environment/integration/energy/pdf/fracking%20study.pdf p56
xxiii http://ec.europa.eu/environment/integration/energy/pdf/fracking%20study.pdf

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Why we are here
To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

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