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Can Ukraine secure enough gas for the winter? A scenario analysis

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Can Ukraine secure enough gas for the winter? A scenario analysis

Executive Summary

In June 2014 Russia stopped gas exports to Ukraine. Russian gas covered about half of Ukraine's gas consumption in previous years and during winter demand is about three times higher than in summer. Consequently, without substantial action Ukraine will not be able to cover its gas demand this winter. To ensure adequate supplies Ukraine seeks to reduce gas demand and increase gas imports from the west ('reverse flows').

Based on a scenario analysis we find that Ukraine can only get over the winter without Russian gas when demand is reduced by at least 20% and reverse flows from Slovakia are inaugurated. If one of these two conditions is not met, then storages would run below critical levels in early 2015. The only way to avoid a shortfall of gas in this case would involve resuming imports from Russia several weeks before the storage runs empty.

Simulation Results – When would Ukraine need to resume importing 100 mcm/d from Russia to get over the winter2014/15?

	0% demand reduction	**20% demand reduction**
No reverse flows (0 mcm/d)	09.11.2014	25.01.2015
100% from HU and PL and 50% of interruptible capacity from SK (25.3 mcm/d - 38.3 mcm/d)	19.01.2015	No need for Russian gas
100% from HU, PL and SK (38.3 mcm/d)	29.01.2015	No need for Russian gas

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1. Motivation

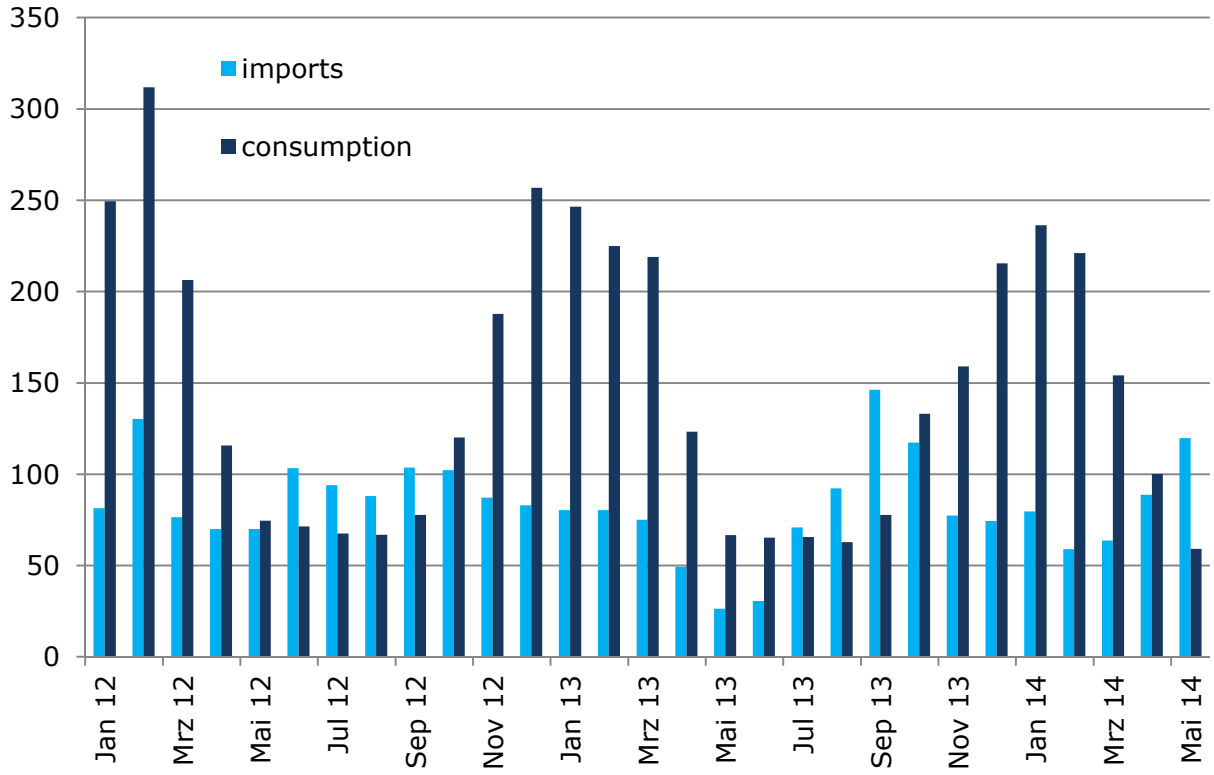
In mid-June 2014 Russia stopped natural gas exports to Ukraine. In the past gas imports from Russia covered about half of Ukraine's gas consumption. So there is a widespread concern that without imports from Russia Ukraine cannot secure gas supplies to Ukrainian consumers in the coming winter. This could have a dramatic economic and social impact. In addition, the ability to ensure adequate gas supplies has repercussions beyond Ukraine. Without adequate supplies Ukraine might be unable to ensure a stable gas transit from Russia to Western Europe. In this case, some 40% of the imports from Russia might not be delivered to the EU.

Until now (mid-August 2014) Ukraine's domestic production and imports from Poland and Hungary were sufficient to cover the current gas demand. In fact, Ukraine was able to even inject small amounts of gas into its storages (about 20 million cubic meters per day [mcm/d]). But the current ability to ensure adequate supplies does not imply that Ukraine will have enough gas to sustain the coming heating period. In previous years Ukraine's gas consumption was more than 210 mcm/d in winter, compared to less than 80 mcm/d in summer (see Figure 1). Consequently, with the current storage volumes Ukraine will run out of gas during winter.

Thus, Ukraine has to reduce demand and increase supplies to stand a chance of ensuring adequate gas supplies during the winter. Accordingly the Ukraine government is actively engaged in enabling additional reverse flows from Slovakia (see 2.1) and encouraging demand reduction (see 2.3).

Figure 1

Ukraine's monthly gas imports and gas consumption in mcm/d



Source: Ministry of energy and coal

In this technical note we want to provide approximate answers to some of the most pressing questions in this regard: Will the currently stored gas, domestic production and imports from the west be enough to cover Ukraine's demand in winter? Which combinations of demand reduction and reverse flow volumes can bring Ukraine over the winter? When would imports from Russia need to resume to ensure adequate supplies?

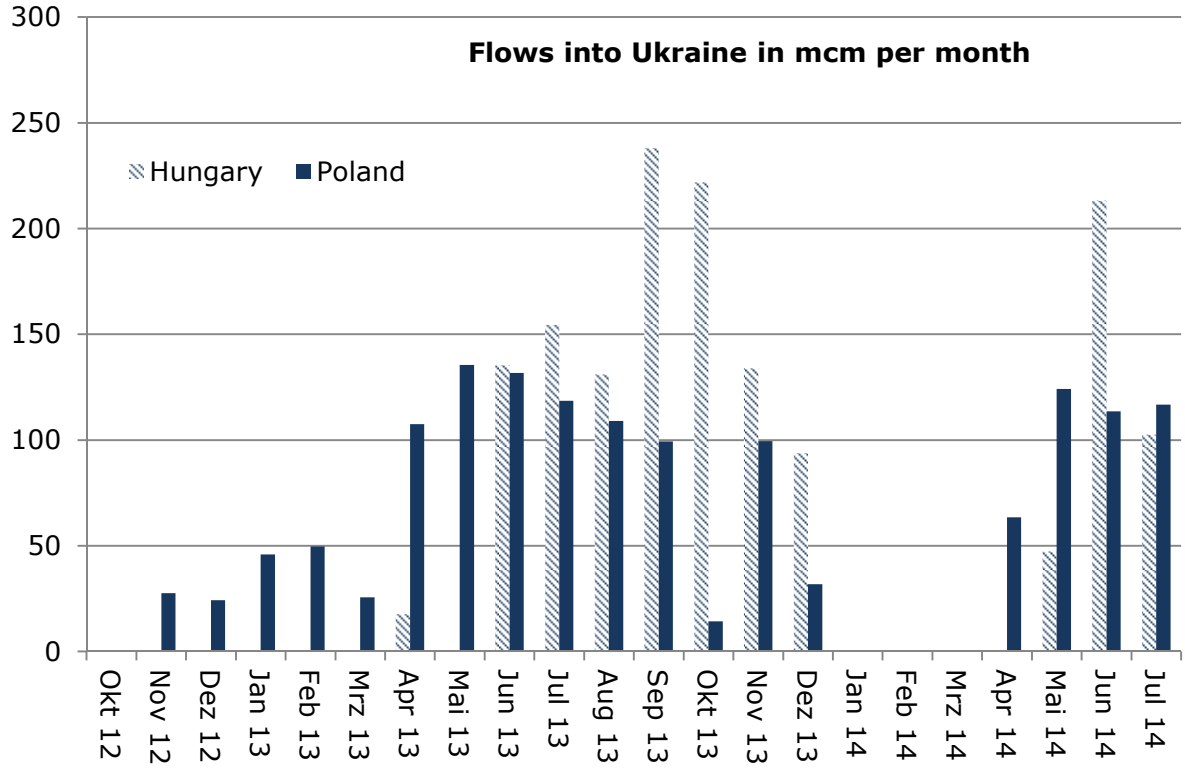
2. Assumptions

2.1 Reverse flows

Since 2012 Ukraine has been importing some volumes of natural gas from Hungary and Poland ('reverse flows'). Due to technical constraints the flows have been somewhat limited. The maximum daily flow rate was 7.9 mcm/d from Hungary and 4.4 mcm/d from Poland[1]. In July and August 2014, however, only about half of the theoretical capacity from Hungary was used (~4 mcm/d). Thus, reverse flows from Hungary and Poland alone would be clearly insufficient to compensate for a shortfall of imports of about 80-100 mcm/d from Russia.

Figure 2

Monthly reverse flows from Hungary and Poland



Source: IEA 2014 (http://www.iea.org/gtf/index.asp) and GIE (http://transparency.gie.eu)

Ukraine and Slovakia have signed a memorandum of understanding on reverse flows from Slovakia. As of now, it is envisaged that from September 2014 on 26 mcm/d of capacity from Slovakia are made available. At the end of August, tests confirmed that an estimated capacity of 27 mcm/d is technically feasible[2]. Due to technical uncertainties, the Slovakian TSO reserves the right to interrupt corresponding flows in September (i.e., shippers that bought such interruptible capacity cannot be sure they will be able to use it). From October 2014 to February 2015 35% of the capacity is sold as "interruptible", while 65% is sold as "firm". Only from March 2015 all reverse flow capacity from Slovakia is sold as firm capacity.

So at best, about 38 mcm/d of reverse flow capacities might be made available for winter 2014/15.

To which extend the pipeline capacities for reverse flows will be used is another question that depends on (i) whether Ukraine is willing and able to pay for the corresponding gas

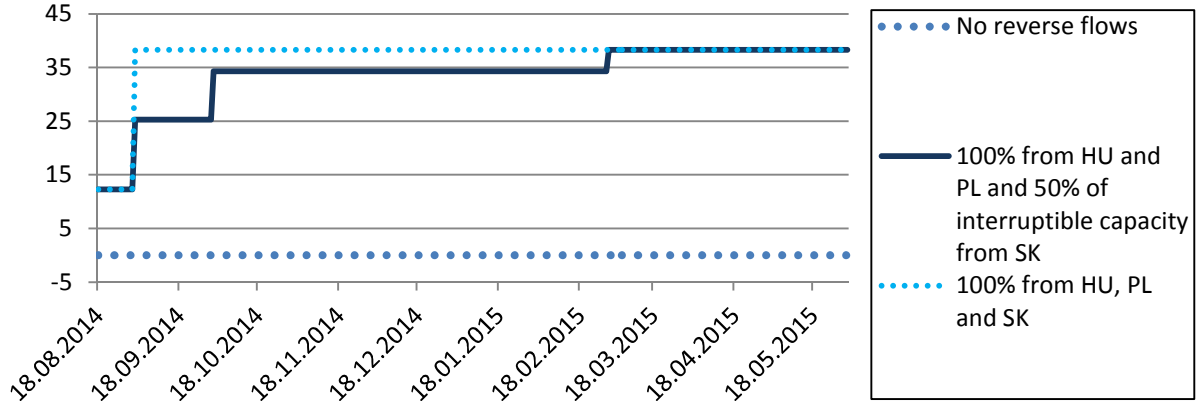
[1] This is in fact the highest average daily value for one month.

[2] http://en.itar-tass.com/economy/747408

from the west and (ii) whether companies are willing and able to sell the corresponding volumes to Ukraine. So it is essentially a question of which price Ukraine and western suppliers could agree on. But an agreement also involves crucial questions on the payment mode (e.g. advance payments), the duration of the contract, the firmness of the contract (e.g., 'Take or pay'), on who bears the cost of technical risks such as a disruption of the pipeline or on who bears the cost of legal risk such as disputes over Ukrainian VAT.

Figure 3

Reverse flow scenarios (mcm/d)



Source: own calculations

Correspondingly, in the scenario analysis we assume two extreme scenarios: no reverse flows and full usage of the technical capacity. As a third scenario we consider the partial usage of the technical capacity from Slovakia and full usage of the capacity from Hungary and Poland (see Figure 3).

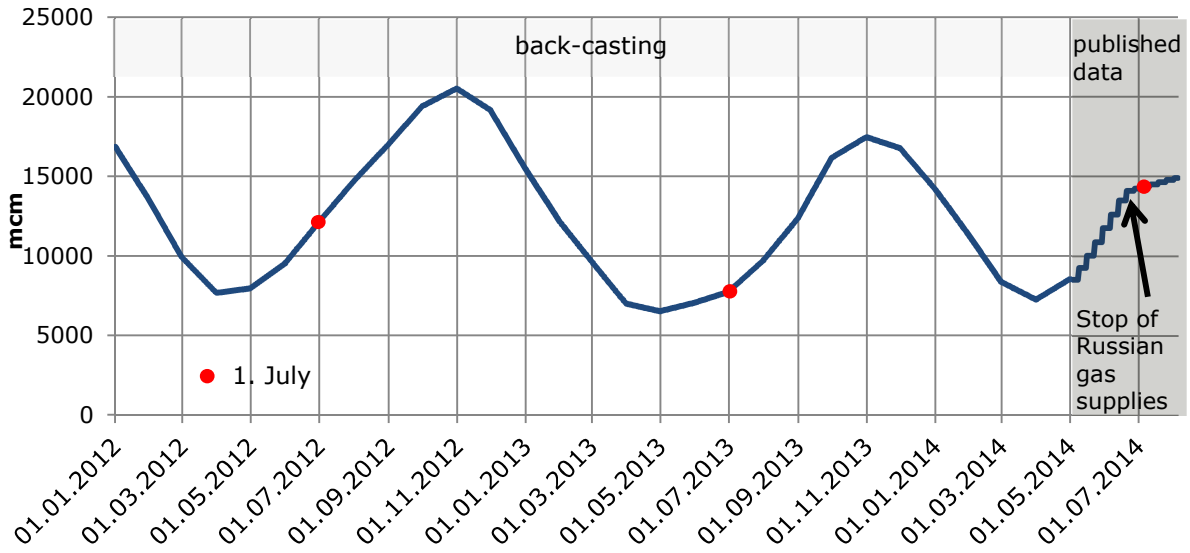
2.2 Storage

Ukraine has substantial storage capacity of about 32 billion cubic meters [bcm]. This allows accommodating the strong seasonal consumption pattern regardless of the rather constant production and import patterns. This required injecting gas into the storages during the non-heating season (typically starting from May).

Comparing current and past storage levels provides a first indication on the gas supply adequacy for Ukraine this winter. As there has been no data published on past storage usage it has to be back-casted based on the monthly gas balance of Ukraine. We assume that the change in storage volumes is equivalent to the production plus imports minus consumption.

Figure 4

Ukraine gas storage usage



Source: own calculations based on data from the Ministry of energy and coal and GIE

The resulting graph allows three observations:

1) In May 2014 – the first date for which we have official storage figures – storage volumes were about 2 bcm higher than what we back-cast for May 2013 (1.5.2013: 6.500 mcm, 1.5.2014: 8.500 mcm). One reason might be the lower winter-consumption in 2013/2014 due to milder weather conditions.
2) In July 2014 there was substantially more gas in the storage than in previous years. This can be due, both, to the aforementioned milder winter and the higher gas-imports from Russia during spring. Those extraordinary high imports might be explained by the low price assumed by Ukraine (268.50 USD/tcm) and the anticipated difficulties with Russian supplies for the rest of the year.
3) With the stop of Russian gas supplies in mid-June 2014, the injection into the storages flattens out significantly (from about 120 mcm/d to about 20 mcm/d).

The starting point for our analysis is the reported storage level of August 18th 2014 of 15,215 mcm.

The main uncertainty with respect to the storages is whether all of the reported gas in storage can actually be used. Official sources say it is the working gas volume, i.e., it could be fully withdrawn and used. On the other hand, in the past three years - including the extraordinarily cold winter 2011/12 - storage levels never went below 6000 mcm. So it is argued that these 6000 mcm are actually cushion gas and cannot be withdrawn. In our scenario analysis we assume an intermediate critical storage level of 3000 mcm[3].

Finally, there is a legal question on the ownership of gas in the Ukrainian storages. A large fraction of the gas does not belong to Naftogaz. A question is under which conditions gas held by other owners might be used for serving Ukrainian consumers.

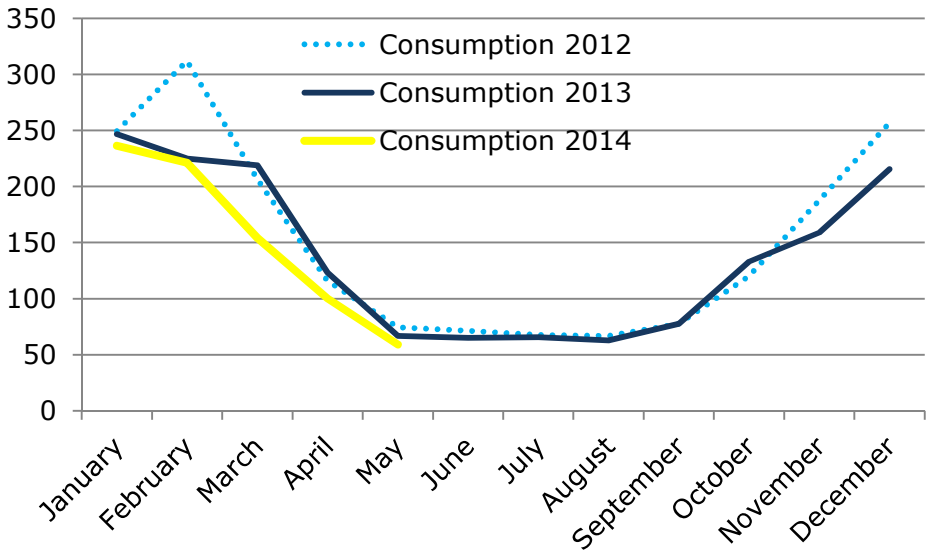
[3] The graphical representation results (e.g., Figure 6) allow to easily see what the implications of higher or lower critical levels would be.

2.3 Demand Reduction

In the past decade Ukraine was able to reduce annual natural gas demand by 35%[4]. This reduction was due to different factors. Higher gas prices for industry (and partly to other consumer groups) led to increased energy efficiency and fuel switching from gas to other energy carriers (coal, biomass). Slow economic growth and a sectoral shift to less energy intensive sectors further reduced gas demand. In the first five months of 2014 Ukraine consumed 13% less natural gas than in the same months of 2012 and 2013[5]. This significant drop was due to the exceptional situation[6]. The political situation led to a drop in industrial production by 5% in the first half of 2014 compared to the previous year (12% in Donetsk)[7]. Accordingly, gas consumption in Donetsk dropped by 25% between the first seven months of 2014 compared to the first seven months of 2013. Demand reduction in May-July was even more severe. According to Ukrstat data gas consumption was down by more than 30% year-on-year. But, as in this season this is largely industrial demand it cannot be extrapolated into the winter.

Figure 5

Gas demand in mcm/d



Source: own calculations based on data from the Ministry of energy and coal

Beyond the demand reduction due to 'external shocks', the Ukrainian government decided to actively reduce the gas consumption of industry and communes by 30% and consumption of schools and hospitals by 10% from August 2014. Accordingly, the city of Kiev already cut warm-water supply in the beginning of August.

Given the already lower gas consumption and the announced measures to reduce consumption our optimistic scenario is the gas consumption during winter 2014/15 is 20% below the 2012 and 2013 level.

However, the past winter had been comparatively mild and gas consumption in Ukraine during the following winter might be substantially higher if temperatures run lower this coming winter (see for example the consumption peak in February 2012, when temperatures were extremely low). Consequently, our pessimistic scenario foresees that gas consumption during winter 2014/15 will be, despite some saving efforts, the same as the average of 2012 and 2013 level.

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[4] According to BP (2014) consumption decreased between 2003 and 2013 from 69 bcm to 45 bcm.

[5] These numbers refer to the statistics of the Ministry of Energy. According to the slightly different but more recent data of Ukrstat, the reduction was 14% in the first seven months of the year.

[6] In addition, gas consumption of Crimea (about 1.4%) is excluded from the data.

[7] http://www.ukrstat.gov.ua/operativ/operativ2014/pr/tpo/tpo_u/tpo0614_u.htm

2.4 Scenarios

To assess how and whether Ukraine can secure enough gas for the winter we run six scenarios that differ in the assumed gas demand and the amount of available reverse flows (see Table 1).

Table 1

Description of Scenarios

	0% demand reduction	**20% demand reduction**
No reverse flows (0 mcm/d)	Scenario 1	Scenario 4
100% from HU and PL and 50% of interruptible capacity from SK (25.3 mcm/d - 38.3 mcm/d)	Scenario 2	Scenario 5
100% from HU, PL and SK (38.3 mcm/d)	Scenario 3	Scenario 6

Source: own calculations

Based on the discussion in section 2 we come up the following key assumptions:

Table 2

Key Assumptions

Minimum storage level	3,000 mcm
Russian imports (when resumed)	100 mcm/d
Starting date of simulation	18 Aug 2014
Starting storage volume	15,215 mcm

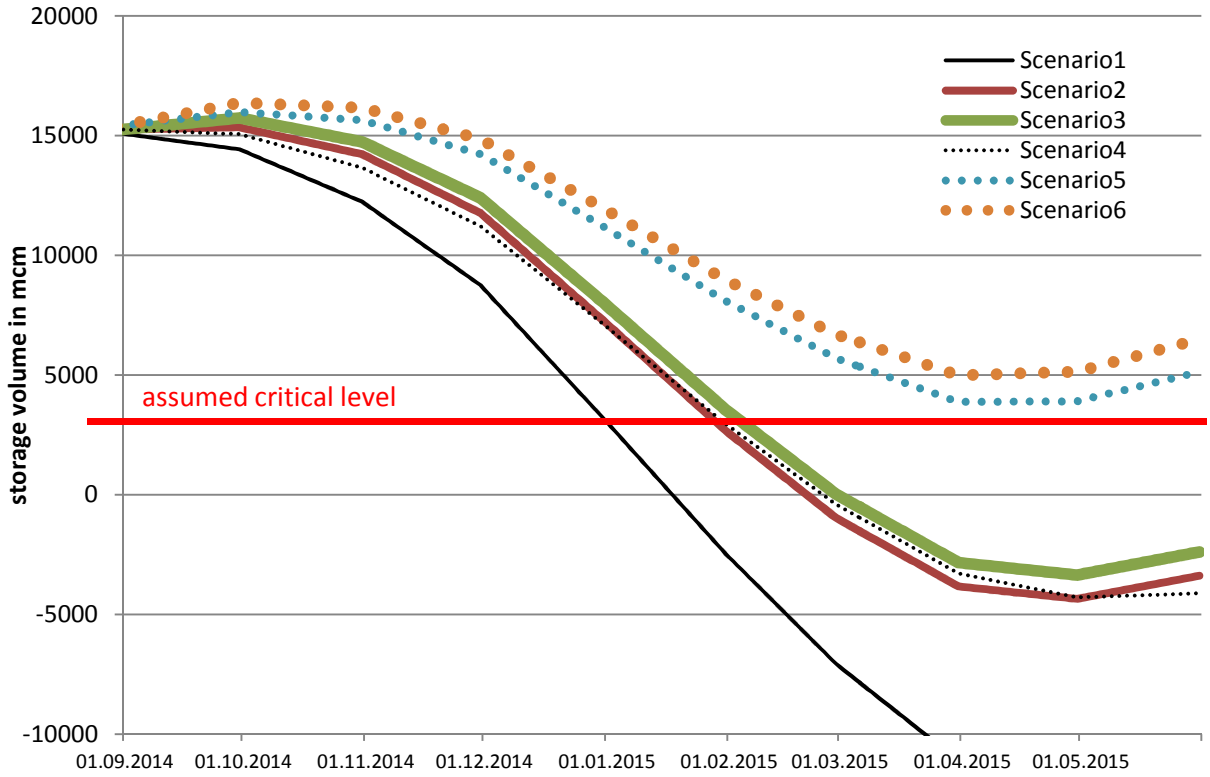
Source: own calculations

3. Scenario analysis

Based on the above we can estimate at which point the storage level would fall below the defined critical level in each scenario.

Figure 6

Simulation results



Source: own calculations

Table 3

Simulation Results – from when will storages run below the critical level?

	0% demand reduction	**20% demand reduction**
No reverse flows (0 mcm/d)	01.01.2015	30.01.2015
100% from HU and PL and 50% of interruptible capacity from SK (25.3 mcm/d - 38.3 mcm/d)	28.01.2015	Not during winter 2014/2015
100% from HU, PL and SK (38.3 mcm/d)	04.02.2015	Not during winter 2014/2015

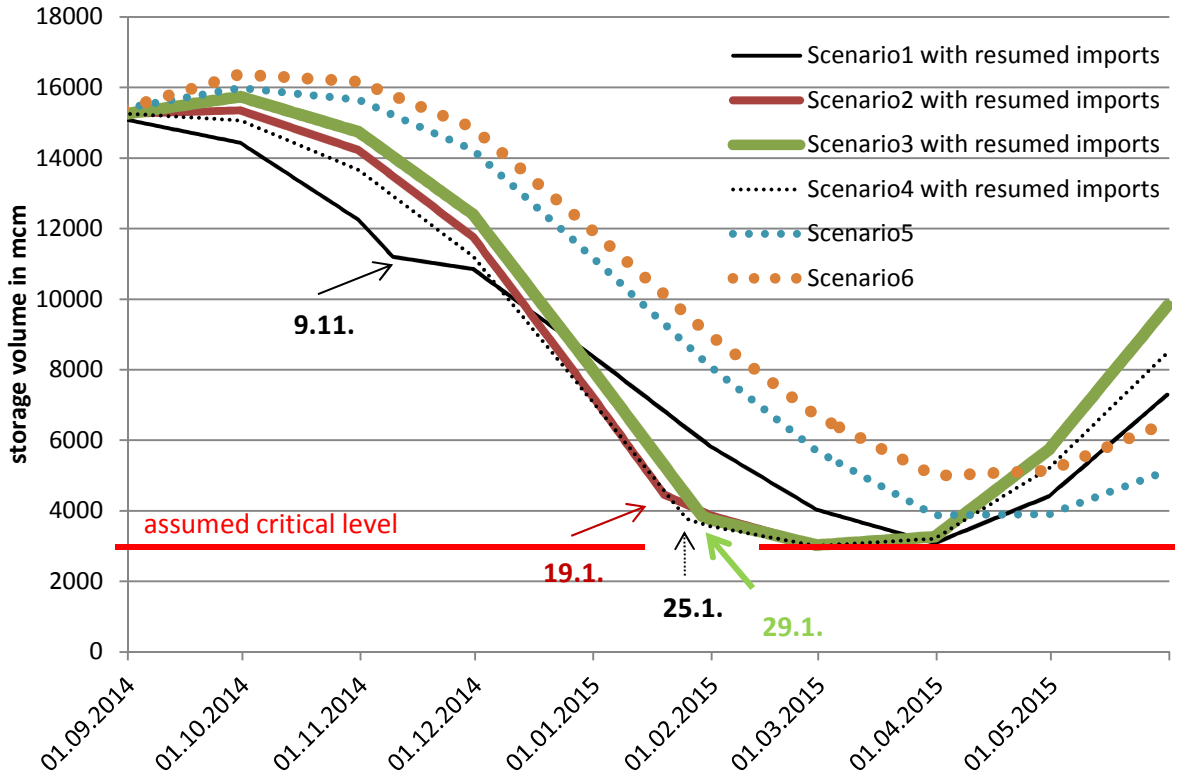
Source: own calculations

The results presented in Table 3 indicate that Ukraine can only come over the winter when demand is reduced by at least about 20% and at least some gas is imported via reverse flows (scenario 5 and 6). That is, without reverse flows (scenario 1 and 4) and without demand reduction (scenario 1, 2 and 3) storages will run below critical levels in early 2015. In fact, imports from Slovakia are crucial, as even with 20% demand reduction and 12 mcm/d of reverse flows– the maximum capacity from Hungary and Poland – storages will fall below critical levels in the second half of February (see Figure 8 in the Annex).

Finding an agreement with Russia on resuming imports when the storages are already depleted is probably too late as even with 'normal' winter-imports from Russia, Ukraine has to draw on its storages. Consequently, to avoid a shortfall of gas, Ukraine might have to resume imports from Russia some time before the storage would run empty. In the following we estimate the date, at which gas imports in the order of 100 mcm/d would need to resume in the six scenarios.

Figure 7

Simulation results with additional imports of 100 mcm/d starting at the latest day to ensure supply adequacy



Source: own calculations

Table 4

Simulation Results – When would Ukraine need to resume importing 100 mcm/d from Russia to get over the winter?

	0% demand reduction	**20% demand reduction**
No reverse flows (0 mcm/d)	09.11.2014	25.01.2015
100% from HU and PL and 50% of interruptible capacity from SK (25.3 mcm/d - 38.3 mcm/d)	19.01.2015	No need for Russian gas
100% from HU, PL and SK (38.3 mcm/d)	29.01.2015	No need for Russian gas

Source: own calculations

According to our simulations sufficient reverse flows will allow Ukraine to not being required to import Russian gas before the second half of January 2015[8].

[8] This shifts to the first half of 2015 in case only 80 mcm/d can be imported (see Annex).

4. Limits of our scenario analysis

The presented results are based on many simplifying assumptions, some of which might distort the outcome. The simulation completely ignores inner-monthly dynamics. That is, we assume that production, consumption and imports are flat during a given month. Thus, we do not properly address the seasonality of demand (e.g., stronger demand at the end of December than at the beginning of December) and weekly patterns (e.g., higher demand on working days). Consequently, the presented dates should be interpreted as rough illustrations, not precise calendar days.

Due to a lack of appropriate data we cannot properly address the dynamics of Ukrainian storage facilities. Thus, we assume that at all storage levels, the desired storage volumes can be withdrawn. It might, however, be the case that when storage volumes run very low, the withdraw rates from the storages collapse and stored gas cannot be made available in the required volumes. For example, in Scenario 1 about 180 mcm/d need to be withdrawn from the storages in January 2015 while the storage levels are close to the critical level. We partly compensate for this effect by assuming a critical storage level significantly larger than 0 and assuming that Ukrtransgas will optimise the usage of the eight major storage facilities (>1000 mcm) so as to have enough storage pressure in individual facilities in critical situations.

The period of analysis is winter 2014/2015. That is, even if Ukraine manages to get over the winter without interruption of supply it might have too little gas in storage to manage the winter 2015/16 without Russian imports. We also highlight the short-term nature of our analysis as gas reverse flows are not particularly economic (shipping gas through Ukraine to Slovakia and back involves transportation and transaction cost). Hence, a corresponding scheme is not the most desirable long term solution.

5. Conclusions

Conclusion 1: In some scenarios Ukraine is able to secure enough gas for the winter, while in other scenarios this is not the case. Thus: No clear answer if Ukraine will be able to get over the winter or not. It depends on two key variables, gas consumption and amount of reverse flows.

Conclusion 2: Both variables are key for getting over the winter. Thus, Ukraine is right to tackle both the demand and supply side.

Conclusion 3: The planned reverse flows from Slovakia are crucial. A 20% demand reduction and full reverse flows from Poland and Hungary are insufficient for getting Ukraine over the winter.

Conclusion 4: Since reduction of gas consumption is well underway and some reverse flows are taking place, Scenario 5 is not an unrealistic prospect. If this scenario materialises, Ukraine would be able to get over the winter without Russian gas.

Conclusion 5: An interruption in gas transits to the west would reduce the ability and willingness of the western neighbours to provide natural gas (reverse flows) and is thus not in the interest of Ukraine.

Conclusion 6: If Ukraine fails to secure enough reverse flows and/or reduce consumption sufficiently, it would need to import additional 100 million cubic meters per day starting at latest in the second half of January 2015.

6. Annex

Figure 8

Simulation results with 20% demand reduction and **12.3 mcm/d reverse flows**

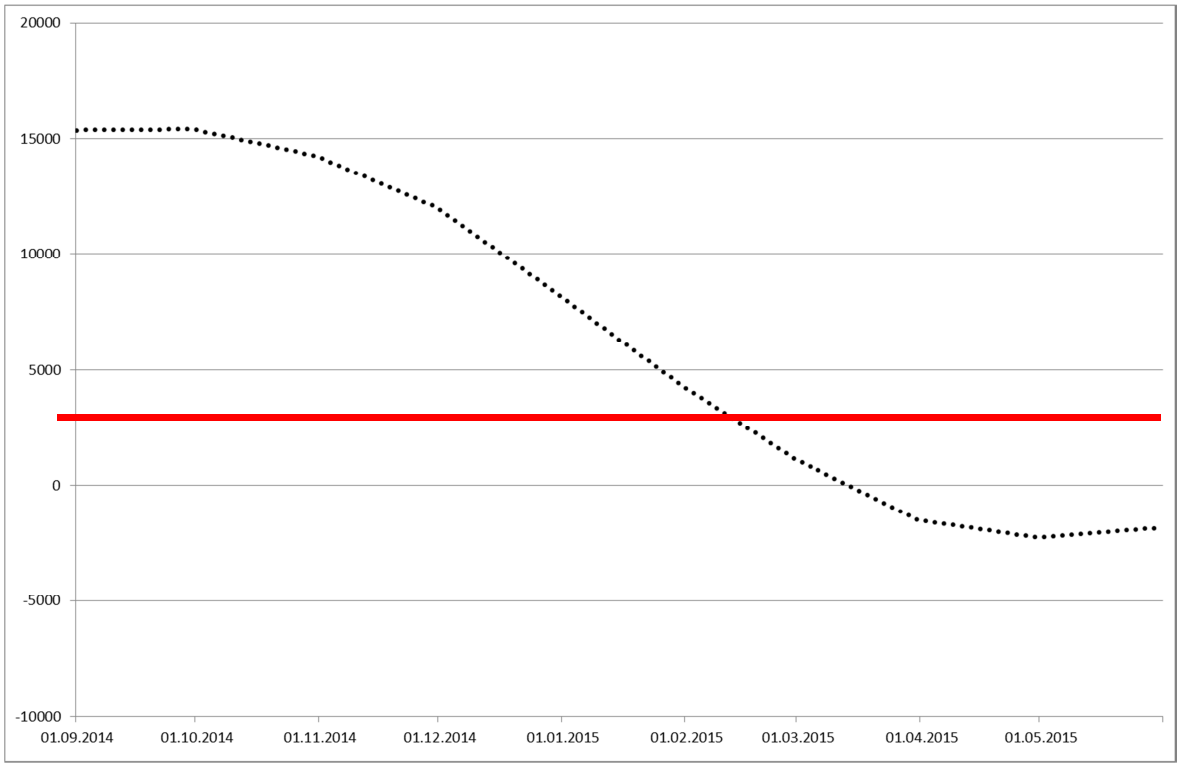


Figure 9

Simulation results with **30% demand reduction** in scenario 4, 5 and 6

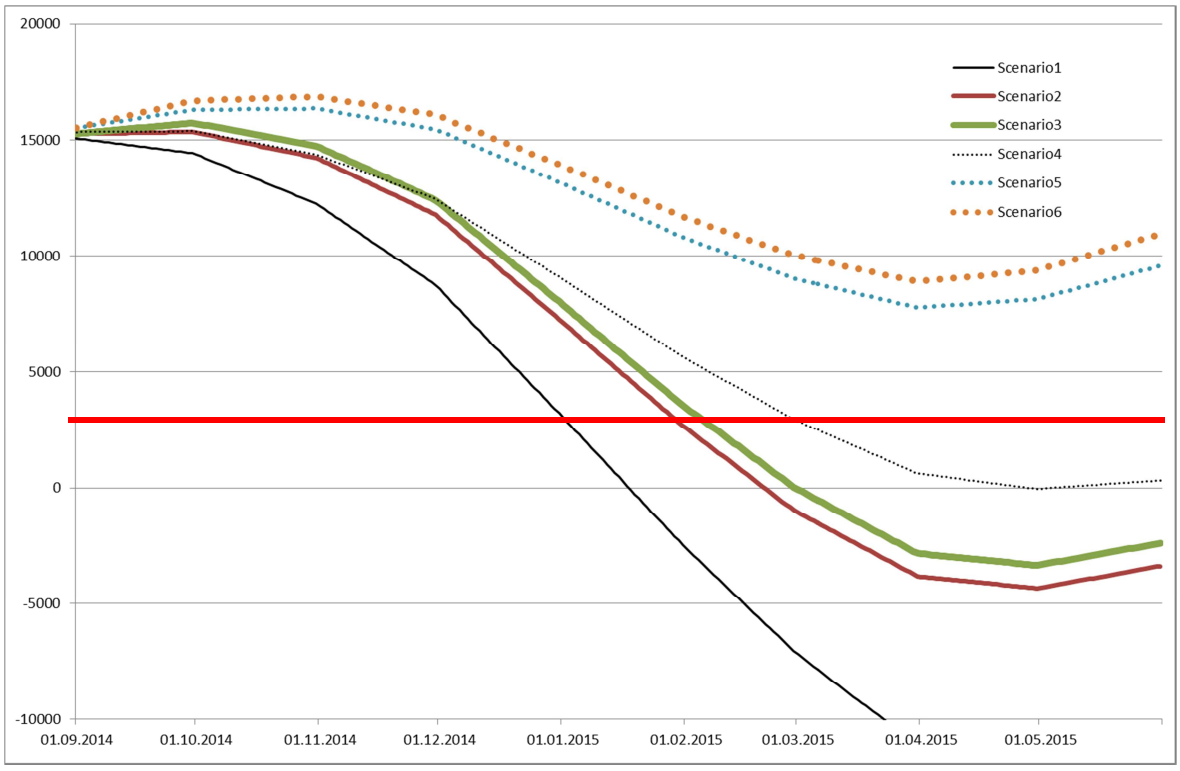


Figure 10

Simulation results with **10% demand reduction** in scenario 4, 5 and 6

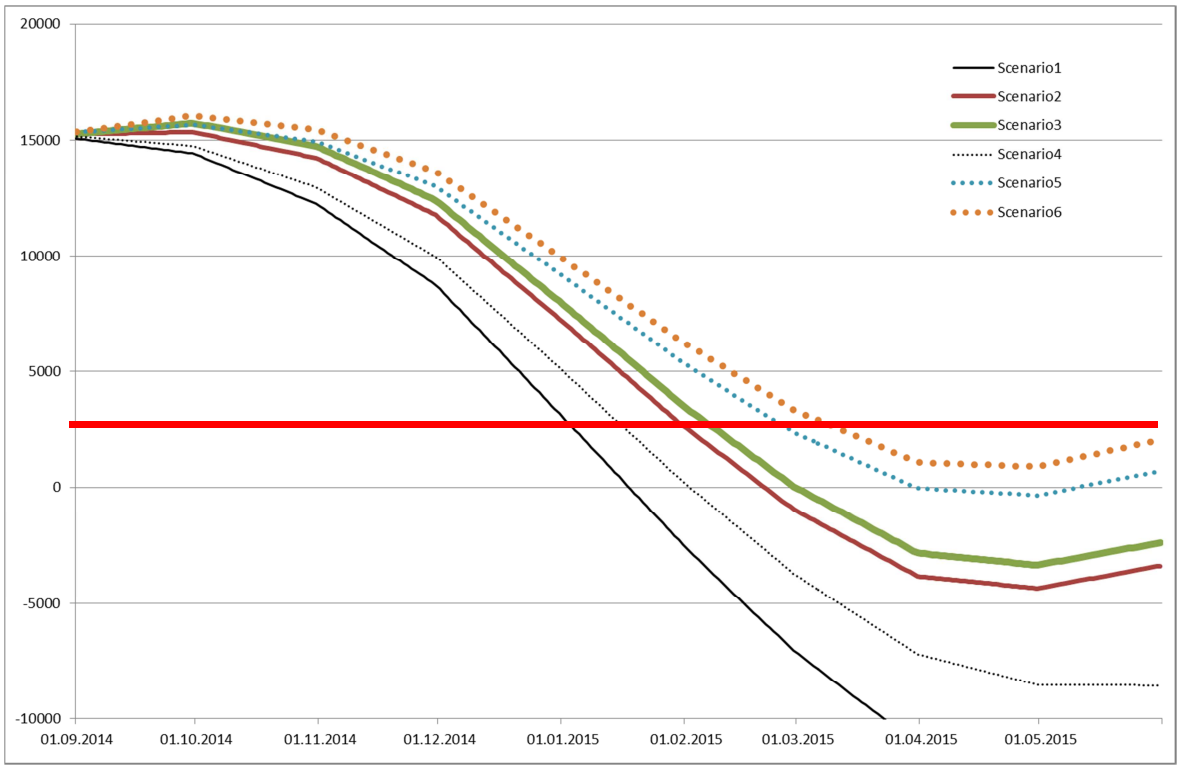


Table 5

Simulation Results – When would Ukraine need to resume importing **80 mcm/d** from Russia to get over the winter?

	0% demand reduction	**20% demand reduction**
No reverse flows (0 mcm/d)	05.10.2014	11.01.2015
100% from HU and PL and 50% of interruptible capacity from SK (25.3 mcm/d - 38.3 mcm/d)	04.01.2015	No need for Russian gas
100% from HU, PL and SK (38.3 mcm/d)	17.01.2015	No need for Russian gas

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