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Towards a More Energy Independent EU: Exploiting Indigenous Potential in the Gas Sector

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The ongoing Russia-Ukraine crisis has triggered anxiety in the EU over the stability of gas imports from its main supplier, Russia. Improving the EU's self-sufficiency in terms of energy has already been indicated in the recent European Energy Security Strategy (EESS). Therefore, the EU should realise that it must not only diversify its gas supplies sources, but also exploit indigenous energy sources and develop up to date gas technologies. In the longer term, these efforts could contribute visibly to the EU's energy security, and to its economic competitiveness, but they do require significant financial investment and firm commitment.

The European Union is the third-largest gas consumers in the world, following the United States and Russia. In 2013, the EU used 462 billion cubic metres (bcm) of gas, yet it remains highly dependent on external gas supplies. In 2013, the EU's indigenous production accounted only for 156 bcm (33% of consumed gas), while the volume of imported gas reached 306 bcm (67%).[1] Russia is the top gas supplier and accounts for 27% of the EU's overall consumption.[2] The greatest volumes of Russian gas are sold to Germany and Italy. Furthermore, six EU Member States (three Baltic States, plus Finland, Slovakia and Bulgaria) are entirely dependent on Russian supplies. Currently, more than half of Russian gas imported to the EU passes through Ukraine.

Russia's decision on 16 June to halt gas supplies to Ukraine over a price dispute, and the possible subsequent supply crunch for Member States in the coming winter, have raised serious concerns for the EU. Moreover, EU leaders cannot ignore the threat that Ukraine's gas infrastructure could be destroyed, reflected by the pipeline explosion in the east of the country in mid-June. Therefore, changes in the gas supply network are badly needed. However, a report by the International Energy Agency indicates that significant diversification of EU gas supplies by 2020 would be very difficult. In this case, the EU should take decisive steps to upgrade the long-term level of energy self-sufficiency. Exploiting indigenous gas potential, namely unconventional resources, but also development of new gas technologies such as coal gasification or biogas, could emerge as vital elements of the EU's energy strategy in this perspective. Both increasing energy production in the EU and further development of energy technologies have been identified by the European Commission (EC) as pillars of the EESS.[3] Yet, so far, the importance of their cumulative contribution has not been properly rated.

[1] In 2012, EU Member States spent €95 billion on importing gas. According to the European Commission, gas imports could reach 340-350 bcm by 2025-2030. See: http://ec.europa.eu/energy/doc/20140528_energy_security_communication.pdf.
[2] The other significant gas sources are Norway (23% of EU annual consumption) and Algeria (8%).
[3] "Communication From the Commission to the European Parliament and the Council. European Energy Security Strategy", 28 May 2014, http://ec.europa.eu/energy/doc/20140528_energy_security_communication.pdf.

Unconventional Gas: Potential Benefits Outweigh the Fears

In the face of high dependence on external gas supplies, as well as shrinking conventional gas resources in the EU, such as in the North Sea region,[4] unconventional gas deposits could be the focal point of the EU's energy strategy in the near future. Unconventional gas is mostly extracted from shale rock, but there are also two less widespread forms of exploitation, from coal beds or impermeable rocks and non-porous sandstone (so-called tight gas).

The shale gas revolution started several years ago in North America, although research and tentative drilling had been carried out for about 20 years. Extraction and use of shale gas on a large scale in the U.S. resulted in a considerable decrease of energy prices on the internal market. That, in turn, contributed greatly to increasing U.S. industry's competitiveness internationally.

The European Union could also benefit from shale gas exploitation. In 2012, the EU Joint Research Centre presented high, best and low estimates (17.6, 15.9 and 2.3 trillion cubic metres, or tcm)[5] concerning technically recoverable shale gas in the EU. There are also deposits of tight gas (around 3 tcm) and coal bed methane (2 tcm). In the most optimistic scenario, and based on current consumption, unconventional gas resources could satisfy the EU's annual gas needs for the next 38 years. Yet in the pessimistic outlook, it could be only about five years.[6]

The biggest identified deposits of shale gas in the EU are located in Central Europe (Poland and Germany), the Baltic States, the United Kingdom, France, Scandinavia (Sweden and Denmark) and in South-Eastern Europe (Hungary, Romania and Bulgaria). Although only research drillings are currently conducted in Europe,[7] the EC anticipates that in countries such as Poland and the United Kingdom, commercial extraction of shale gas could begin by 2015-2017.[8] This means that shale gas should be included, albeit very cautiously, in these countries' medium-term energy policy scenarios. Importantly, despite strong opposition as well as various lobbies,[9] the EC has confirmed Member States' rights to exploit unconventional gas provided it follows EU environmental provisions.[10]

Yet some Member States, such as France, the Netherlands, Bulgaria and the Czech Republic, are strictly opposed to shale gas drilling, mainly because of their internal energy policies or environmental concerns. There is also strong opposition to shale gas extraction in other EU Member States, including Germany and Sweden. Conversely, countries such as Poland and the United Kingdom firmly support shale gas extraction in the EU, as they perceive it mainly as a chance to enhance energy self-sufficiency and to create new jobs. Permits for shale gas research or extraction have also been issued in several other EU countries, such as Germany, Spain, Romania, Hungary and Denmark.

Nevertheless, prospects for European shale gas are less optimistic than, for instance, in North America. Questions concern above all the commercial viability of production. Because of less favourable geological conditions and the widely-dispersed nature of shale gas deposits in Europe, commercial extraction would probably entail greater costs than in the U.S. or Canada. This could make shale gas production less competitive in terms of price, in comparison to gas imported from Russia or LNG from the Middle East. Therefore, possible low viability could reduce interest in shale gas among some EU countries.

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[4] New conventional gas deposits have recently been discovered in the eastern Mediterranean Sea and Black Sea region. However, it will take some time to make them fully operational.

[5] In the case of the U.S., it was 47, 20 and 13 tcm, respectively. See: "Unconventional Gas: Potential Energy Market Impacts in the European Union", A Report by the Energy Security Unit of the European's Commission Joint Research Centre, http://ec.europa.eu/dgs/jrc/downloads/jrc_report_2012_09_unconventional_gas.pdf.

[6] Assuming that annual needs are equal to those of 2013 (462 bcm). However, efforts are being made to decrease this level through, amongst other things, increased energy efficiency in the EU.

[7] Poland is a leader in this area, with more than 60 exploratory shale gas wells on its territory and 40 more that could be drilled by the end of 2014. See: http://af.reuters.com/article/commoditiesNews/idAFL5N0OY12020140617.

[8] However, estimates by the Polish state-controlled oil and natural gas company PGNiG suggest that this could happen no earlier than 2020. http://ec.europa.eu/environment/integration/energy/pdf/swd_2014_22_pl.pdf.

[9] Including nuclear power, renewable energy sources and conventional gas lobbies. There are suggestions that the conventional gas lobby is supported by influential companies, such as Gazprom. See: www.foreignpolicy.com/articles/2014/06/20/russias_quiet_war_against_european_fracking?utm_content=buffer1b283&utm_medium=social&utm_source=facebook.com&utm_campaign=buffer.

[10] At the beginning of 2014, the European Commission published recommendations concerning the environmental aspects of unconventional fossil fuels. Recommendations will be overhauled this autumn, and will be reviewed in spring, to see if they are sufficient or whether stricter legal guidelines are needed.

Furthermore, hydraulic fracturing, the most popular technique regarding unconventional gas extraction, has given rise to ecological concerns about potential adverse environmental effects of the technology, which uses water, sand and several chemical compounds to crush rocks and enable swift gas flow. Although no convincing proof of the devastating effects of hydraulic fracturing on the natural environment have yet been found, existing doubts entail difficulties in persuading public opinion to support shale gas extraction.

Concurrently, European companies have little experience and technical capacity in exploiting shale gas reserves, and will therefore have to rely mostly on U.S. firms. That would limit the positive influence of shale gas exploitation on the EU economy. It is also probable that shale gas production will contribute unevenly to the energy security of individual Member States. France, the United Kingdom and Poland are among the countries that could potentially benefit the most. For the region as a whole, a shale gas revolution could have less impact unless energy infrastructure such as interconnectors is extended to enable efficient gas transport throughout the EU. Improved gas transport among Member States could also underpin the EU's internal energy market creation.

Coal Gasification: The Technology of the Near Future

Modern technologies also enable gas to be obtained from other raw materials. In this context, abundant deposits of fossil fuels, especially coal, on EU territory, also have a role to play in the gas security strategy. In 2012, the EU produced 128 million tonnes of hard coal and 433 million tonnes of lignite (the highest in the world). Moreover, more than 200 million tonnes of coal are imported annually, mainly from Russia and the United States. In the last 10 years, the share of coal in the EU's energy mix has remained at around 25%., as a result of relatively low coal prices as well as CO2 emission permits in the EU. According to EC analysis, coal will remain one of the EU's key energy sources in the near future.

Using significant coal deposits in countries such as Poland, Germany and Hungary could reduce dependency on external gas supplies provided it is in line with the EU's climate policy. This could be achieved by developing clean coal technologies (CCT) converting coal into gas. According to this author's estimations, and given existing technologies as well as EU approximate coal reserves (56 billion tones), if even half of the available resources were gasified it would yield more than 46 tcm of syngas,[11] which could be used to produce electricity and heat.[12]

Manifold coal gasification technologies that use heat or chemical agents (such as **gas turbines in combined cycle** technology), are currently being researched. Modern power plants using this technology, which captures waste heat to create steam, record energy efficiency reaching as high as 60%.[13] There are great expectations of modern underground coal gasification (UCG) technology, which does not require coal to be mined or transported to the surface and could thus offer more environmental and financial benefits. However, there is still no up to date facility at the operational stage.[14] Advanced research is also being carried out on prospective coal chemical looping gasification (CLG) technology, which will use chemical compounds to limit CO2 emissions. Among the experimental projects underway is that at the Central Mining Institute (GIG) in Katowice, Poland. More attention should also be paid to integrated gasification combined cycle (IGCC) technology. It is anticipated that IGCC technology could be fully commercialised by 2020, and reach 55-60% efficiency by that time.

However, the costs to implement these technologies on a wider scale could be significant. Moreover, high-quality coal is needed to fully exploit the efficiency potential of these solutions. Given the relatively low quality of coal in Europe, efforts aimed at its enrichment should be made. Furthermore, although the EU has been financing CCT research for almost 20 years, investment concerning gas usage projects and other initiatives, most of all carbon capture and storage (CCS), is visibly disproportionate. Paying attention to the prospects CCS development and more proportionate prioritisation reflected in a stronger push for coal gasification and other CCT solutions could bring significant long-term benefits for the EU.

[11] Syngas is a synthetic gas, a mixture of carbon monoxide, carbon dioxide, and hydrogen.

[12] Calculations are based on the assumption that it is possible to convert 1 metric tonne of coal to 1.66 thousand cubic metres of syngas (Siemens gasifier SDF-850; www.siemens.com/press/en/pressrelease/?press=/en/pressrelease/2014/energy/power-generation/ep201405047.htm&content[]=EP).

[13] The typical existing pulverised coal plant in the EU records 45–48% efficiency.

[14] Initial approval for such a project was granted in Poland in July. It will be developed in the coal reserves near Kraków in southern Poland.

Biogas: Available, but still a Mostly Untapped Technology

Biogas could be also named as a prospective and relatively easily available source of energy. [15] It could be extracted from organic waste, such as agricultural residue (such as straw and manure), energy crops, or sewage sludge. Biogas is most often used for heat and power production, but it has also become more and more popular as transport fuel (in Sweden and Germany, among others). Biogas is currently produced on a wider scale in 12 EU countries - Austria, Germany, Denmark, Spain, Finland, France, Hungary, Italy, Luxembourg, the Netherlands, Sweden and the United Kingdom. Moreover, production facilities exist in non-EU states, such as Switzerland, Norway and Iceland. Currently, there are about 200 plants in the whole of Europe, which produce 14 bcm in natural gas equivalent, yet this could be doubled by 2020. Biogas is also used directly in the gas systems of eight countries, which are Austria, Germany, Spain, Finland, France, Luxembourg, the Netherlands and the United Kingdom.

Current biogas technology is perceived as well-developed and proven in various conditions. What is also important is that there is no need to build specific biogas infrastructure, as existing gas grids can be used. As a relatively clean fuel, biogas usage could underpin attempts to achieve the EU's climate goals, and could have a positive impact on the whole EU economy as it entails the creation of jobs in agriculture and other areas.

However, the main questions concern the potential capacity of biogas production and its commercial feasibility. Different standards and procedures regarding biogas exploitation in Member States hamper efficient gas transportation. Moreover, there is a noticeable lack of political support for biogas development, not only within individual Member States, but also on the EU level, as more attention is paid to other renewable sources of energy, such as wind or solar power.

Conclusions: More Action Needed to Tap the EU's Gas Potential

One of the noticeable ramifications of the Ukrainian crisis is EU mobilisation to take a closer look at its energy security. The need to diversify energy supplies is clearer than ever. The EC's stance regarding the South Stream pipeline[16] is an evident signal of EU willingness to limit dependency on gas imported from Russia. However, changes regarding gas supply directions are not sufficient. Therefore, one of the key roles in enhancing the EU's long-term gas security should be played by its indigenous resources which have not so far been tapped.

In order to seize the potential economic and security opportunities connected with unconventional gas extraction, several initiatives should be undertaken within the EU. It is important to ensure favourable and transparent business conditions in the mining sector in order to attract investors, especially those with cutting-edge technology and experience in the area of unconventional gas extraction, and who could set up joint ventures with European companies. Otherwise, potential investors could pass over the EU in their business plans and seek chances in other parts of the world, such as Australia, Argentina or Brazil.

It is also necessary to conduct extensive research on the EU's unconventional gas resources, which could support an evaluation of the viability of exploitation. An EU campaign on the anticipated impact of unconventional gas usage on both economy and environment could also be helpful in winning over public opinion. The current coal to gas price ratio, which makes "blue fuel" less competitive, is also a challenge. Furthermore, without financial support such as subsidies or attractive state guaranteed credit for research, at least at the early stage, shale gas is unlikely to be cheap enough to compete with imported natural gas.

Advanced gas and coal technologies also require financial support. More EU funds from the Horizon 2020 Programme, targeted at supporting energy research, could be spent on up to date indigenous technologies. Concurrently, the strategy concerning coal should assume lower imports and higher use of rich indigenous deposits in an effective and environmentally friendly way. Favourable tax regulations and fiscal incentives could have a positive impact on further development of CCT and biogas technologies, both of which could be capital-intensive at the early stage. Last but not least, scientific and research cooperation in these areas in the EU could be also valuable.

[15] Cleaned and enriched biogas, called biomethane, has features comparable to natural gas and can also be used as fuel for transport.
[16] D. Kałan, "The 'South Stream' Train Stops in the Balkans", *PISM Bulletin*, 11 June 2014, www.pism.pl/publications/bulletin/no-82-677 .

As EU Member States still make sovereign decisions regarding their energy mixes, close cooperation between them seems to be particularly important.[17] As an example, Polish-British cooperation on environmental and economic consequences of shale gas extraction in the EU was announced in June. A long-term cooperation strategy concerning unconventional gas, coal gasification and biogas should accompany the EU's climate policy. These tools should also be part of a combined approach that includes energy consumption reduction through the enhancement of energy efficiency and use of renewable energy sources.

Although all of the abovementioned measures and technologies will not make the EU fully self-sufficient in terms of energy, they could contribute to reducing dependency on external supplies. Therefore, they should be developed further, even if they require significant financial contributions, political will and time to be implemented. The question is whether the EU is ready to pay the price by directing more funds and efforts to increasing its long-term energy sovereignty, or whether it will yield to the temptation, particularly its western Member States, of cheaper and more easily available gas supplies from Russia.

[17] It is also significant because of the locations of shale gas basins, which often straddle the territories of several countries.