Strengths and weaknesses of the European Union gas security of supply

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The aim of this paper is to analyse the strengths and weaknesses of the EU energy security of supply, with a specific focus on the gas sector. The internal and external dimensions of security of gas supply are considered, with a view to elaborating specific recommendations for the short and longer term.

The current conflict between Russia and Ukraine puts energy security again at the top of the political agenda of the European Union. The EU remains widely dependent on external gas supplies, with imports representing 70% of its consumption in 2013. Member States have different import profiles with divergent levels of dependency on Russian imports. Several European Member States rely heavily on Russian supplies (Greece, Austria, Poland, Romania, Hungary, Bulgaria, Czech Republic, Estonia, Finland, Latvia, Lithuania and Slovakia), which demonstrates that the EU’s gas supply security needs to be examined both from an internal and international perspective.

Since the 2009 crisis between Russia and Ukraine, the EU has adopted several legislative tools to strengthen EU gas security of supply. The 3rd legislative package, the security of supply Regulation (EU) 994/2010 and the Energy Infrastructure package identifying Projects of Common Interest (PCI) have significantly improved the ability of the EU to face import disruption situations. However, several countries remain particularly vulnerable to the occurrence of disruption. Table 1 (see Annex) considers a variety of factors such as, national production, the diversity of suppliers, and storages. It highlights that Member States Bulgaria, Czech Republic, Estonia, Finland, Latvia and Lithuania are exposed to a higher risk to supply interruption from Russia. Romania, Poland and Hungary also import the bulk of their gas requirements from Russia, but have either a domestic production or significant storage capacity.

A number of key measures are necessary in order to strengthen the EU’s security of gas supply. Firstly there is a need to prioritize the investments among the PCIs list by targeting the projects that enhance interconnections in the most vulnerable countries, specifically in the South-East Europe (SEE 1) region and ensure access to gas storage infrastructures on the EU network. Secondly there is a need to establish a scheme for integrated utilisation of all import sources (including LNG), in line with the capability of the transmission system to spread the gas across the whole EU network to cope with crisis situations.

The Internal Dimension of the EU’s Approach towards Gas Security of Supply

An analysis of the implementation of the Regulation (EU) 994/2010 on security of supply shows that, in 2013, only sixteen countries reported an ability to be resilient (as measured by the N-1 rule) to potential gas disruptions. The Members States which did not pass the N-1 rule are Sweden, Lithuania, Luxembourg, Estonia, Bulgaria, Ireland,  

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1 SEE countries are: Greece, Bulgaria, Albania, Republic of Macedonia, Kosovo, Serbia, Montenegro, Bosnia and Herzegovina, Romania, Moldova, Croatia, Slovenia, Cyprus, and Turkey.
Portugal, Slovenia and Greece. The Energy Community South-West sub-region, could meet the N-1 criterion on a regional level, presuming that interconnections between countries exist, all the storage projects are implemented and at least one large supply source is built (be it an LNG terminal or gas pipeline). The N-1 criterion should however be used with caution, since it accounts only for theoretical capacity of gas infrastructure and does not take into consideration available gas flows (booked capacity), nor the case of transit countries, where not all existing capacities are available to the transiting country. This criterion should be considered only as one of the indicators for security of gas supply.

The map of Projects of Common Interest shows a high density of pipeline projects in the SEE region and a large number of reverse flow projects in the western part of Europe. Although Western Europe is already well interconnected, west-east interconnections remain insufficient, particularly in order to facilitate flows of gas from LNG terminals in France, Spain and Portugal to the central part of Europe. Implementation of the proposed PCIs will create the basis for solidarity mechanisms and allow greater flexibility of gas flows in case of emergency. Reverse flows capacity has significantly increased since the 2009 crisis, especially in Western and Central Europe, as reported in the ENTSOG Ten Year Network Development Plan 2013 – 2022 (TYNDP). The situation is however different in SEE countries, where there is a need to develop the transmission gas network to increase interconnections and create new supply routes.

Modelling of the gas network by ENTSOG shows that in the event of a disruption to Ukraine gas transit, the SEE countries will be severely impacted if only projects that reached Final Investment Decision (FID) were commissioned (the main countries affected would be Bulgaria, Greece, Croatia, Hungary, Romania, Serbia and Slovenia), while in case of implementation of all projects (FID and non-FID), the infrastructure resilience would be satisfied. A similar conclusion also holds for Poland and Lithuania in case of disruption to gas transit through Belarus, although not as severe as the SEE situation. The lack of approved projects relevant to Ukraine gas transit therefore has a wider regional dimension.

Based on the ENTSOG analysis for the upcoming winter 2014/2015, the impact of a Ukraine and Russian disruption on natural gas shortages in Europe in the case of an average winter demand can be seen in Figure 2. The figure clearly shows that in the case of disruption through Ukraine, SEE countries will lack gas supply, while in the case of a Russian disruption the impacted area will be also widened to part of Central and Eastern Europe.

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2 In-depth study of European energy security, European Commission.
3 Croatia and six Balkan Contracting countries: Albania, Bosnia and Herzegovina, Kosovo, FYR of Macedonia, Montenegro and Serbia.
4 European Network of Transmission System Operators for Gas.
5 See GIE presentation, Madrid Forum XXV, 6th May 2014.
More serious disruption, with January peak demand is depicted in Figure 3. Again, the SEE region is heavily impacted in both Ukraine and Russian disruption cases, while the rest of Europe only in the latter case.

Figure 3: Gas disruption under peak January demand

Given the lack of interconnections in the SEE region, the improvement of interconnection capacity between the countries and the integration of new supply routes should be considered as an EU priority in order to mitigate identified risks in the region.

In addition to the development of sufficient interconnection capacity, the improvement of storage infrastructure is key for EU security of supplies. Storage can allow for timely response in prolonged periods of high demand or cold peaks, as well as a reliable back-up for renewables integration. Storage can also safeguard against unexpected high impact events, technical failures and mitigate geopolitical risk. The EU has approximately 146 storage facilities with a capacity of approximately 94 bcm, and a small number of facilities in development.

Gas storage obligations for supplying customers are issued in several Member States (Hungary, France, Italy, Slovakia, Spain and Portugal). In all these countries, storage capacity plays an important role in supplying customers in the winter season, in particular on peak days. Furthermore, Hungary has a special security (strategic) storage unit, which exists exclusively for the supply of protected customers. It should provide the country with 40-45 days of autonomy, if the main import source from Russia failed.

Strategic storage is an instrument to supply gas in emergency cases. A number of EU Member States do not have any gas storage facilities such as Cyprus, Estonia, Finland, Greece, Luxembourg, Malta and Slovenia. Among these countries, Estonia, Finland and Lithuania have a very high reliance on Russian imports. Currently, Lithuania has a project in the planning phase (Syderai UGS) and is expected to be commissioned in 2018.

Figure 2: Gas disruption under average winter demand

Figure 4: Gas storage capacity in Europe

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6 http://www.gie.eu.com/
7 Storage and Security of Supply, 25th Madrid Forum, 6-7 May 2014 Nicole Otterberg GSE President Ryan McLaughlin CEER Storage Task Force Co-chair
number of LNG projects are also proposed in Malta, Greece and Finland.

For those countries without an adequate geological structure for gas storage, policy coordination could provide some support, potentially including the lease of storage capacities in neighbouring countries having adequate storage. However, a number of barriers exist for the development of new storage facilities, as they are capital intensive with 20-25 years pay-back and long lead times (5-8 years) for construction. Equally sustained low seasonal price spreads may ultimately lead to facility closures.

Ensuring access to storage facilities and sufficient interconnections to guarantee their use in case of supply disruption should also be an EU priority.

Following the US shale gas boom, expectations of the contribution of domestic gas production to the EU’s security of supply have grown, with a view to addressing the decline of the European conventional gas production. The EU’s technically recoverable reserves of unconventional gas are estimated to be 18 tcm (of which 13 tcm of shale gas). However, there is still a large uncertainty around the potential of unconventional resources in Europe, due to the limited number of exploratory drillings to date.

Three EU countries (Poland, UK and Denmark) have been exploring their unconventional gas potential during the last number of years. Social acceptability is a key challenge for a wider development of these resources. The EU has an important role to play in promoting transparency and dialogue between communities and the industry. The Commission’s recommendation of 22nd January 2014 is an encouraging step in setting high health and environmental standards, but should lead to the definition of binding criteria and common procedures at an EU level. The predictability of the fiscal framework is also key for the companies: the Polish experience shows that, despite favourable fiscal measures, the uncertainty around the licensing process and the future concessions’ duration can lead companies to limit their investments.

The indicative production costs for unconventional gas in Europe are higher than the production costs in the US, due to more challenging geological conditions and the lack of industrial capacity (rigs, trucks, roads). The production costs are however expected to be lower than the estimated gas import prices by mid-2020 (IEA estimations range from 10.5$/Mmbtu to 12$/Mmbtu). According to a Pöyry study, it is estimated that around 60% of production would be possible in 2020 at a cost between $8-11/Mmbtu. These production costs could decrease by 50 to 60% by 2030, aided by technological progress and the development of industrial infrastructure. However, all scenarios confirm that the development of domestic shale gas resources could contribute to reduced EU import dependency only from 2025 onwards, if the measures favouring their development were adopted. By 2035, production estimates for unconventional gas vary between 20 and 78 bcm per year according to the International Energy Agency, between 60 and 160 bcm in 2035 with no shale, the EU gas import dependency will be approximately 80%. In a shale boom scenario (160 bcm per year of total production) it will be reduced to 60% (source: Pöyry).

14 Ifri, Gaz de schiste en Pologne, au Royaume-Uni et au Danemark : vers un modèle européen ?, January 2014
15 IEA, World Energy Outlook 2013
16 Pöyry, Macroeconomic effects of European shale gas production, November 2013.
17 In 2035 with no shale, the EU gas import dependency will be approximately 80%. In a shale boom scenario (160 bcm per year of total production) it will be reduced to 60% (source: Pöyry).
the Pöyry study and between 30 and 130 bcm according to an EC study.\(^\text{19}\)

The development of biomethane would also contribute to increase the EU domestic production. The European Biogas Roadmap indicates\(^\text{20}\) that, if the necessary actions were taken, the level of biomethane production could reach 18-20 bcm in 2030, providing about 3% of the European natural gas consumption, and around 10% of total gaseous vehicle fuel consumption.

The development of the EU domestic production of shale gas, and to a lesser extent biogas, could offset the decline of domestic conventional production and at best contribute to reduce EU energy dependency as of 2025 if the measures favouring their development were adopted. However, even in a shale gas boom scenario in Europe, Russian imports will still represent more than 1/3 of the total EU gas supply in 2025 and up to 50% in 2050.

The External Dimension of the EU’s Approach towards Gas Security of Supply

Given the current tensions between Russia and Ukraine, the EU is seeking to diversify its supplies through additional pipelines sources. The development of the Southern Corridor figures amongst the most debated options. Its original planned contribution was to secure 10–20% of natural gas demand in the EU by 2020, which would total 45–90 bcm per year. The gas would come from Azerbaijan’s Shah Deniz field through Georgia, Turkey, Greece, and Albania to the south of Italy. Currently, the Southern Corridor relies on the Trans Adriatic Pipeline (TAP) project, which will be operational at the earliest in 2019, with initial capacity of 10 bcm and potentially rising to 20 bcm, and the Trans-Anatolian gas pipeline (TANAP), expected by 2018, with initial capacity of 16 bcm rising to 31 bcm in 2026.

TAP is currently planning construction commencement in 2015 and is on schedule with planned project activities. A challenge for the project is the exiting of companies, Total and E.ON from the TAP consortium, nevertheless TAP has been selected by the Shah Deniz consortium to deliver gas volumes from Shah Deniz stage 2 project to customers in Greece, Italy and South-east Europe. The other major project, TANAP, has awarded a five year contract for the supply of engineering, procurement and construction management (EPCM) services to an Australian-based engineering company.

Two other projects key to the future of the Southern Corridor are the expansion of the South Caucasus Pipeline (SCP) – a section of the Baku-Tbilisi-Erzurum (BTE) pipeline, which will provide an additional 16 bcm of gas per annum from the Shah Deniz 2 development in the Caspian Sea to the Georgia-Turkey border by 2018 – and the Trans-Caspian Pipeline (TCP) between Turkmenistan and Azerbaijan via the Caspian Sea. TCP could provide additional diversification of gas supply, but numerous risks and difficulties concerning costs and investments undermine its feasibility.

The Southern Corridor may have a significant impact on the diversification of import routes and could increase long-term security of gas supply. Although primarily focused on bringing Caspian gas to Italy, the Southern Corridor could open the possibility of connecting Albania and Croatia via the Ionian-Adriatic Pipeline, which would also add to creating an interconnected SEE gas network. However, its success will be affected by the development of other gas markets and their rising consumption, primarily energy-hungry Asian countries. China has strong interests in the Caspian Region, especially in Turkmenistan with the additional advantage of an already existing pipeline that transports gas to China. The development of South Stream, which

\(^{19}\) Macroeconomic impacts of shale gas extraction in the EU, study for the European Commission, ICF GHK, Eneredata and Cambridge Econometrics, March 2014

\(^{20}\) http://european-biogas.eu/
would allow Russia to bypass Ukraine, could also jeopardize the full implementation of Southern Corridor. If this pipeline is built, it would reduce the EU’s vulnerability between Russia and its neighbours, but reinforce its dependency to a single supplier.

Other alternative import sources from pipelines are uncertain. Israeli’s offshore production is still in its early stages and debates on whether to use the gas for internal purposes or exports are vivid. The Iraqi and Iranian gas potential is real: with more than 15% of global gas reserves, Iran could contribute to the EU supplies through Turkey provided the necessary investments are made. However, the development of the Iranian resources remains subject to a high geopolitical risk and to several internal obstacles such as domestic energy consumption. As for additional supplies coming from Africa, the future of the GALSI pipeline remains uncertain. The Trans-Saharan pipeline that would bring Nigerian gas (up to 30 bcm per year upon completion) to Europe through Algeria is also struggling to secure resources from the Niger delta, as well as to design a safe route north amidst terrorism threats and geopolitical tensions.

However, it should be noted that several EU gas pipelines remain currently underutilized. The total EU import capacity from Russia is currently 256 bcm, while actual flows to Europe were 94.6 bcm in 2012\(^\text{21}\). This is also the case of the Nord Stream pipeline directly connecting Russia to Germany. Thus, additional investments for security of supply reasons should be assessed with regards to the current overcapacity in the European transmission system.

\[\text{These new routes will probably not improve the EU security of supply before five to ten years. On a 5-years horizon, supply diversification will mainly rely on the potential achievement of the Southern Corridor.}\]

A strong growth of LNG supplies in Europe has been observed during the last decade, reaching 60 bcm or 12.7% of the total gas supply in 2012\(^\text{22}\). However, the imports of LNG into Europe fell by a quarter between 2011 and 2012 and by almost a third between 2012 and 2013. LNG is preferentially shipped to where prices are the highest, i.e. currently Asia and South America (around 15$/Mmbtu in Japan compared to about 12$ in Europe). Sustained flows of LNG returning to Europe are not expected immediately.

LNG supply provides a diversified source of gas, due to its availability from multiple suppliers on the global market. The bulk of LNG imports (45%) to the EU in 2012 came from Qatar. These primarily went to the UK (13.3 bcm) while Spain imported 21.4 bcm of LNG from a number of countries including Nigeria, Qatar, Algeria, Peru, Trinidad and Tobago and Norway\(^\text{23}\).

Current LNG regasification capacity in Europe amounts to 207 bcm per year. Confirmed new projects will bring it to at least 231 bcm and up to 362 bcm per year in 2022\(^\text{24}\). Worldwide regasification capacity is currently 720 bcm and exceeds by 2.5 times the total liquefaction capacity. However, new liquefaction capacities planned in Eastern Africa, North America and Eastern Mediterranean would represent an additional 100 bcm in 4 years. Until these new liquefaction plants are commissioned, competition between importers will still be to Europe’s disadvantage, as long as Asian gas prices remain higher than in Europe. The low utilization rates of European regasification terminals (26% in 2013) will remain a key issue.

\[\text{Given low utilization rates of LNG terminals in 2013, in the case of a Russian gas disruption via Ukraine, the current LNG terminals in Spain, Belgium, Portugal, France, Italy, Netherlands and UK could receive around 130 bcm of}\]

\(^\text{21}\) The EU’s energy security made urgent by the Crimean crisis, European Parliament, April 2014.

\(^\text{22}\) GIIGNL, The LNG Industry, 2013.

\(^\text{23}\) BP statistical review.

\(^\text{24}\) GLE Investment database data.
additional LNG in 2014\textsuperscript{25}. However, the potential flow of LNG from the west to the east of Europe would be limited by constraints on the transmission network, especially in Central and Eastern Europe.

Conclusions

Several recommendations for policy can be drawn from this analysis, to cope with the disruption of gas supply from Ukraine.

In the short term (next 2 years):

The EU should reinforce the solidarity mechanisms between Member States to be triggered during a crisis situation.

- Because of the current low utilization rates of LNG terminals, additional LNG deliveries to several EU countries can help balance EU requirements in the event of supply disruption from Ukraine. However, the use of these LNG terminals should be optimized according to the ability of the transmission network to transport the LNG to the rest of Europe. Some measures could be designed and implemented in order to allow/reorient the reloading of LNG cargoes near the disruption source.

- Additional LNG imports cannot compensate alone for the deficit of supply sources in the east. The use of storage facilities is a key component in emergency situations and access to storage facilities for predominantly importing countries should be a priority.

In the Medium term (next 5 years):

- Reverse flows projects on the EU transmission system should be considered as priority projects, as they will provide greater interconnectivity across Member States and therefore greater flexibility to supply gas in the case of an emergency.

- Prioritization across PCIs should be adopted. This is required in order to achieve the necessary reverse flow capacities and interconnections to improve the integration of the EU gas market.

- Concerning domestic biogas production, the establishment of national biomethane registries in all European countries producing biomethane is strongly recommended in order to provide reliable, transparent and independent documentation and strengthen market confidence.

With regards to the development of domestic shale gas production:

- The Commission’s recommendation of 22\textsuperscript{nd} January should be used as a basis for a directive with a view to adopting binding European criteria on health and environmental standards and ensuring a certain level of decentralization and the predictability of national legislation.

- A European Transparency Registry should be created in order to ensure the availability and reliability of information on companies’ activities. In the medium-term, it could contribute to improving the acceptability of shale gas exploration and production.

In the longer term, the EU roadmap to increase security of supply should consider the following elements:

- To ensure adequate level of energy security, the EU should find the right balance between ensuring adequate capacity of supply pipelines and LNG terminals to be able to cope with supply disruptions through Ukraine, and avoiding the commitment to additional investment in infrastructure given the existing overcapacity. The need for supplementary investments in order to increase the diversification of energy supplies to Europe should be assessed with regards to the current situation of underutilization of several already existing infrastructures.

\textsuperscript{25} See CEER presentation, Madrid Forum XXV, 6 May 2014.
The EU should continue to encourage strong efforts from Member States with regards to energy efficiency. In the Directive 2012/27/EU on energy efficiency, EU-28 countries are required to use energy more efficiently at all stages of the energy chain. Improved monitoring and reporting of Member States progress on energy efficiency plans is key, in order to lower demand for natural gas, and thus ameliorate the EU’s security of supply.

Annex

Figure 5: Locations of underground storage facilities and LNG terminals in the SEE region (source http://www.entsog.eu/)
## Strengths and weaknesses of the European Union gas security of supply

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<table>
<thead>
<tr>
<th>Country</th>
<th>Share of gas in energy consumption in 2012 (in %)</th>
<th>Share of gas in electricity production in 2012 (in %)</th>
<th>Gas imports from Russia (in %)</th>
<th>Number of other suppliers (EU countries; LNG; Norway; Algeria; Libya)</th>
<th>National production of gas in % of consumption</th>
<th>Storage capacity in % of consumption</th>
<th>Russian gas transit through Ukraine to EU countries in bcm in 2012</th>
<th>Total gas imports in 2012 (in bcm)</th>
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### Strengths and weaknesses of the European Union gas security of supply

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<table>
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<th>Country</th>
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| Source | GIE, BP Statistical review, Eurostat, Oxford Institute for Energy Studies, DIW Berlin, OECD, EC In-depth study of energy security |

Table 1: Overview of Member States gas consumption, production, storage capacity and LNG infrastructure.