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Thinking ahead for Europe

Shale Gas and the EU Internal Gas Market:

Beyond the hype and hysteria

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Abstract

This paper analyses the interplay between shale gas and the EU internal gas market. Drawing on data presented in the 2012 International Energy Agency's report on shale gas and additional scenario analyses performed by the Joint Research Centre, the paper is based on the assumption that shale gas will not fundamentally change the EU's dependence on foreign gas supplies. It argues that attention should be shifted away from hyping shale gas to completing the internal gas market. Two main reasons are given for this. First, the internal gas market is needed to enable shale gas development in countries where there is political support for shale gas extraction. And second, a well-functioning internal gas market would, arguably, contribute much more to Europe's security of supply than domestic shale gas exploitation. This has important implications for the shale gas industry. As it is hard to see how subsidies or exemptions from environmental legislation could be justified, shale gas development in Europe will only go ahead if it proves to be both economically and environmentally viable. It is thus up to the energy industry to demonstrate that this is the case.

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1. Introduction

Since the so-called silent energy revolution in the US, shale gas has sparked considerable debate in many parts of the world and has often been described as a geopolitical game-changer.[1] At the same time, shale gas has sparked fears of negative environmental externalities such as water and air pollution and resource costs, especially in water-scarce regions. The climate impact of shale gas is also far from clear.[2]

This paper does not aim to contribute to the debate on the negative environmental externalities of shale gas, nor does it inform the debate on the implications of shale gas for climate change. Rather, it aims to assess what shale gas development in Europe and the world mean for the European gas market. Two key dimensions are discussed: first, in an optimistic scenario, how much could shale gas change the structure of European gas supplies? Second, to what extent do shale gas developments depend on a well-functioning European energy market and, conversely, would shale gas complement or run counter to the EU's efforts to complete the internal gas market?

Having clarified how shale gas interacts with the EU's agenda to complete the internal gas market, the paper looks at the implications of this analysis for stakeholders. What key requirements do European and international companies with a stake in the shale gas business need to fulfil to do business in Europe? Here, the emphasis is not so much on what regulatory framework is necessary for economically and environmentally viable shale gas development, which is discussed elsewhere,[3] but rather on the challenges business and industry would face if they intend to develop shale gas in Europe.

This paper makes a sober assessment of the contribution that global shale gas development could make to securing Europe's energy supplies and aims to outline the real challenges that lie ahead. It attempts to take some of the emotion out of a debate that is still characterised by hype about a 'shale gas revolution' or hysteria about shale gas leading to 'the end of the world as we know it'.

2. The potential of shale gas

Before analysing how shale gas may (or may not) affect European gas supplies, it is necessary to outline what role natural gas can be expected to play in Europe and the world in decades to come.

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[1] This paper focuses on shale gas, which has been recognized as the most 'promising' unconventional gas (the other ones being tight gas and coalbed methane). As opposed to conventional natural gas, unconventional gas extraction requires more sophisticated technologies such as horizontal drilling.

[2] AEA Technology, 2012a; Lechtenböhmer et al., 2011, and AEA, 2012b; Schrag, 2012.

[3] International Energy Agency, 2012, JRC, 2012, Philippe & Partners, 2011.

2.1 The role of gas in the energy transition

Gas is projected to play an increasingly important role in the world's future energy mix; the International Energy Agency (IEA, 2011) has even wondered if we are entering a 'golden age of gas.' In fact, in all scenarios of the IEA's 2011 World Energy Outlook the demand for gas is expected to rise until 2035, unlike the demand for all other fossil fuels.[4] In short, gas will play an important role in the world's future fuel mix beyond 2030.

With respect to the EU, the IEA projects that the share of gas in total energy demand will fall between 23- 31% in 2035, compared to 25% in 2009.[5] Accordingly, in the Commission's (2011) Energy Roadmap 2050, gas is expected to play an important role in the EU energy mix across all scenarios; representing 22-25% of primary energy consumption by 2030, and between 19 and 26% by 2050.

In decarbonisation scenarios the EU's gas consumption in absolute terms is set to decrease due to assumed energy efficiency improvements, but the general message is clear: gas will be needed for some time to come and will complement variable renewables. Besides the power sector, gas is also relevant for the petrochemicals sector, and may increasingly also play a role in transport (WEC, 2012). However, if carbon capture and sequestration (CCS) technologies are not commercially viable by the 2030s, gas would need to be phased out to reach the EU's ambitious goal of decreasing CO_2 emissions to 80-95% of 1990 levels by 2050.

2.2 Geographic distribution of shale gas

While conventional natural gas resources are concentrated in similar locations to those of oil,[6] shale gas and other unconventional gas resources (tight gas and coalbed methane) do not follow the usual oil boundaries (Verrastro el al., 2010). Figure 1 shows the ten largest unconventional gas producers in the *optimistic* IEA "Golden Rules" scenario.[7] Its implications are discussed separately for each major region. All data is from IEA (2012), unless otherwise stated.[8]

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[4] The compound annual growth of gas for the period 2009-2035 is 0.9-2%, depending on the assumptions about global climate action (the higher the climate ambitions, the lower the share of gas). Non-OECD countries make up the largest share of demand growth in the IEA's 2011 "New Policies Scenario".

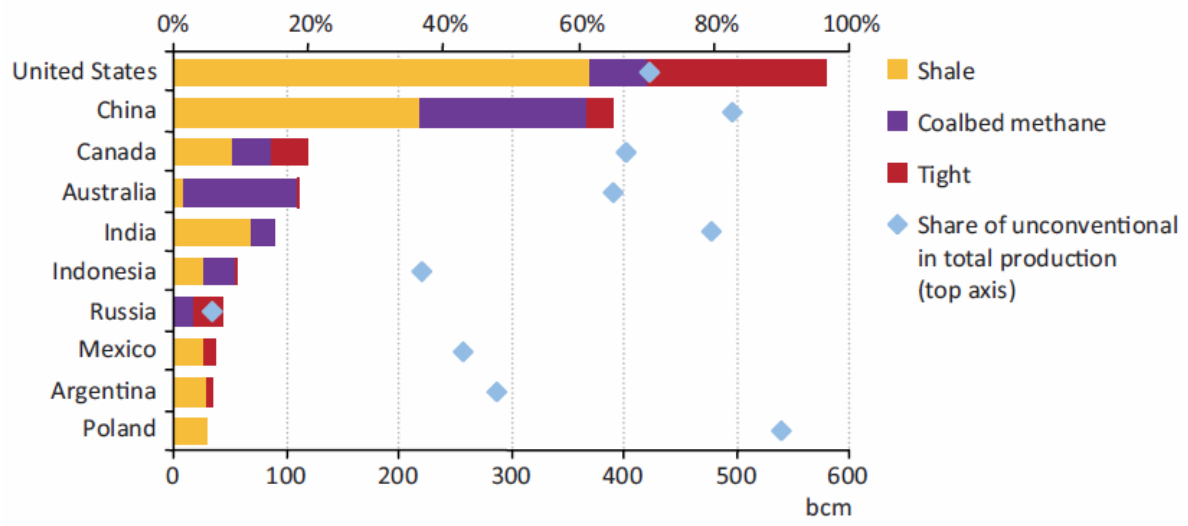
[5] In the most ambitious "450 Scenario" of the IEA 2011 outlook, the compound annual growth rate for gas is thus negative (-0.5), but it is clear that even then the share of gas in the energy mix would be significant.

[6] Approximately 70% of conventional natural gas resources are geographically concentrated in only three countries: Qatar, Iran and Russia (Massachusetts Institute of Technology, 2010).

[7] This scenario makes a number of favourable assumptions about "the conditions [that] are put in place to allow for a continued global expansion of gas supply from unconventional resources. This allows unconventional gas output to expand not only in North America but also in other countries around the world with major resources." (IEA, 2012).

[8] As these predictions depend on many highly uncertain variables (the existence of technically and commercially exploitable reserves, economic growth, demographic developments, etc.), they should be treated with caution.

Figure 1. Ten largest unconventional gas producers in the Golden Rules Case, 2035



Source: IEA, 2012.

2.2.1 *Europe and Russia*

Gas production in the EU is expected to reach 165 bcm in 2035, 47% of which is 'unconventional', meaning that the EU's import dependency would amount to 74%. Unconventional gas would thus not reduce the EU's import dependency compared to today's levels (2010: 63%, 2020: 73%), but it would offset the decline in conventional European natural gas production foreseen for the post-2020 period.[9] When compared with a projected low unconventional gas scenario the difference is (merely) 11 percentage points in 2035.

While unconventional gas resources are thought to exist in many parts of the EU, even in their favourable Golden Rules scenario, the IEA expects only Poland to become a major shale gas producer. It should, however, be noted that the IEA study draws on the estimates from Rogner and Advanced Resources International (ARI) published by the US Energy Information Administration (EIA) in 2011. As acknowledged by the IEA itself, a more recent assessment by the Polish Geological Institute estimates recoverable resources to be *ten* times lower. More exploratory drilling will be needed to arrive at more reliable estimates. Actual EU unconventional production might thus turn out to be (even) less promising than suggested in the Golden Rules scenario.

Two non-EU countries in the region also merit some discussion: Ukraine and Russia. In the Golden Rules scenario, Ukraine could produce 3 bcm of unconventional gas in 2020, and approximately 20 bcm in 2035 (3% of projected EU demand). This would not turn Ukraine into an exporter, yet decrease its import dependency on Russia. Given Russia's ample conventional gas resources – roughly one quarter of global natural gas reserves – eventual unconventional resources are less important.

2.2.2 *North America*

Even in an optimistic unconventional scenario, North America is not expected to export significant amounts to other regions (and possibly Europe). It may, however, continue to free

[9] Note that one of the JRC's (2012) scenarios paint a somewhat more optimistic picture in which shale gas developments help maintain the EU's import dependency ratio at roughly today's level. Apart from that, the key results are similar to the IEA's projections.

liquefied natural gas (LNG) streams from other parts of the world (e.g. Qatar), that would otherwise be directed to the US.

In the Golden Rules scenario, US unconventional gas production would amount to 71% of total US gas production in 2035 and the US would become a net natural gas exporter of 34 bcm, corresponding to some 5% of the gas demand predicted for the EU in 2035.[10] While in this optimistic 'unconventional scenario', Canada would also be expected to export some 4% of projected EU demand, Mexico would be an importer (almost equivalent to 56% of projected US exports) even with its own unconventional production.

2.2.3 *Asia*

The viability of indigenous shale gas resources may influence domestic political leaders in their decision whether to allow gas to figure more in their energy mix (the fuel-switching argument). As regards European gas imports, China and India are relevant not as potential exporters, but as competitors for LNG streams.

If unconventional gas took off in China, it could cover approximately 80% of its projected demand with its own production, while increasing its share of gas in the energy mix from 4% currently to up to 13% by 2035 (IEA, 2012). Although India is estimated to have significant shale gas *resources* as well, only 20% are deemed to be accessible. The IEA (2012) therefore concludes that "unconventional gas resources in India are not sufficient to make more than a dent in […] imports".

In Indonesia, by contrast, shale gas and coalbed methane could contribute to strengthening Indonesia's position as an exporting country. More importantly, unconventional gas production could complement Indonesia's ample conventional gas production and may represent 37%of its total gas production in 2035.

2.2.4 *Australia*

In Australia unconventional production could reach some 60 bcm by 2020 and around 110 bcm in 2035. This could free approximately 120 bcm for exports in 2035, corresponding to 19% of the gas demand projected for the EU in 2035. Whether Europe will import some of this Australian gas depends on a number of factors, including LNG transport costs (see also section 3.1) as well as demand and supply-side developments in Asia.

2.3 Global gas market implications

Traditionally gas markets are characterised by their regional structure (MIT, 2010). This a consequence of the relatively high transportation and storage costs, compared to oil, for example, which has a higher energy per unit of volume (Rogers, 2012). In addition, gas prices are often indexed to the oil price, limiting the possibility for arbitrage.[11]

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[10] One may not expect significant exports from the US, even if gas prices there continue to be very low, as the US may prefer to stick to low energy prices to keep its competitive advantage and foster its reindustrialisation. Unsurprisingly, the US is still undecided about large-scale LNG exports (Boersma & Johnson, 2012). Other observers doubt that it is possible to withhold market forces for a long time. One existing loophole would be re-exporting gas through Canada (JRC, 2012).

[11] Excluding the possibility of renegotiation, there are two scenarios that limit arbitrage opportunities. First, if spot prices are higher than oil-indexed prices, the annual contract quantity level (ACQ) represents the maximum availability of oil-indexed imports. Second, if spot prices are lower, take--or-pay clauses represent the minimum level of oil-indexed imports.

The fact that shale gas resources are more geographically dispersed than conventional natural gas may contribute to the transformation of regional markets. In fact, the US shale gas boom has already had an effect on global gas markets, as LNG supplies originally directed to the US were redirected to Europe and Asia, as the US could meet most of its gas demand with national resources.

However, if shale gas was developed in many different parts of the world, this may actually lead to less interregional gas trade than in a 'conventional' scenario, because of the greater geographical dispersion of shale gas resources. This is confirmed by the JRC's (2012) scenario analyses, which, however, also show that the global trade in natural gas will grow in any case (but more so in a scenario with relatively moderate shale gas production).

This is not to say that unconventional developments will not have a positive effect on the establishment and functioning of international gas markets. Quite by contrast, as the IEA (2012) notes, with a view to potential US LNG export capacities, the mere potential of LNG (more so than the actual level of export) may "play […] an important role in creating a more competitive international market for gas supply". There seems to be little value, however, in predicting specific trade flows, as this hinges on a large number of highly uncertain variables, not least on LNG cost assumptions, as demonstrated by the JRC's (2012) scenario analyses.

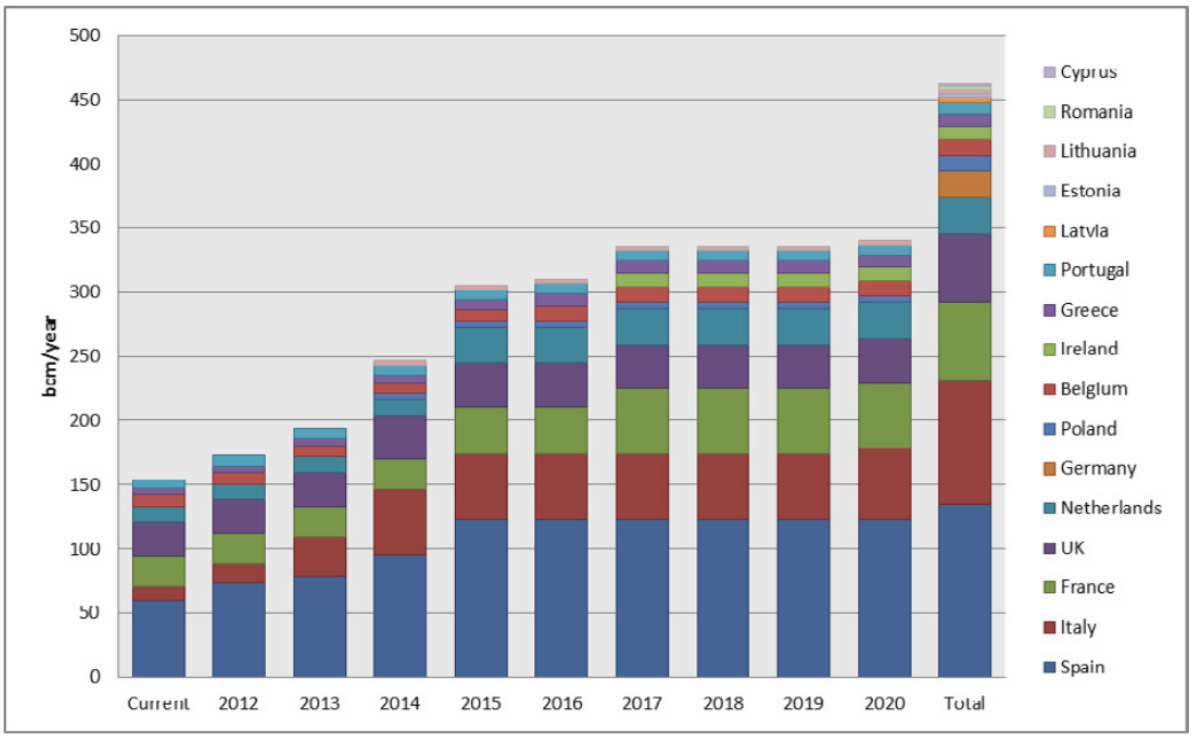
3. Interdependencies with the EU Internal Gas Market

3.1 Liquefied Natural Gas

As Europe is unable to achieve self-sufficiency, even in the case of domestic shale gas exploitation, transport infrastructure will be important to ensure energy security. As shale gas (and other unconventional) resources are distributed all around the world, and most locations cannot be connected to Europe by pipeline, LNG infrastructure will play a central role in determining the effect shale gas has on the European gas market. LNG re-gasification terminals are technologically more flexible than pipelines and thereby give less leverage to suppliers. Yet, at the same time, LNG liquefaction facilities are destination-flexible, meaning that producers can, in principle, export to any country with available LNG re-gasification capacity.

While the majority of LNG is traded under long-term contracts just like pipeline gas, there has been a shift to more flexible arrangements, partly as a result of very liquid markets (Rogers, 2012). Besides North American projects, Rogers (2012) expects Australia, Qatar and Nigeria to become the most important players in global LNG supply. However, there may also be increasing competition for LNG among European, American and Asian consumers in the future (Verrastro et al., 2012).

Figure 2. Current and planned EU-27 LNG re-gasification capacity (as of September 2011)



Source: JRC, 2012 based on "Gas Infrastructure Europe", GIE LNG Investment Database, 2011.

Planning and building an LNG terminal takes 4-5 years, and they are expected to run for at least 20 years. Currently the EU has 150 bcm of yearly LNG re-gasification capacity. This capacity could double by 2020, and triple if all planned projects materialise (see Figure 2). In 2020, EU LNG re-gasification capacity could thus equal three-quarters of EU imports as projected in the IEA's Golden Rules scenario for 2020 (438 bcm). It has to be noted, however, that, according to 2010 IEA data, global re-gasification capacity represents roughly 2.5 times the global liquefaction capacity (JRC, 2012). Having sufficient re-gasification capacity thus does not mean that Europe will be able the secure all these supplies at a reasonable price in practice.

3.2 Market access

It has been argued that one important enabler of shale gas exploitation in the US is the access project developers have to a competitive pipeline market, so they can bring the gas to consumers. This is also among the central objectives of the energy market liberalisation process in the EU, which is, however, not on track to meet the target of completing the internal energy market by 2014. This issue is expected to be taken up in the Commission Communication on the Internal Energy Market (autumn 2012). Progress towards completing the internal gas market may thus also facilitate shale gas exploitation.

In this regard, the JRC (2012) report notes that:

> Questions [...] remain as to whether the EU's internal market rules can be practically applied in the context of possible unconventional gas development and be clear, non-discriminatory, timely and repeatable across large operations.

3.3 Opportunities and threats

The EU's gas market has already benefited and will probably continue to benefit indirectly from unconventional gas developments in the US and other parts of the world. While the US

may not export significant amounts of gas to the EU, it will not compete with the EU for LNG supplies from other parts of the world. Having other credible sources of supply should increase the EU's bargaining position vis-à-vis Russia (and other suppliers).

If EU member states started exploiting unconventional gas reserves, this would affect internal gas market dynamics, but not be a game-changer in the sense that the EU would still largely depend on external gas suppliers. However, as a well interconnected European market would probably be essential to bring domestic gas to consumers, European shale gas developments may help spur investment in European gas infrastructure. In addition, it may create additional pressure from the unconventional gas industry to ensure third party access to gas infrastructures in practice and increase competition in the European energy market where incumbents are still in a very favourable position.

But shale gas developments will not necessarily complement the EU internal gas market. The shale gas hype, especially in some parts of Europe, may detract attention from the issue of gas market integration, which is politically less salient. In addition, the quest for indigenous resources may lead some governments to resort to subsidies to foster domestic shale gas exploitation.[12]

As an EU energy autarchy based on indigenous gas production is not on the horizon, a well-integrated internal gas market still seems to be the most likely means of ensuring a strong EU bargaining position vis-à-vis external suppliers. There are two main reasons for this. First, the pooling of natural gas into a single market contributes to the diversification of energy sources. Second, an interconnected market that allows the transportation of gas to wherever it is needed will also lead to a diversification of transport routes, reducing the dependence on politically unstable transit countries.

4. The way forward

It seems unlikely that subsidies or exemptions from environmental legislation will be justified to enable shale gas exploitation in the EU, so shale gas developments will only go ahead if they turn out to be both economically and environmentally viable in Europe. It is up to enterprises to demonstrate that this is indeed possible, for example by developing "less environmentally hazardous drilling and fracturing fluids." (AEA, 2012a).

It is challenges such as these that could also represent a business opportunity for European enterprises undertaking shale gas development. They could develop the technology that would allow the extraction of shale gas in a way consistent with Europe's environmental standards. These technologies could then also be applied elsewhere, providing both an export opportunity for European businesses and a potential European contribution to more sustainable shale gas exploration in other parts of the world.

To enhance the trust between the general public, the energy industry and the companies in charge of shale gas exploitation in Europe, a step-by-step approach may be needed. One idea would be to evaluate the environmental sustainability of shale gas by conducting a pilot project in a transparent and participatory manner. If such a project, under the close supervision of trustworthy and disinterested expert organisations could prove that the risks to European citizens are manageable, shale gas developers may be able to (re)gain the confidence of citizens and investors.

[12] According to Geny (2010), shale gas will be two-to-three times more expensive in the EU than in the US. The IEA (2012) estimates well-head development and production at $3-7 2010 for US shale gas and at $5-10 for the EU.

The most likely country to host such a project would seem to be Poland, which has been described as the EU's "shale gas lab" (Wyciszkiewicz et al., 2011). However, as the success of such a pilot project would also depend on the idiosyncratic characteristics of the selected site (e.g. local geological conditions), the extent to which one may derive general conclusions from just one case may well be questioned. Transparency and the involvement of affected citizens early on should thus not be limited to pilot projects, but would need to become general practice.

To conclude, this paper has argued that a fully functioning European gas market is a key strategic priority. Making the internal gas market work may also increase the prospects of shale gas development in Europe. Only if companies believe in the existence of a stable and sufficiently large European market will they invest in the technology that could make shale gas exploitation both economically and environmentally viable in Europe.

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