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Civil unrest in North Africa - Risks for natural gas supply?

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Abstract

The uprising and military confrontation in Libya that began in February 2011 has led to disruptions of gas supplies to Europe. An analysis of how Europe has compensated for these missing gas volumes shows that this situation has not affected security of supply. However, this situation would change if the North African uprising were to spread to Algeria. Since Algeria is a much more important gas supplier to Europe than is Libya, more severe consequences would be likely. Applying a natural gas infrastructure model, we investigate the impact of supplier disruptions from both countries for a summer and winter period. Our analysis shows that disruptions in the low-demand summer months could be compensated for, mainly by LNG imports. An investigation of a similar situation at the beginning of the winter shows that security of supply would be severely compromised and that disruptions to Italian consumers would be unavoidable.

Keywords: Natural gas; security of supply; network modelling; North Africa

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1. Introduction

The political uprising in Libya at the beginning of 2011 has severely affected the country's pipeline exports to Europe. The Greenstream pipeline from Libya, which supplies around nine billion cubic metres (bcm) of natural gas to Italy each year, stopped operations on 22 February 2011 and deprived the Italian gas market of significant volumes at the end of the winter and into spring.

This article analyses the current and potential effects on the European gas market of supply disruptions in North Africa. The dependence of the individual European countries on North Africa differs significantly, but, in general, the European Union (EU) imports 10 bcm annually from Libya and another 47 bcm from Algeria. Together this equates to about 12 percent of EU gas consumption and about 26 percent of non-European imports. With the currently well-supplied global gas market, the share of supplies delivered as liquefied natural gas (LNG), about 30 percent, may be substituted by LNG from other sources.[1] However, southern European countries are also exposed to disruptions of pipeline supplies from North Africa: the Greenstream pipeline supplies about 12 percent of Italian gas consumption, while links from Algeria deliver about 30 percent of Italian and 20 percent of Spanish gas demand.[2]

Security of natural gas supply has so far been addressed by studies that focus on aspects of global geopolitical security of supply (Holz et al., 2009; Victor, 2007) or on short-term disruptions. Weisser's (2007) extensive definition of security of natural gas supply refers to risks associated with source, transit and facility dependence and structural risks of natural gas supplies. According to Weisser (2007), risks from these dependences could be triggered by drivers like natural disasters, political conflicts, terrorism, wars and civil unrest. With respect to short-term disruptions, the limited literature addresses risks arising from transit dependence, such as the transit disruption of Russian gas via Ukraine (Bettzüge and Lochner, 2009; EWI, 2010; Dieckhöner, 2010; Monforti and Szikszai, 2010).

The prolonged disruption of natural gas supplies from Libya suggests a different threat to European security of natural gas supplies. It not only concerns a different route and region but it is also due to a different cause: domestic political uprisings leading to civil-war-like unrest and, in the case of Libya, outside military intervention and war.

Focusing on southern Europe, the next section investigates the disruption of pipeline supplies from Libya to Italy in 2011. In a model-based analysis, Section 3 evaluates the effects of a potential extension of disruptions from the potential spread of unrest to Algeria.

[1] For the same reason, this study does not discuss Egyptian LNG exports (7 bcm to Europe in 2009), which might also be compensated from other sources.

[2] These percentages are for the year 2009 and based on BP (2010).

2. The Disruption of Libyan Gas Supplies

On 22 February 2011, Libyan pipeline gas exports to Italy came to a halt because of the political turmoil in Libya. Before the disruption, Italian imports from Libya amounted to about 26 million cubic metres (mcm) per day. In winter, these imports supply about 8% of the average total Italian consumption of 330 mcm per day (see Table 1). In addition to LNG, Italy imports pipeline gas from Algeria, Russia (via Austria and Slovenia) and northern Europe (via Switzerland). Gas from Italian gas fields and from gas storage is also available. Table 1 illustrates how the volumes were compensated for during the early days of the Libyan disruption: mainly by withdrawals from storage and additional imports from Algeria. Volumes supplied from all other sources remained close to the January level or even declined slightly because of lower demand in February/March.

Table 1: Italian gas supplies before and during the Libyan supply disruption

Source of gas (entry point)	Max capability[a]	Jan/Feb 2011[b]	Libya disruption[c]	Change
Algeria via Tunisia (Mazara)	100.8	82.6	96.4	+13.8
via Austria (Tarvisio)	112.2	90.0	83.1	-6.9
via Switzerland (Passo Gries)	59.2	29.0	27.7	-1.2
via Slovenia (Gorizia)	0.7	0.5	0.7	+0.2
Libya (Gela)	34.3	25.8	0.0	-25.8
LNG (Panigaglia)	7.8	5.5	6.1	+0.6
LNG (Cavarzere)	25.7	21.0	18.5	-2.5
Storage Withdrawals	n/a	55.1	75.8	+20.6
Domestic Production	27.1	21.4	21.3	-0.1
Total demand	n/a	330.9	329.7	-1.2

Source: Based on SnamReteGas data.
Notes: All values in mcm per day.
[a]Maximum supplied volume between 01/01/2010 and 11/03/2011.
[b]Data from 01/01/11 to 20/02/2011.
[c]Data from 22/02/11 to 11/03/2011.

Supply capabilities from the alternative sources suggest that additional increases would have been possible, depending on the supply situation in the rest of Europe, primarily imports on the transit routes through Switzerland and Austria. However, in absolute terms, LNG imports and domestic production would not have been able to contribute significant additional quantities.

Regarding storage, which have contributed significantly to meeting demand, the relevant question concerns how long the stored gas volumes will be sufficient. On 17 March 2011, 7.4 bcm were left in Italian storage (Gas Storage Europe data), so even high storage withdrawal rates of 80 mcm per day could have been sustained for more than 90 days. With the arrival of spring, however, such withdrawals will no longer be necessary; therefore, supply for Italian consumers was secured at all times during the disruption of Libyan imports.

However, this stable situation might change if the disruption in North Africa spreads to other countries, particularly Algeria. Therefore, we analyse two disruption scenarios: one that assumes an additional cut-off of pipeline imports from Algeria in summer 2011 and another that assumes a disruption of supplies from North Africa in times of higher gas demand (e.g., winter 2011/2012).

3. Scenario Analysis of Continued and Extended Supply Disruptions from North Africa

The situation in Libya is less of a concern to the European gas market than is the potential spread of the North African uprising to Algeria, the EU's third-largest (after Russia and Norway) foreign gas supplier. The effects of disruptions of gas supplies from Algeria are investigated in a simulation analysis that applies the TIGER model (Lochner and Bothe, 2007; Lochner, 2011), a linear program with high temporal and spatial granularity. It optimizes the dispatch of natural gas volumes in Europe, subject to supply, the available infrastructure (pipelines, storage, and LNG import terminals), and demand. The model provides a dynamic and integrated evaluation of the infrastructure components, their interaction, and the effects of import disruptions on security of supply.[3]

3.1. Disruptions during summer

The first scenario (Summer Disruption) assumes a disruption of North African supplies from 15 March to 30 September 2011. Figure 1 compares the aggregated effects for the Italian gas supply mix in this time period relative to a simulation without supply disruptions.[4]

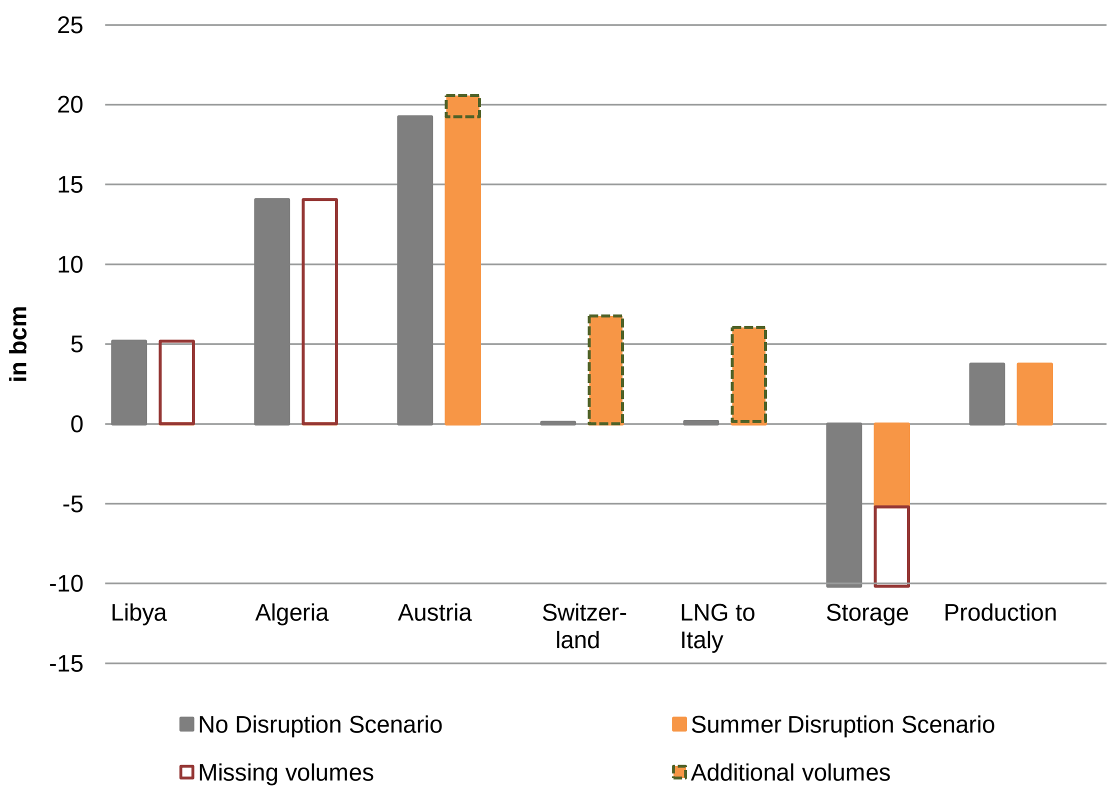
The missing volumes of 19 bcm from Libya and Algeria are compensated for mainly by additional LNG imports in Italy (5.6 bcm) and LNG imports to the UK that are transported to Italy via Belgium, Germany, and Switzerland (6.7 bcm). Additional Russian volumes are routed to Italy via Austria, and injections into Italian storage in summer decline (compensated for by additional LNG imports the following winter). Therefore, even a prolonged stop in the transport of pipeline gas from both Libya and Algeria causes no disruption to consumers if it starts in spring and does not last into the winter.

The situation in Spain, whose dependence on pipeline supplies is lower than that of Italy, is similar. Additional LNG imports can easily compensate for the volumes that Spain does not import from Algeria

[3] See Lochner and Bothe (2007) and Lochner (2011) for a detailed description of the model. Demand assumptions here are based on Capros et al. (2010), and infrastructure and supply assumptions are based on EWI (2010).

[4] The model's suitability for replicating actual gas flows is shown in EWI (2010).

Figure 1: Simulated gas supplies to Italy, March to September 2011



in summer.[5] As there are sufficient LNG capacities, this also holds true for Spain in the winter months. However, the situation is different for Italy, where LNG import capacities are limited, and winter demand is significantly higher.

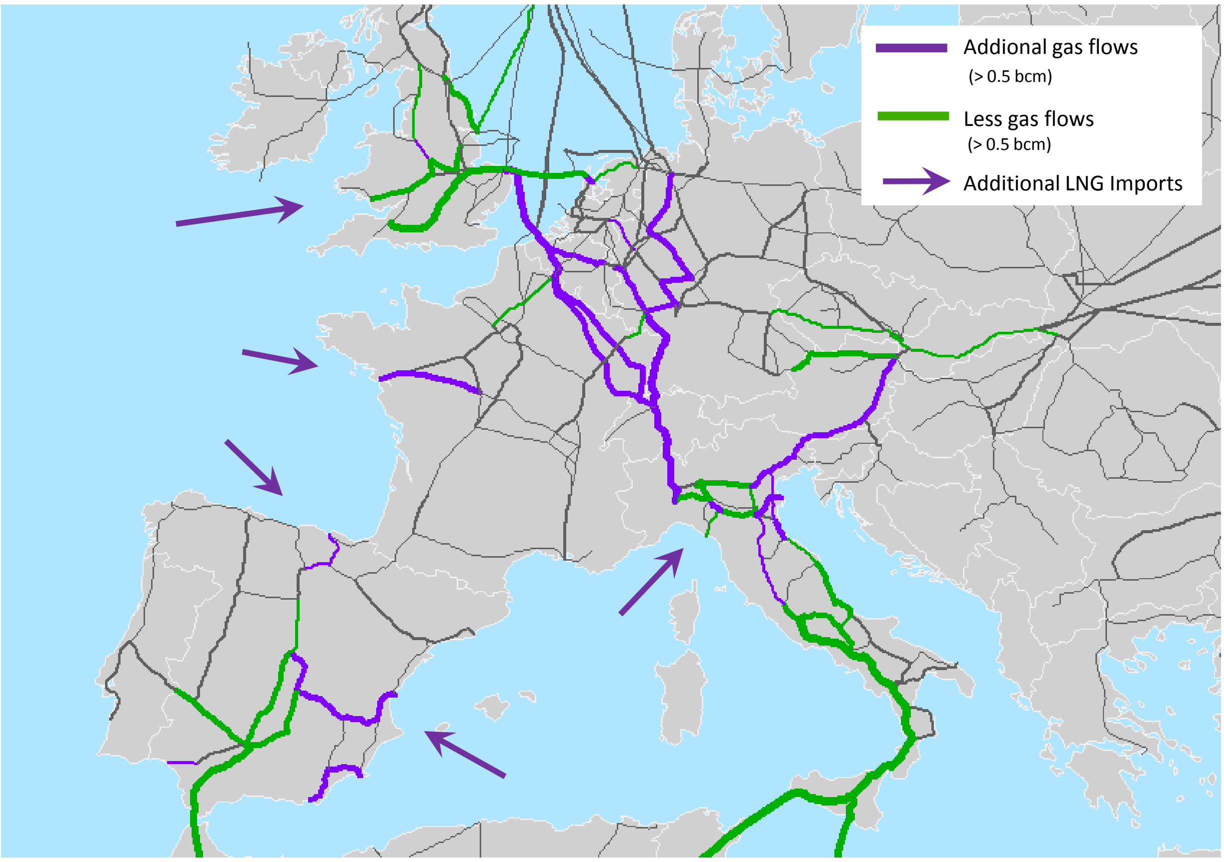
3.2. Disruptions during winter

Our second simulation investigates a disruption of supplies from October 2011 to March 2012. As in the summer analysis, we find that significant volumes of gas can be rerouted (Figure 2). In addition to LNG transported to the Italian terminals, compensation for the missing volumes in Italy comes from additional LNG imported from other European countries and the routing of additional Russian and Norwegian gas to Italy.

However, with these measures, all import infrastructures must operate at capacity, and any additional volumes required need to be withdrawn from Italian gas storage. Therefore, Italian gas storage are depleted

[5]We assume that the well-supplied global LNG market allows the purchase of additional cargo from other sources.

Figure 2: Simulated changes in gas flows in case of prolonged disruptions from North Africa in winter, relative to the normal situation

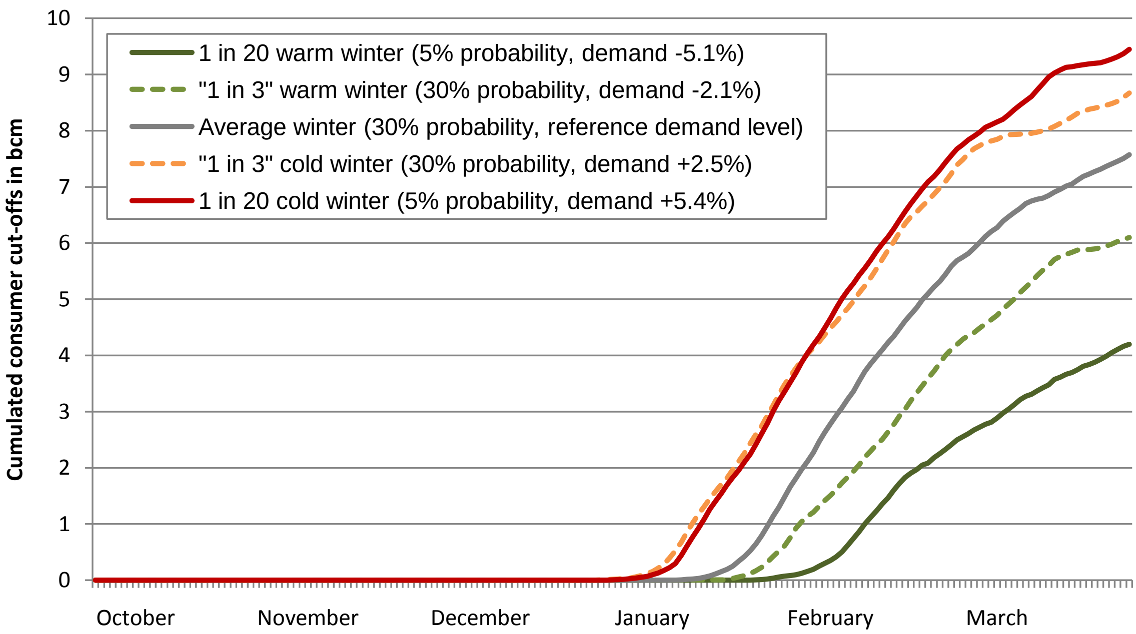


much faster than they would be under normal circumstances. The time until depletion of gas stocks then depends largely on the temperature (which determines household gas demand) and the price elasticity of demand in the industry and power sectors. Assuming these to be inelastic, the first disruptions to consumers would occur between 86 and 114 days after the start of the disruption - that is, in December 2011 or January 2012. Figure 3 illustrates the accumulated of unsupplied demand in such a scenario.[6] During this time of the year, industrial gas consumption is approximately 7.5 bcm, so unless the power sector can substitute sufficient gas-fired power plants with other types of power generation, household consumption may also have to be rationed. Because of the infrastructure bottlenecks into Italy in such an extreme scenario, suppliers in other countries would not be able to supply additional volumes, despite presumably high prices in the day-ahead market at the country's trading point (Punto di Scambio Virtuale, PSV). The congestion into

[6]We analysed temperature-demand correlations and temperatures to derive a distribution of gas demand for Italy. (See Figure 3 caption for summarized results.) Average demand for the October to March period is 49.67 bcm.

the country would also prevent price spikes at other locations.

Figure 3: Supply disruptions to consumers based on level of demand



The expected unsupplied demand in Italy for the entire winter season is 7.6 bcm. A comprehensive valuation of the welfare losses from of such a supply shortfall is beyond the scope of our brief analysis, but relating this loss of gas sales to the current PSV future price for the 2011 Gas Year of 32.30 EUR/MWh (ICIS Heren data, 13/04/2011) yields 2.7 billion EUR. Hence, based on the model results, a prolonged supply disruption from North Africa poses a severe threat to security of Italian natural gas supplies. All other countries are less dependent on the region, and Spain has sufficient redundant capacities.

4. Conclusion

Past supply disruptions that have affected Europe were brief and were due to either technical problems or economic disputes with transit countries. Technical problems, such as that which led to the disruption of the Transitgas line in Switzerland in 2010, usually affect only single infrastructure elements, so they do not necessarily affect large volumes of gas. Long-lasting economic disputes harm the reputation of gas producers, transit countries and natural gas in general. Therefore, such conflicts are not in the best interests of these stakeholders, and they have typically been resolved within a relatively short time. The disputes disrupting Russian gas transits via Belarus in 2006 and Ukraine in 2009 are good examples.

These concerns are also reflected in the relevant regulations: the security of supply guideline by the European Commission emphasises system resilience for supply disruptions lasting up to sixty days (European Union, 2010). The situation in Libya falls into neither of those categories. Unlike technical issues (or potential terrorist attacks), a war-like situation may affect whole countries, not just single infrastructure components. Unlike the transit problems of the past, economic concerns regarding future gas sales are not a priority in wars, which hamper most economic activity. Therefore, speedy resumption of gas deliveries in such a scenario is far from certain.

The model results show that short-term interruptions of gas supply can be compensated for, but prolonged interruptions of gas supply from North Africa in winter would pose a severe threat to security of supply and cause disruption to end consumers. Therefore, a reassessment of the short-term security of gas supplies might be required in which the potential for long-lasting supply disruptions, especially from politically unstable countries, is taken into account.

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