BECKER BÜTTNER HELD

SUMMARY

"Possibilities to improve gas security and crisis prevention via regulation of storage (strategic reserve, storage obligations), including the costs and the economic effect on the market"

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A study commissioned by
the Federal Ministry for Economic Affairs and Energy –
Bundesministerium für Wirtschaft und Energie (BMWi)

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Background and scope of the study

The security of natural gas supply in Germany is currently ensured to a large degree. However, the experiences made in the cold winter of 2011/2012, periods of low storage filling levels and the discussions about possible, politically motivated restrictions on gas imports as well as the importance of natural gas supply for private consumption, for the electricity generation sector and the industry have increasingly drawn the attention of both the public and the political world to the issue of gas supply security.

Gas storage facilities play a significant role in safeguarding the security of gas supply in Germany. This study analyses the possibility of a (regulated) contribution of gas storage facilities to improving supply security. The scope, costs and effects of such contribution are examined and the results are made available to serve as the basis for the necessary political debate. In accordance with the assignment, the main focus of the study is on the strategic reserve and the storage obligation – two variants of storage-related measures for the purpose of ensuring security of supply.

Simulation of crisis scenarios as a basis of the examination

The security of gas supply can be influenced by a variety of factors. This study focuses on how to meet the demand in a market area, and respectively, throughout Germany with the gas volumes available at a given time. Accordingly, scenarios of restricted security of supply are only dealt with in relation to gas supply shortages.

For this purpose, a static model targeted at balancing supply and demand was used to simulate for a time period of up to one month the possible impact that external factors (a complete failure of an import point for technical reasons as well as a political conflict resulting in the complete disruption of gas supplies from Russia) and unfavourable framework conditions affecting the German gas supply system (low storage filling levels and low winter temperatures) may have on supply security. The results of the analysis are supplemented by recommendations on how to take into account the allocation of storage capacities in the context of the network topology in the future. The simulation and analysis relate to the months of November 2015 and February 2016 and also provide an outlook to the months of November 2025 and February 2026.

The study does not address potential supply restrictions resulting from disruptions or bottlenecks in the transmission or distribution system or the economic viability of gas storage facilities in general.

Assessment of the security of supply based on the scenarios analysed

High level of supply security in general

The overall picture revealed by the study shows that the security of gas supply in Germany remains at a very high level. Unless supply disruptions or additional demand persist over a long period, they can be compensated by adjusting alternative supply options accordingly.

Provided that well-functioning market mechanisms are in place, gas storage facilities in Germany are sufficiently dimensioned to safeguard supply even in severe winter periods (with prolonged or extremely low temperatures, as specified in Regulation (EU) No 994/2010 on security of gas supply. During an average winter, the emergence or escalation of a political conflict with an exporting country would also be manageable without the supply security being compromised – at least for a limited period of time. Accordingly, natural gas supply is considered secure for at least one month if a crisis arises at the end of the winter period, and even for several months if the crisis arises at the beginning of winter. First signs of emerging supply problems could only be detected where a longer political conflict was simulated.

In general, a supply shortage becomes apparent only where many factors occur simultaneously. In this regard, the scenarios analysed in the study illustrate, to a certain extent, rather extreme constellations that are not very likely to occur, especially not cumulatively. No statement is made in this study as to the likelihood of these worst-case scenarios, which is – at least as regards the probability of a political conflict – to be assessed primarily at political level.

Security of supply strongly dependent on storage filling levels

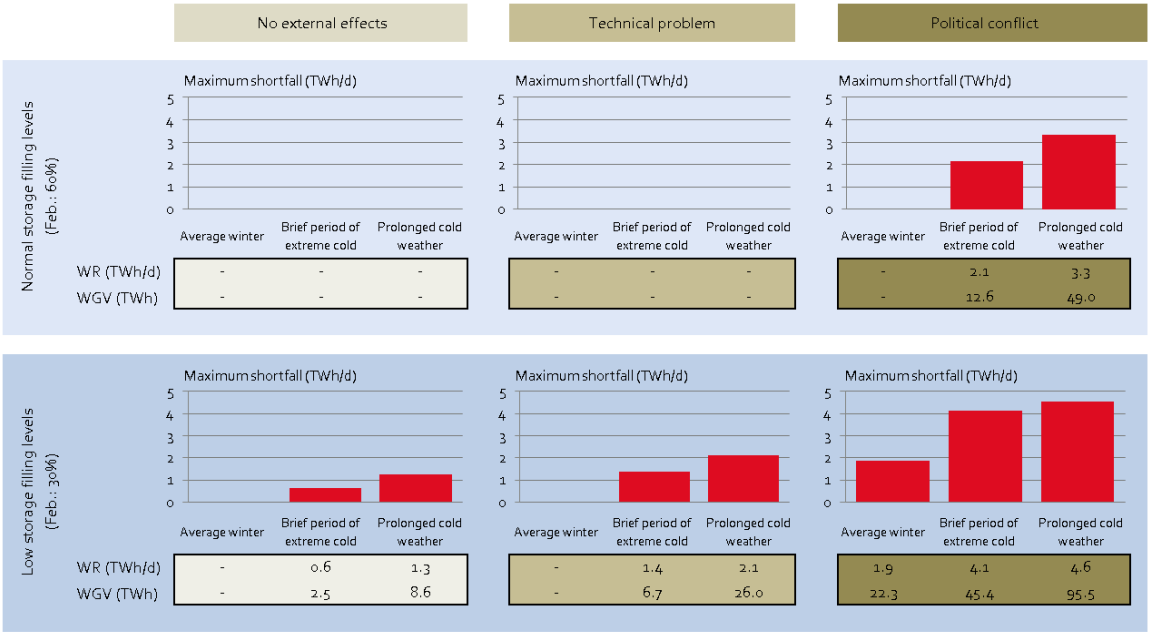
The analysis shows the extent to which the German gas system depends on the storage filling levels. In the event that the storage facilities do not contain sufficient gas volumes, an unusually severe winter combined with technical problems could already lead to substantial supply shortages which could not be closed instantly, even if gas imports to Germany were increased.

The impact of low filling levels is only felt at the end of the winter period since the withdrawal rate in storage facilities with high filling levels has proven to be relatively stable and only starts to flatten out notably where a certain residual amount, which is different for each storage facility, has been reached.

In the scenarios examined, the gas supply situation in November appears to be largely uncritical. Except for the event of a political conflict resulting in a total disruption of gas supplies, supply shortages were only identified for the month of February, which is less due to increased gas demands in this period but rather to the lower withdrawal rate of the storage facilities, which again underlines the importance of the storage filling levels.

Political conflict during a severe winter critical

The scenario in which a political conflict coincides with a severe or prolonged period of cold weather shows a supply shortage occurring even in the case of normal storage filling levels. In terms of the withdrawal rate and the working gas volume needed to compensate for the shortage, it would not suffice to book the currently available storage capacities of 35 TWh of working gas volume; it is rather the case that new storage capacity amounting to 75 TWh of working gas volume (equalling a total of approx. 7 billion m^3) would have to be provided additionally. **Figure 1** below illustrates the results of the supply shortages identified for the month of February 2016 under consideration of the market-based possibilities for compensation.



WR = maximum shortfall (in relation to storage facilities: withdrawal rate)
WGV = total volume shortage (in relation to storage facilities: working gas volume)

Figure 1: Supply gaps identified under consideration of market-based possibilities of compensation (Feb.)

Key points in the assessment of the strategic reserve

The first measure the study focuses on is the strategic reserve. The key element of a strategic reserve is that a certain part of the gas storages is set aside from general market mechanisms to be used only in clearly defined scenarios outside of the general gas market. The volumes of gas placed in strategic reserve are not to be traded on the gas market and may only be drawn on in the event of a supply crisis.

A strategic reserve in analogy to the German National Petroleum Stockpiling Agency

In the event the strategic reserve is to be designed in analogy to the model of the *Erdölbevorratungsverband* (EBV – German National Petroleum Stockpiling Agency) it will be necessary to establish a public body with compulsory membership. Membership should be mandatory for domestic producers and importers. In principle, the task of building up a strategic reserve may be entirely entrusted to the public body. Costs arising in the context of the stockpiling obligation would

have to be borne by the members in accordance with the volumes they contributed to the national market. Recourse to the volumes of gas held in strategic reserve may be subjected to the federal government announcing an emergency (emergency level as set out in the national emergency plan), and the volumes may be allocated by the (federal) load dispatcher.

Holding available a strategic reserve by means of a natural gas stockpiling agency is not entirely suitable for very short-term releases of additional gas volumes and thus for reacting to short-term, mainly weather-induced supply disruptions, as the announcement of an emergency according to the federal government's emergency plan and the approval of gas volumes to be released by means of an ordinance require a certain lead time.

A strategic reserve within the responsibility of the transmission system operators

Delegating the responsibility for the strategic reserve to the transmission system operators (TSO) may improve the reaction time to short-term, primarily weather-induced supply disruptions. The reserve is to be built up by means of bookings, the acquisition of shares in storage facilities or the tendering of supply commitments. The release of volumes may, among others, be coupled to the development in the control energy market at the gas exchange. The volumes released in the event of a crisis may be deployed as a special type of balancing activity within the grid (internal control energy). The costs for the set-up and operation may be financed through an existing or newly created surcharge or via grid charges.

At the same time, there are limits to the TSOs' capability of operating the strategic reserve, particularly so in case of a very large reserve due to the substantial efforts arising in the context of the operation of such a reserve. Therefore, as regards the protection against longer-term crises – which involves a considerable precautionary effort –, it appears to be more favourable to assign the operation of a strategic reserve to an independent organisation, such as a natural gas stockpiling agency.

Where the strategic reserve is to take a smaller scale, it will form part of the contingency instruments for mitigating more severe supply crises. However, in the event of a major gas shortage, it will be necessary to take additional measures such as, for example, procuring LNG volumes – assuming that capacities and spot cargoes are available.

Costs of a strategic reserve

The costs of setting up a strategic reserve depend on the size it should take. The annual costs of a strategic reserve which, for example, serves to ensure the security of gas supply in the event that a political conflict resulting in the cessation of all gas flows from a supplier country over the period of one month coincides with overall low storage filling levels and prolonged cold weather in February amount to approx. €1.6 billion. When calculated over 25 years, this amounts to costs of approx. €40 billion. Additional grid expansion costs which may be kept very low or may even be avoided completely if the strategic reserve is allocated appropriately have not been taken into account in this calculation; this also applies to the costs listed below.

Where the strategic reserve is to be modelled after the Bundesrat resolution dated 11 July 2014, costs amounting to approx. €1 billion per year are to be expected. When calculated over 25 years, this amounts to costs of approx. €26 billion.

A smaller dimension of the strategic reserve for the purpose of bridging times of low natural gas volumes in store and short periods of seven days of extremely cold weather would (based on a storage filling level of 30% in February) result in total costs of approx. €379 million per year and, respectively, approx. €9.5 billion over a period of 25 years.

Where the prices are entirely passed on to the final customers and other charges remain stable, the impact on the final customer price (incl. grid charges, taxes etc.) amounts to between 0.6% and 2.4% for the household customer sector depending on the size of the reserve. With regard to the wholesale price (commodity, net), an increase of between 1.2% and 5.2% is to be expected.

Key points in the assessment of the storage obligation

The second key measure examined in the study concerns the introduction of a storage obligation. By means of storage obligations, market participants are required to place and hold in storage a certain amount of gas at one or more specific points in time. This is to guarantee that there are always sufficient volumes of gas in store for emergency situations. Unlike the strategic reserve, the storage obligation is thus effective ahead of a crisis. If it still comes to a gas crisis, a storage obligation also ensures that the grid operators and load dispatchers can draw on the corresponding volumes of gas held in storage.

The calculations performed for a range of different crisis scenarios show that securing minimum storage levels can prevent supply crises in almost all of the cases considered. It is only where a technical problem (such as a four-week-long disruption of an important interconnection point) or a political conflict coincides with an extreme or prolonged period of cold weather that gas volumes held in existing storage facilities cannot fully mitigate the impact of such a scenario.

Storage obligation to be incumbent on the balancing group responsible parties

If a storage obligation is to be introduced, it is considered preferable – in particular due to the current structure of the German gas market – to place a relevant obligation on the balancing group responsible parties (BRPs). This obligation should be effective both at the start (November) and towards the end (February) of the withdrawal period. The storage obligation, too, should be designed in a way so as to ensure the necessary regional distribution. The specific amounts to be stored by each party should be determined on the basis of the total volumes of gas balanced and withdrawn in the preceding year. The market area managers could be tasked with monitoring the compliance with this obligation.

Availability of free storage capacities to be taken into account

The fact that the majority of existing storage capacities is currently booked may prevent the introduction of a storage obligation in the short term. Based on our market intelligence, only approx. 35 TWh of working gas volumes are assumed to be freely available for booking in the primary and secondary market. At the moment, the vast majority of storage capacities is tied up contractually. As a result, the successful implementation of the storage obligation cannot be guaranteed in the short term and the introduction of such obligation would have to be accompanied by additional measures.

Assessment of the costs of a storage obligation

The costs of implementing the storage obligation are dependent on its specific dimension. According to our calculations, ensuring a target storage filling level of 40% in February (70% in November) would require an initial investment of approx. €563 million and further annual costs amounting to approx. €133 million would arise. When calculated over 25 years, the costs would thus amount to €3.9 billion. The intended storage filling level would alleviate gas shortages brought about by a brief period of seven days of extremely cold weather.

A more extensive safeguard, e.g. against prolonged cold weather periods coinciding with a technical failure of a vital interconnection point lasting for four weeks or against the non-availability of supplies from an important gas-exporting country for one month, may be achieved through higher storage filling levels (February: 60%, November: 90%). This would require an initial investment of approx. €1.7 billion and annual costs of approx. €355 million would have to be borne additionally. When calculated over 25 years, the costs would thus amount to approx. €10.6 billion.

Furthermore, a key characteristic of a storage obligation is that the obligations placed on market participants vary in degree and also apply at different points in time. The initial investment costs to be incurred by BRPs which have already booked storage capacities in order to optimise their portfolio may be significantly lower than the costs to be borne by market participants which have not yet done so. As a result, it is not necessarily to be expected that the prices for final customers would rise uniformly. It is therefore impossible to anticipate a uniform percentage increase of final customer prices.

Market impact of the measures

Negative effects on the gas and storage market are most likely to occur in the context of introducing a storage obligation. While the obligation secures specific minimum storage filling levels on the one hand, it significantly restricts the gas and storage market/flexibility market on the other. In particular, the possibility to quickly react to price signals with gas injections or withdrawals will be entirely subject to the framework provided by the state. One of the essential characteristics of a functioning (European) storage market, i.e. the possibility to undertake price-driven gas withdrawals in order to counteract a potential volume shortage, is thus considerably restricted.

The implementation of a strategic reserve would have far less impact on the market due to the fact that it comes into play only in the event of a market failure.

What both implementation options have in common is that they withdraw capacities from the storage market. For a conservative estimate of the related negative market impact that would be brought about by the implementation of the strategic reserve, the analysis is based on the assumption that demand exceeding the currently available free storage capacity (approx. 35 TWh) is to be assessed in analogy to the costs of newly built storage facilities.

Both options would require extensive regulatory market intervention and significant efforts in terms of legal implementation. The statutory regulations under the Energy Industry Act (*Energiewirtschaftsgesetz* – EnWG), the Gas Grid Access Ordinance (*Gasnetzzugangsverordnung* – GasNZV) and the Gas Network Charges Ordinance (*Gasnetzentgeltverordnung* – GasNEV) will require extensive amendments. The determination on gas balancing rules (implementation of the Network Code on Gas Balancing, "GaBi Gas 2.0" – *Festlegung in Sachen Bilanzierung Gas*) will be affected as well. In the event that a natural gas stockpiling agency is to be formed, a legal framework analogous to the Petroleum Stockholding Act (*Erdölbevorratungsgesetz* – ErdölBeVG) would have to be created. The regulatory burden, caused by the necessary monitoring activities and other factors, is rather likely to be extensive in the case of storage obligations.

Supplementary and/or alternative measures

Alternatively or in addition to a storage obligation or the setting up of a strategic reserve, further measures may be carried out to increase and safeguard the level of supply security:

- As an alternative to the introduction of a storage obligation and in addition to the setting up of a strategic reserve, sec. 53a EnWG may be adjusted with regard to the definition of protected customers or with a view to introducing the requirement to provide proof as to how the obligation is complied with. In this regard, the revision of the SoS regulation, which is under discussion, should be taken note of, as a uniform European approach would be preferable.

- The system security and the transmission system operators' as well as the distribution system operators' possibilities of intervention under sections 16, 16a EnWG should be substantiated and further specified. This applies, in particular, to the recognition of costs of a "market-based instrument", the possibility to access stored volumes and the clarification of liability exemptions in the context of emergency measures.

- Furthermore, demand-side management should be strengthened. Market participants should be enabled to offer a reduction of loads in a legally binding manner in exchange for the payment of a premium.

- In addition, a revision of the balancing rules may be used to provide further incentives for keeping the balancing groups balanced, thus indirectly improving security of supply. This should be realised in particular through a clarification regarding the settlement of balancing groups in the case of a crisis.

- The costs of LNG as a precautionary option depend on the intended degree of security. Provided that one is willing to rely on market mechanisms, to pay peak prices for the commodity and the transport on the world market as well as the regasification and is prepared to accept the additional risk of a potential capacity shortfall caused by a crisis, LNG may serve as a flexible supplementary measure for crisis prevention, even though its costs cannot be anticipated with accuracy. It must, however, be taken into account that LNG cargoes need a certain amount of time to reach a relevant terminal. In all cases, there is a timeframe of approx. two weeks during which the security of supply must be ensured by other means. The availability of natural gas in the event of a crisis may be secured by supply options and fixed bookings of capacities at relevant terminals and within the transmission grid. In this case (based on a rough cost estimate) one must, however, expect costs that are comparable or even higher than those incurred for the construction of new storage facilities for corresponding gas volumes.

- Transmission system operators should be obliged to model and to calculate different security of supply scenarios within the framework of the gas network development plan pursuant to sec. 15a EnWG.

Concluding remarks

The overall picture of the cases examined and documented within the scope of this study shows that there currently is a very high degree of security of gas supply in Germany. At this point in time, the introduction of specific instruments and measures to increase the security of supply appears to be necessary and urgent only if the desired level of supply security is to cover any and all potential risks, including several individual risk factors occurring at the same time.

On the premise that the level of supply security which was historically and is currently considered sufficient shall remain the basis for the future, the authors of the study would like to recommend that the level of supply security be increased

by means of the alternative and supplementary measures set out in Part 8 of the study and monitored continuously before either the strategic reserve or the storage obligation is implemented. In this respect, priority should be given to specifying sec. 53a EnWG and the network operators' possibilities of intervention under sections 16, 16a EnWG as well as to modelling different scenarios regarding the security of supply in the gas network development plan and to implementing the grid development measures derived therefrom.

The authors believe that these measures will contribute to further reducing the likelihood of gas supply shortages, which – while being low, as described above – cannot be ruled out entirely. As a result, comprehensive changes in the market structure, in the individual market roles and the corresponding high macroeconomic costs may thus initially be avoided.

If a level of supply security is aimed at that is higher than the one currently regarded as sufficient, or if the implementation of an additional measure is – in the future – considered to be inevitable for maintaining the current level of supply security, the authors recommend developing a small strategic reserve within the responsibility of the transmission system operators that is combined with further security measures.

Berlin, June 2015