ANNEX 5: Common Risk Assessment – South-East Risk Group – Southern Corridor – Caspian

Member States

The Caspian Risk Group is composed of: Austria, Bulgaria, Croatia, Greece, Hungary, Italy, Malta, Romania, Slovakia and Slovenia.

Gas Storage Capacity in Member States

	Working gas volume in TWh	**Share of capacity in risk group in %**
AT	97,64	22,01%
BG	5,89	1,33%
EL	0,00	0,00%
HR	4,77	1,08%
HU	67,70	15,26%
IT	195,20	44,00%
MT	0,00	0,00%
RO	33,86	7,63%
SI	0,00	0,00%
SK	38,55	8,69%
Total	**443,62**	**100,00%**

Source: AGSI+, 16.08.2023

Summary of the Common Risk Assessment

The identification of a single main geopolitical risk source (the halt to Russian gas supplies to EU) is the unprecedented geopolitical factor that has been the focus of the work of various Risk Groups (RGs), as the most severe and likely event that can affect the EU gas network. The practice of assessing risks, in the framework of the Regulation (EU) 2017/1938 on security of gas supply, typically analysed RG specific events and sources of risk, identified and modelled with the highest possible accuracy, with limited geographical coverage. The current circumstances have suggested to expand the geographical coverage to provide a common set of boundary conditions for the quantitative analyses.

The JRC, after agreement with the respective RG coordinators, has conducted modelling simulations on a risk scenario, namely a prolonged halt of all the Russian gas deliveries to the EU, from 1 October 2022 onwards. This Pan-European risk scenario is of high impact and high probability compared to other potential risk scenarios. Thus, the JRC has analysed a number of variants (48 simulations) in order to account for (i) two crisis management strategies (non-cooperative vs. cooperative), (ii) uncertainty on gas consumption profiles (historical consumption from 2015 until 2021), (iii) underground gas storage boundary conditions leading to two different storage management strategies (short-term vs. long-term security of supply), and (iv) two capacity maps for interconnection points between neighbouring countries (business-as-usual vs. maximum flows under crisis condition given by some Member States).

Additionally, a series of sensitivity analyses has been performed:

- The proposed Regulation (EU) 2022/1369 sets a target for all Member States (MSs) to reduce gas demand by 15% between 1 August 2022 and 31 March 2023. The new Regulation would also give the Commission the possibility to declare, after consulting MSs, a 'Union Alert' on security of supply, imposing a mandatory gas demand reduction on all MSs. Along these lines, 36 additional scenarios have been simulated by decreasing the demand along the optimisation horizon by 5%, 10% and 15%. These reductions are kept even after the winter 2022-2023.
- The report has also introduced additional risk events not connected with Russian supply, of interest for the different RGs. Seven risk events have been examined on top of the total disruption of Russian gas supplies, namely (i) total disruption of Algeria's gas supplies for two months, (ii) partial disruption of the Transmed pipeline for five months, (iii) total disruption of Europipe 2 arriving in Dornum (partial disruption of Norwegian gas flows) for two months, (iv) total disruption of Csanádpalota interconnector connecting Hungary and Romania for one month, (v) total disruption of Stenlille gas storage (no withdrawal) for two weeks, (vi) a two-week cold spell in the EU, and (vii) total disruption of the Azeri route for two months. In total, 84 simulations have been run to analyse all these risk events.

This addendum provides the results from the modelling exercise conducted by the JRC for the RG Caspian. The main conclusions are as follows:

- The non-cooperative context when assuming a short-term storage management strategy (i.e. storages could be used as much as possible during winter 2022-2023) leads to 5 bcm of

unserved gas in the RG on average, however it varies between 0 and 10 bcm depending on the demand scenario. In relative terms, gas curtailment is around 50% on average over the winter in Slovenia and Bulgaria, 30% in Slovakia and Hungary, and below 7% in Romania and Croatia. No curtailments are observed in Italia, Austria and Greece under those modelling conditions.

- The cooperative approach decreases the curtailment to 3.5 bcm when assuming a short-term storage management strategy. Under these conditions, the unserved demand in the worst-case demand variant is around 5 bcm. In absolute terms, average curtailments are kept below 1 bcm (less than 20% of the corresponding gas demand) for all countries belonging to the RG.
- Assuming a long-term storage management strategy prevents the exhaustion of storages during the upcoming winter. As a consequence, the average curtailment in the RG increases to 19.5 bcm under a non-cooperative approach and to 12.2 bcm under a cooperative one. However, the maximum curtailment achieved under a non-cooperative strategy is close to 25 bcm, much higher than under a cooperative one (around 15 bcm). In absolute terms, the highest curtailment is identified in Italy (6.5 bcm on average over the winter) followed by the remaining countries of the RG with less than 1.5 bcm on average in the cooperative context. In relative terms, unserved gas demand is kept below 20% for all countries belonging to the RG, being lower in Italy (15%) and Greece (6%). In contrast, in the non-cooperative counterpart, curtailments achieve more than 70% of the corresponding demand in Slovenia, Slovakia, Hungary, Austria, and Bulgaria, 19% in Romania, and curtailments below 10% in Italy, Croatia and Greece.
- Peak gas curtailment is around 80 mcm/d (20% of its peak demand) in Italy in the cooperative contexts, regardless of the storage boundary conditions. However, in a non-cooperative strategy, this peak may increase to 160 mcm/d (around 40%). In general, the remaining countries keep their peak curtailments below 55 mcm/d in absolute terms. However, in relative terms, we identify curtailments up to 98% in Slovenia or 84% in Slovakia when using a non-cooperative strategy. It should be noted that this peak curtailment is the one happening in the worst-case demand scenario with a probability of 1/6.
- Greece, Croatia and Italy are the only countries in the RG with access to LNG facilities. LNG send-out flows are kept around 10-12 bcm over the winter regardless of the assumptions. The LNG send-out utilisation over winter in these three countries increases when resorting to cooperation mechanisms compared to the ones under a non-cooperative management strategy in order to keep gas curtailment in Central and Eastern European countries under a certain threshold (i.e. 20%).
- All countries in this RG except Greece and Slovenia have underground gas storage facilities. When assuming a short-term storage management strategy, the aggregated filling level at the beginning of the heating season is slightly higher than 80%, and the storages are depleted over the winter thus arriving at 10% on 1 April 2023 on average. There are demand scenarios in which storages are exhausted and other scenarios in which filling level is kept just below 20% (cooperative strategy). Long-term storage management leads to higher curtailments, as stated previously, in order to prevent the use of gas in storage. In this case, the average filling level is kept around 40% on average on 1 April 2023 (cooperative strategy). There is a wide range of possible filling levels at the end of the heating season depending on the demand scenarios,

thus arriving at either just below 50% or around 35%. A non-cooperative strategy may lead to higher filling levels at the end of the winter.

- Cooperation implies more intense use of transmission capacities. Per se, interconnection transmission capacities do not affect substantially the impact on curtailment. Moreover, it can be seen that higher flows go to countries with storages when assuming a long-term security of supply perspective.
- Regarding the sensitivity analysis on demand reduction, it can be concluded that 5% reduction over the winter is enough to mitigate completely gas curtailments when storages could be used as much as possible during winter. However, if security of gas supply in the long-term (next winter) were prioritised, the needed demand reduction would be 15%. Note that this reduction factor has been applied throughout the simulation horizon.
- Regarding the additional risk events, the total interruption of Algerian gas supplies for two months is the event leading to the worst gas curtailment (6.6 bcm on average for the RG). There is a probability of 1/6 that the cold spell causes unserved gas demand up to 10 bcm over the winter (10.7% of the worst-case gas demand variant in the RG), but there is another probability of 1/6 to have a milder winter without any curtailment. The partial disruption of Transmed pipeline for five months can also cause higher curtailments than the ones led by the baseline scenario, thus resulting in 5.5 bcm on average (or 9 bcm in the worst-case demand scenario). A two-week cold spell could also impact on the unserved gas demand in this RG (4.7 bcm on average). The total disruption of the Azeri route for two months could result a curtailment of 4.1 bcm on average (and 6 bcm in case of the highest demand taken into account) in the RG Caspian. The remaining risk events do not affect substantially to the RG compared to the baseline scenario.

Description of the System

Bulgaria

The total length of the gas transmission infrastructure in Bulgaria is 3.531 km. Two gas transmission operators are certified and operating on the territory of the Republic of Bulgaria - "Bulgartransgaz" EAD and "ICGB" AD. Bulgartransgaz's gas transmission network infrastructure mainly consists of 3.380 km of gas pipelines and gas pipeline branches, eleven compressor stations and underground gas storage facility in Chiren (Chiren UGS). The gas transmission infrastructure of IGB consists of 182,6 km gas pipeline of which 151 km on Bulgarian territory. The gas transmission network of Bulgartransgaz has interconnection points (IPs) with gas transmission networks of TSOs from all neighboring countries. The main entry and exit points of Bulgartransgaz's gas transmission network are the following: IP point Negru Voda / Kardam and IP Ruse / Giurgiu (with Romania), IP Kulata / Sidirokastro (with Greece), IP Stara Zagora-(with ICGB), IP Kyustendil/ Zidilovo (with North Macedonia), IP Strandzha / Malkoclar and IP Strandzha 2/Malkoclar (with Turkey) and IP Kireevo / Zaychar and IP Kalotina / Dimitrovgrad - available after commissioning of IBS project (with Serbia). There are also entry points in the transmission system from local production (GMS Dolni Dabnik) and coastal production (GMS Galata), as well as one entry-exit point GMS Chiren.

Gas is currently a very important component of the country's energy mix. It is primarily utilized by the industrial and district heating sectors and less in the residential and commercial sectors. The natural gas has a potential for a significant and steady growth in country's energy balance considering the evolving gasification and the natural gas role as a transition fuel for a low carbon economy.

Bulgaria's natural gas consumption generally varies between 2.9-3.4 bcm per year. However, the country has an extensive network of gas pipelines that serve Bulgaria's needs as well as those of neighbouring countries. The quantities of natural gas transported through Bulgartransgaz infrastructure in Bulgaria meet 100% of the consumption in North Macedonia and significant part of the consumption in Greece and Serbia.

Due to the lack of significant quantities of domestic production, the natural gas demand for natural gas in the country is met by imports from neighboring countries. Gas quantities from alternative sources for consumption in Bulgaria marked a significant increase in 2022 compared to 2021.

The gas interconnector Greece-Bulgaria (IGB) was put into commercial operation on 1 October 2022. The interconnector IGB connects the natural gas transmission network of Greece near the town of Komotini with the Bulgarian transmission network near the town of Stara Zagora, including approximately 31km running through Greece and 151km through Bulgaria. As part of the development of the Southern Gas Corridor, through IGB Bulgaria and its neighbouring countries will have access to alternative supplies from the Caspian region as well as from existing or planned LNG terminals. The interconnector Greece-Bulgaria along with the existing infrastructure owned by Bulgartransgaz play a key role in meeting Bulgaria's objectives of diversifying energy sources, energy security and independence. By implementation of the projects for new gas infrastructure in the country and the region, a significant increase in natural gas quantities from alternative sources is expected, to be transported through Bulgartransgaz EAD gas transmission infrastructure both, for Bulgaria and the countries of the region. Chiren UGS has a technical volume of 550 million cubic meters (1300 MSm3 of

total gas volume minus 750 MSm3of cushion gas). To enhance the security of natural gas supply, the storage operator is working on a project to expand its capacity. It is planned to reach up to 1 billion cubic metres after the project is completed.

In 2021 natural gas consumption amounted to 3,4 bcm, against a domestic production of 0,7% of annual consumption; total storage capacity amount to 5,81 TWh. In 2022 natural gas consumption amounted to 2,65 bcm, against a domestic production of 0,38% of annual consumption; total storage capacity amount to 5,81 TWh.

	2021			**2022**		
	Real Data			**Real Data**		
	Protected customers		Non Protected Customers	Protected Customers		Non Protected customers
	Protected customers of solidarity	Rest		Protected customers of solidarity	Rest	
Gas consumption (bcm)	**3,4**			**2,65**		
Industrial	0.14		1.37	0.12		0.83
Electricity generation	0.04	0.21	0.45	0.04	0.22	0.39
District heating	0.075	0.13	0.67	0.07	0.16	0.52
Residential	0.095		0	0.1		0
Other	0.02		0.2	0.02		0.18
Peak demand (mcm/d)	**15,33 / 15.02.2021**			**14,38 / 24.01.2022**		
Industrial	0.7		6.38	0.68	0	6
Electricity generation	0.75	0.48	1.7	0.73	0.47	1.5
District heating	0.2	0.83	2.35	0.2	0.81	2.1
Residential	0.7		0	0.7	0	0
Other	0.5		0.74	0.5	0	0.69

Table 1: Gas consumption and peak demand of Bulgaria


Balanceanca
Ghercesti
Constanța
Zaychar
Giurgiu
Ruse
Silistra
Kardam
Negru Voda
Kireevo
Chiren
Razgrad
Dobrich
Pleven
Valchi Dol
Montana
Shumen
Vetrino
Niš
IBS
Vratsa
Lovech
Targovishte
Provadia
Varna
KAVARNA
Veliko Tarnovo
GALATA
KALIAKRA
Dimitrovgrad
IBS
Botevgrad
Gabrovo
Rupcha
Novi Iskar
Pernik
SOFIA
BULGARIA
Lozenets
Burgas
Stara Zagora
Yambol
Kyustendil
Ihtiman
Gueshevo
Pazardzhik
Zidilovo
Blagoevgrad
Plovdiv
Dimitrovgrad
Strandzha
Malkoclar
Smitli
Bansko
Kardzhali
Edirne
Kirklareli
Shtip
Smolyan
IGB
Negotino
Petrich
Kulata
Kıyıköy
Sidirokastron
Karperi
Kipi
Gevgelija
Xanthi
Istanbul
Evzoni
Lachanas
POSEIDON
Komotini
Tekirdağ
Marmara Ereglisi
Silivri (Marmara)
Nea Mesimvria
Serres
Kavala
Alexandroupolis
TANAP
Plati
Thessaloniki
Yalova
South Kavala

Croatia

Croatian gas transmission network has a total length of 2.694 km of transportation pipelines. The natural gas transmission network has cross-border interconnections with Slovenia (Rogatec) and Hungary (Drávaszerdahely) usually utilised to import gas. There are also 7 entry points from production plants and one interconnection with the underground storage facility of Okoli.

The upstream pipelines in the Adriatic Sea are used to export Croatian natural gas from the production platforms to Italy. Panon gas fields are connected by upstream pipelines to the transmission network and to the underground gas storage facility at the Okoli site.

The Okoli gas storage infrastructure (553 million cubic meters) is located at Okoli, it is part of the Underground Gas Station d.o.o..

In 2020 Croatia completed the construction of the LNG terminal on the island of Krk, with a storage capacity from up to 265.000 m3 of LNG; nominal regasification capacity of 8 billion m3 of gas per year.

There were 33 companies for natural gas distribution in the Republic of Croatia in 2020. In total, the gas distribution network in Croatia is 18,429 km long. In 2021 natural gas consumption amounted to 31,70 TWh, against a domestic production of 8,08 TWh; total storage capacity amount to 5,22 TWh.

Table 2: Inland gas consumption of Croatia

	2017	**2018**	**2019**	**2020**
	Real data	**Real data**	**Real data**	**Real data**
Inland Gas consumption (TWh)	32.22	29.62	31.09	32.63
Industrial	10.28	9.52	10.53	10.15
Electricity - CHP	8.86	6.92	7.58	9.34
Heating	0.59	0.58	0.55	0.57
Residential	6.19	6.04	5.93	6.28
Commercial and public services	2.48	2.61	2.70	2.53
Transport	0.05	0.05	0.05	0.04
Other	3.77	3.90	3.75	3,73

Historical data on Croatian inland gas consumption and its composition (2017-2020)


HUNGARY
SLOVENIA
LJUBLJANA
ZAGREB
CROATIA
BOSNIA
AND
HERZEGOVINA
SARAJEVO
MONTENEGRO
PODGORICA
Adriatic S
Weitendorf
Murfeld
Klagenfurt
Arnoldstein
Tarvisio
Cersak
Tornyiszentmiklos
Pince
Nagykanizsa
Kidricevo
Rogatec
Zabok
Kozármisleny
Kiskundorozsma
Subotica
Udine
Gorizia
Ajdovščina
Sempeter
Lučko
Drávaszerdahely
Sombor
Donji Miholac
Osijek
Trieste
Koper
Umag
Karlovac
Zlobin
Rijeka
Bosiljevo
Sotin
Bačko Novo Sel
Novi Sa
Porto Levante
Cavarzere
Omišalj
Krk LNG
Vrl. Kladusa
Trzac
Cazin
Slobodnica
Brod
Modrica
Vodnjan
Pula
Licka Jasenica
Rakovica
Bos. Krupa
Banja Luka
Bihac
Gospic
Loznica
Zvornik
Travnik
Zenica
Zadar
Knin
G.Vakuf
Benkovac
Kiseljac
Ancona
Split
Imotski
Posusje
San Marco
Recanati
Zagvozd
Mostar
Monte Urano
Ploce
Cellino
L'Aquila
Chieti
ADRIATIC PIPELINE
IAP
MGP

Greece

The National Natural Gas System (NNGS) transports natural gas from the Greek-Bulgarian and Greek-Turkish borders, the Trans Adriatic Pipeline (TAP) as well as from the Liquefied Natural Gas (LNG) terminal located on the island of Revithoussa in the Megara bay, to consumers in the continental Greece.

The network has four entry points: three at the north and north-eastern borders, Sidirokastro, Nea Mesimbria and Kipi, connecting Greece with the Bulgarian and Turkish gas networks, and one in southern Greece, Agia Triada, linked to the LNG terminal.

The Greek NG system consists of:

- gas transmission network of 953.204 km;
- the border metering stations at Sidirokastro, near Serres, and at Kipi, near Evros river as well as the metering station at Agia Triada (related to the LNG terminal);
- the LNG terminal at Revithoussa;
- the Compression Station at Nea Messimvria, Thessaloniki;
- the Control and Dispatching Centers at Patima Elefsinas and at Nea Messimvria, near Thessaloniki;
- 6 Operation & Maintenance Centers of Sidirokastro, Eastern Greece, Northern Greece, Central Greece, Southern Greece and the Peloponesse;
- 2 offshore pipelines each with diameter of 24 inches and length 620 m and 630 m, connecting the Revithoussa LNG Station to the NNGTS.

The three pipeline entry points have a total capacity of 171 GWh/d. The Greek-Turkish interconnector at Kipi brings gas mainly from the Middle East and the Caspian region into Greece. The interconnector with Bulgaria (Sidirokastro) allows gas flows from the Russian Federation via Turkish Steam-Bulgaria. The interconnector at Nea Mesimbria brings gas from Azerbaijan through Turkey.

The biggest natural gas infrastructure of Greece is the LNG terminal located at Revithoussa island. The terminal has a maximum send out capacity of 224.59 GWh/d and a storage capacity of 225.000 m3.

The upgrade of the terminal of Revithoussa Station has been completed at the end of 2018. The project includes:

- The construction of a 3rd LNG tank of 95,055 m3
- The upgrading of gasification rate (from 150,000 MWh/d to 224,593 MWh/d)
- The increase of the gasification capacity to 1,400 m3 LNG/h from 1,000 m3 LNG/h
- The upgrading of marine environment to accommodate larger ships (allowing the reception of LNG carriers with a capacity of up to 260,000 m3 from 140,000 m3)
- The upgrading of Agia Triada metering station

In 2021 natural gas consumption amounted to 69,96 TWh. In 2022, consumption dropped to 56,64TWh.

Table 3: Gas consumption and peak demand of Greece

	2021			2022		
	Real Data			Real Data*		
	Protected customers		Non Protected Customers	Protected Customers		Non Protected customers
	Protected customers of solidarity	Rest		Protected customers of solidarity	Rest	
Gas consumption (bcm)	**6,08**			**5,34****		
Industrial		0,15	1,08		0,14	0,24
Electricity generation			4,19			3,59
District heating	0,02			0,01		
Residential	0,55			0,56		
Other	0,09			0,09		
Peak demand (mcm/d)	**27,08** / 18.01.2021			**26** / 27.01.2022		
Industrial		NA	NA		NA	1,26
Electricity generation	NA		NA	NA		16,4
District heating	NA			NA		
Residential	NA			NA		
Other	NA			NA		

* *bcm, at reference conditions {1.01325 bara; 0°C}*

** *It refers to physical off-takes*

Hungary

Hungary, being a landlocked country, has a well developed domestic natural gas system considering the limited options to diversify natural gas supply. 85% of the Hungarian gas demand is secured from import sources.

Hungarian gas transmission network has a total length of 5.889 km of transportation pipelines. The natural gas transmission network has cross-border interconnections with Ukraine (Beregdaróc), with Slovakia (Balassagyarmat), with Austria (Mosonmagyaróvar)[1], with Croatia (Drávaszerdahely), with Romania (Csanádpalota) and with Serbia (Kiskundorozsma). Thus, the Hungarian natural gas system is connected to all of the adjacent networks except for Slovenia.

Hungary has developed gas interconnectors with six out of seven neighbours (except for Slovenia).

The potential supply routes are thus well diversified. The Krk LNG terminal in Croatia ensures access to the global LNG market.

The 2 pipeline interconnections with Ukraine have been operating as a single virtual interconnection point since 1 May 2020, where the clearing of inbound and outbound deliveries is netted.

With the commissioning of a new Hungarian-Serbian interconnector (Kiskundorozsma 2) on 1 October 2021, Hungary is able to receive and transport a significant amount of natural gas (up to 8.5 bcm per year) from Serbia.

Natural gas plays an important role in the electricity generation with a share of around 25% and it is forecasted to remain a crucial energy carrier also in the coming years. In 2021 36% of the natural gas was consumed by the households, 27% by power generation, 16% by the industry and 15% by other sectors (e.g. services, agriculture, transport) respectively and 6% was consumed for non-energy purposes.

In 2021 natural gas consumption amounted to 117.83 TWh against a domestic production of 13.36 TWh; total storage capacity amount to 69.4 TWh (5 storage sites combined).

In 2021 natural gas consumption amounted to 117.83 TWh against a domestic production of 13.36 TWh. Hungary has expanded its natural gas storage capacity, with five commercial and one strategic underground gas storage facility (total storage capacity amount to 69.4 TWh (5 storage sites combined).

[1] The Austrian interconnection is physically unidirectional towards Hungary. Commercially it is a bidirectional interconnection point.

Table 4: Inland Gas consumption of Hungary

Historical data on Hungarian inland gas consumption and its composition (2017-2020)

	2017	2018	2019	2020	2021	2022
	Real data	Real data	Real data	Real data	Real data	Real data
Inland Gas consumption (TWh)	**110,44**	**106,97**	**109,44**	**113,32**	**120,17**	**100,02**
Industrial	24,80	24,80	24,49	24,85	25,74	
Electricity - CHP	19,36	17,92	20,88	21,97	23,48	
Heating	7,10	6,72	6,43	6,60	6,74	
Residential	38,40	36,58	36,09	39,11	43,02	
Commercial and public services	15,12	14,25	13,69	13,73	14,37	
Transport	0,85	1,01	1,07	0,79	0,44	
Other	4,80	5,71	6,79	6,27	6,38	

Italy

Italian gas transmission network extends for more than 32.000 km. Snam Rete Gas (SRG), part of the Snam Group, is Italy's main gas Transmission System Operator (TSO). SRG operates a nationwide pipeline network and supplies around 95% of the Italian market. All pipelines have reverse flow capability.

The national network has cross-border interconnection points with Austria (Tarvisio/Arnoldstein), Slovenia (Gorizia/Sempeter) and with Switzerland (Griess Pass). Italy is also supplied through three offshore interconnectors: Transmed (with Tunisia and Algeria – entry point in Mazara del Vallo), Greenstream (Libya – entry point in Gela) and Trans Adriatic Pipeline (Azeri gas from Caspian Sea Region to Italy at Melendugno entry point). There are four entry points from the regasification terminals (Panigaglia, Livorno, Cavarzere and the newly operational Piombino), as well as another new point under construction in Ravenna, where the FSRU BW Singapore is expected to moor and become operational within the beginning of 2024 .There are also twelve entry exit point from storage plants. Stogit, controlled by Snam, is the most significant operator of natural gas storage in Italy. Local production shows a historical decreasing trend due to the decline of domestic sources, not sufficiently offset by new production developments.

Natural gas is a critical energy source, accounting for almost half of electricity generation. It will continue to play a central role in power generation in the coming decade, particularly as coal-fired capacity is being phased out. Currently nearly 44% of gas consumption comes from the distribution network demand, 38% from power generation demand and 18% from the industrial demand.

In 2022 natural gas consumption amounted to 724,49 TWh, against a domestic production of 35,05 TWh; total storage capacity amount to 197,52 TWh.

Table 5: Inland gas consumption of Italy

	2017	2018	2019	2020
	Real data	Real data	Real data	Real data
Inland Gas consumption (TWh)	795.44	769.34	788.13	754.24
Industrial	123.10	119.73	118.67	112.87
Electricity - CHP	322.88	298.65	325.38	309.54
Heating	3.19	3.54	3.34	3.50
Residential	223.05	213.21	208.39	205.88
Commercial and public services	85.16	93.69	91.57	86.45
Transport	13.75	14.13	14.83	12.50
Other	24.32	26.41	25.95	23.50

Historical data on Italian inland gas consumption and its composition (2017-2020)


SWITZERLAND
HUNGARY
SLOVENIA
LJUBLJANA
ZAGREB
ITALY
CROATIA
BOSNIA AND HERZEGOVINA
SARAJEVO
MONTENEGR
PODGORICA
CORSICA
SARDINIA
ROME
TUNIS
Ligurian Sea
Tyrrhenian Sea
Adriatic Sea
Ionian Sea
TRANSMED
TARBONCA PIPELINE
POSEIDON
IAP
ADRIATIC PIPELINE
MELITA TRANSGAS
OLT Offshore LNG Toscana
PSV
MGP

Malta

Natural gas in Malta is used solely for the generation of electricity and currently constitutes the largest share of Malta's electricity generation mix (around 86%). The only source of natural gas in Malta is imported LNG. Malta does not have gas distribution networks or any district heating networks and there are no end-use gas customers apart from two electricity producers at the Delimara Power Station. Currently, Malta does not form part of the EU internal gas market as it is not interconnected via a gas pipeline.

Malta's gas infrastructure consists of an LNG facility with import and offloading capability; a Floating Storage Unit (FSU); LNG jetty, pipework and other services; and a regasification facility with ancillary services. The regasification facility provides natural gas to two centrally dispatched electricity generation units. All gas infrastructure is within the Delimara Power Station complex.

Should Malta become interconnected via a gas pipeline, the risk to Malta in the context of regional risk groups would change and the risk to gas security of supply would need to be reassessed[2].

LNG Facilities

In January 2017, Malta began its gas supply thanks to the new floating storage unit and regasification facility at Delimara, which supplies gas to two electricity producers. The terminal has a total LNG storage capacity of 125,000 m3 and a maximum send-out capacity of 165 GWh/d. Since the beginning of its operation in 2017, the Delimara LNG terminal has not received gas from Southern Gas Corridor - Caspian, so that it would not be directly affected by a hypothetical curtailment in gas from the Caspian Sea region. Up till now, Malta has purchased LNG from the following countries of origin:

- Netherlands
- USA
- Equatorial Guinea
- Egypt
- Trinidad & Tobago
- Peru
- Norway
- Nigeria

From 2017 to 2021, from a regional perspective Malta has sourced its LNG primarily from South America (69%), followed by the United States (16%), Africa (14%) and then Europe (1%).

Transport Network, Compression Stations, Underground Storage

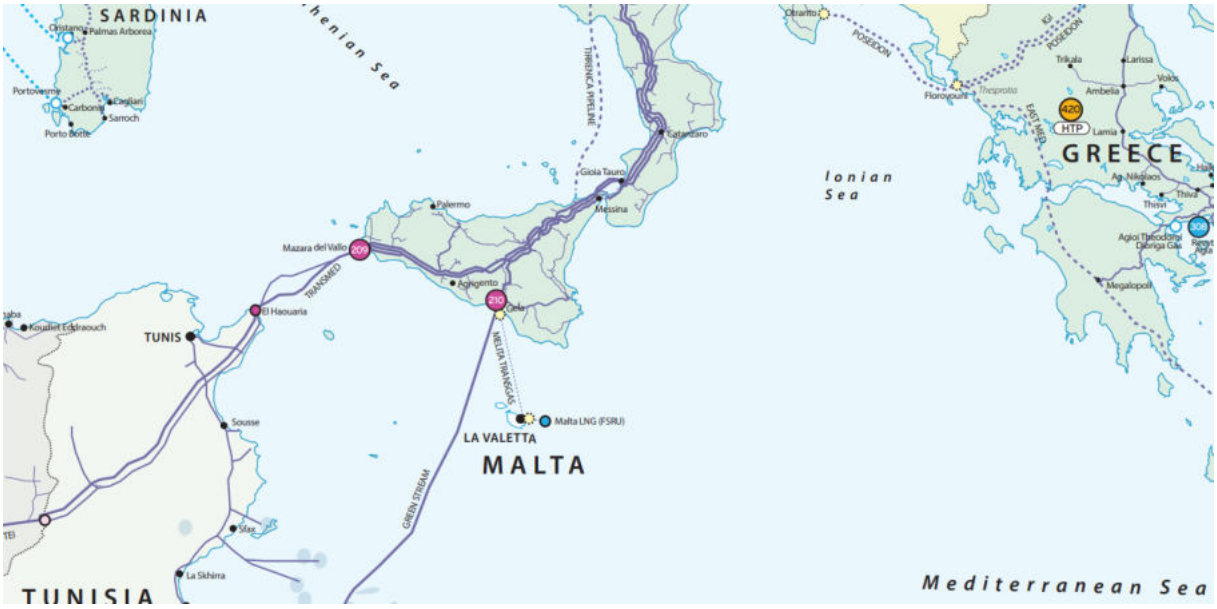
N/A

[2] In the JRC model Malta was not included because of the lack of interconnected gas transmission network and features of METIS software applied.

Table 6: Inland gas consumption of Malta

	2017	2018	2019	2020	2021
	Real data	**Real data**	**Real data**	**Real data**	**Real data**
Inland Gas consumption (TWh)	3.12	3.79	3.96	4.11	4.12
Industrial	0.00	0.00	0.00	0.00	0.00
Electricity - CHP	2.99	3.78	3.95	4.11	4.10
Heating	0.00	0.00	0.00	0.00	0.00
Residential	0.00	0.00	0.00	0.00	0.00
Commercial and public services	0.00	0.00	0.00	0.00	0.00
Transport	0.00	0.00	0.00	0.00	0.00
Other	0.13	0.01	0.01	0.00	0.02

Historical data on Maltese inland gas consumption and its composition (2017-2021)



Romania

The National Transmission System (NTS) was conceived as an interconnected radial-ring system, being developed around and starting with the large natural gas deposits in Transylvania Basin, Oltenia and then East Muntenia (south of the country). Destined were the large consumers in the Ploiesti area - Bucharest, Moldova, Oltenia, as well as the central (Transylvania) and northern parts of the country.

Subsequently, natural gas flows have undergone significant changes due to the decline of sources in the Transylvanian Basin, Moldova, Oltenia and the emergence of other sources (imports, OMV-Petrom, concessions made by third parties, etc.), given that the natural gas transmission infrastructure remained same.

The main components of the National Gas Transmission System as of 31.12.2021:

- 14,209.55 km main transport pipelines and natural gas supply connections, out of which 183.5 km international natural gas pipelines (T3);
- 1141 measuring stations for measuring natural gas (SRM) - (1,237 247 measuring directions);
- 58 valve control stations (SCV, NT);
- 7 gas measuring stations for import and export;
- 2 measuring stations located on the international natural gas pipelines (SMG);
- 8 natural gas compressor stations (SCG), with an installed power of approx. 70.2 MW;
- 1,045 cathodic protection stations (SPC);
- 1,026 natural gas odorous stations (SOG).

The National Transmission System is represented by the set of main pipelines, as well as their installations, equipment and endowments, used at pressures between 6 bar and 63 bar, which ensures the taking over of natural gas extracted from the production perimeters or those coming from import and their transport in order to be delivered to the participants on the internal market of natural gas, export, international transport, etc.

At the end of 2020, the modernization of the measuring stations Isaccea I (new station) and Negru Vodă I was completed, giving the possibility of a bidirectional flow of natural gas on the T1 international transport pipeline. At the same time, the connection of the T1 pipeline to the NTS (through Isaccea) was completed, thus being possible both the delivery of natural gas from the T1 pipeline to the NTS and the delivery of natural gas from the NTS to the T1 pipeline at a maximum level of 6.3 Mil Sm3 / day , which will be offered in concurrent capacity (not all conditions are currently met in order to offer this concurrent capacity).

At the end of 2021, the modernization of the measuring stations Isaccea II and Negru Vodă II was completed, giving the possibility of the bidirectional flow of natural gas on the T2 international transport pipeline. At the same time, the connection of the T2 pipeline with the T1 pipeline and implicitly to the NTS (through Isaccea) was completed, thus making it possible to deliver natural gas from the T2 pipeline to the NTS. The national network has cross-border interconnection points with Moldova (Ungheni), with Ukraine (Orlovka/Isaccea and Mediesul Aurit/Tekovo), with Bulgaria (Negru Voda/Kardam and Giurgiu/Ruse) and with Hungary (Csanapadlota/Nadlac).

In 2021 natural gas consumption amounted to 129,33 TWh, against a domestic production of 93,52 TWh; total storage capacity amount to 32,97 TWh.

Table 7: Gas consumption and peak demand of Romania

	2021		
	Actual data		
	Protected customers		Non protected customers
	Protected customers of solidarity	Rest	
Gas consumption (bcm)	**11,33**		
Residential	3,18	-	-
Commercial	0,78	-	
District heating	1,05	-	
Industrial sector (electrical and thermal)	-	-	2,05
Chemical industry	-	-	1,02
Other industrial customers	-	-	0,52
Other secondary customers	-	1,53	
Third party suppliers	-	-	0,36
Technological consumption related to the gas sector activities	-	-	0,85
Energy consumption related to the gas sector activities	-	-	0,004
Peak demand (mcm/d)	**72**		
Residential	16,69	-	-
Commercial	4,88	-	
District heating	6,03	-	
Industrial sector (electrical and thermal)	-	-	10,57
Chemical industry	-	-	9,06
Other industrial customers	-	-	4,96
Other secondary customers		8,51	
Third party suppliers	-	-	4,30
Technological consumption related to the gas sector activities	-	-	6,98
Energy consumption related to the gas sector activities	-	-	0,02

Slovakia

The gas transmission, for the total length of the gas transmission network of 2,376 km, amounts to 411 mcm/day. Due to the amount of transported gas eustream remains one of the most important TSO based on the volume of gas transported within the EU.

Five compressor stations are part of the transmission network – Veľké Kapušany, Jablonov nad Turňou, Veľké Zlievce and Ivanka pri Nitre and Lakšárska Nová Ves – which provide a pressure differential needed for the flow of gas with a total output of 450 MW. The total transmission capacity of the network is more than 90 bcm per year. Natural gas from the transmission network in the defined territory gets through intrastate stations into the distribution networks and is transported to the final customers. The Slovak transmission system is fully bidirectional. On 30 November 2011 implementing measures were completed that allow reverse flow within the transmission network in Slovakia. In this mode it is possible to transport in the west – east direction the amount of gas that is higher than the highest consumption in Slovakia in the winter months. Slovakia interconnection with neighboring countries on the level of transmission networks currently exists with Austria [border point Baumgarten], Czech Republic [border point Lanžhot], Hungary [border point Veľké Zlievce] and Ukraine [border point Veľké Kapušany and border point Budince. Since November 2022 the Slovak – Polish interconnector started its commercial operation. Slovakia is now connected to all neighboring countries and their transmission systems.

Slovakia has in its territory several geological formations which are suitable for construction of underground gas storage facilities. Currently there are two companies active on the market, that are storage system operators - NAFTA a.s., Bratislava and POZAGAS a.s., Malacky. Total storage capacity in Slovakia is 3.66 bcm, which represents more than 65% (based on 2021 data) of total consumption . The facilities are located in the southwestern part of the country near the border with Austria and the Czech Republic.

According to the available data the share of natural gas in the electricity production was 15 % in 2021.

In 2021 natural gas consumption amounted to 58,81 TWh, against a domestic production of 0,63 TWh; total storage capacity amount to 41,53 TWh.

Table 8: Inland gas consumption of Slovakia

	2017	2018	2019	2020
	Real data	Real data	Real data	Real data
Inland Gas consumption (TWh)	53.46	52.68	52.80	52.83
Industrial	16.03	17.30	15.53	15.63
Electricity – CHP	5.64	5.88	8.40	9.96
Heating	2.79	2.47	2.38	2.58
Residential	14.86	14.46	14.47	14.78
Commercial and public services	7.38	6.33	5.16	4.60
Transport	1.95	1.72	2.39	1.07
Other	4.81	4.53	4.47	4.22

Historical data on Slovakian inland gas consumption and its composition (2017-2020)

Slovenia

The Slovenian transmission network has cross-border interconnections with Austria (Murfeld/Ceršak interconnection point), with Italy (Gorizia/Šempeter) and with Croatia (Rogatec).

Slovenian gas system has no storage facilities nor any local gas production. The gas network was put into use 1978 and further developed over its lifetime. Slovenia uses approximately between 0.9 and 1 billion cubic meters of natural gas annually, accounting for about 13 percent of the country's final energy consumption. Most of gas was supplied on a short-term basis from Central European Gas Hub. A minor portion was supplied through a long-term contract from Russia until early 2022. Slovenian companies depend on infrastructure in Austria, Italy and Croatia. Slovenia has expressed interest in securing LNG sources via terminals in Krk, Croatia, or Rovigo, Italy, to diversify its supply away from Russia. Various projects and investments are planned to develop the gas network. Two corridors are envisaged, one of them Croatia – Slovenia – Austria, which would enable gas transport from enlarged LNG terminal at Krk. In Slovenia this project requires investments into both interconnectors, Rogatec and Ceršak, and an enlargement of Kidričevo compressor station. The second corridor connects Hungary – Slovenia – Italy. The pipeline would run from Kozármisleny to Nagykanizsa, Tornyiszentmiklós, Lendava, Kidričevo, Ajdovščina, Šempeter, Gorizia. It is listed in 10-year natural gas development plans for Slovenia and Hungary. In Slovenia the gas interconnector consists of two sections: repurposing of Šempeter-Vodice Gas Pipeline and building a new gas pipeline Pince-Lendava-Kidričevo. Both corridors would be hydrogen ready.

In 2021, the total natural gas consumption amounted to 10,13 TWh, out of which 8,20 TWh by the non-household customers, i.e. industry and services which are not protected customers. Protected customers consumed 1,95 TWh of gas. Household consumption was 1,31 TWh. The structure of gas consumption in the year 2021 is representative.

Use of gas in the electricity mix is very specific. Both larger gas-fired power plants are only used for peak power production and auxiliary services for the electricity system. In addition, they both have fuel switching capability which they efficiently utilise. They play a very important role for the operation of electricity, system, for which they consume very small gas volumes. The largest gas power plant consumed only 4,63 mcm of gas in that year, the others even less.

Table 9: Inland gas consumption of Slovenia

	2017	2018	2019	2020
	Real data	**Real data**	**Real data**	**Real data**
Inland Gas consumption (TWh)	9.54	9.36	9.51	9.50
Industrial	5.74	5.98	5.91	5.86
Electricity – CHP	1.19	1.19	1.37	1.51
Heating	0.38	0.36	0.41	0.39
Residential	1.54	1.43	1.37	1.36
Commercial and public services	0.64	0.34	0.38	0.32
Transport	0.04	0.04	0.06	0.05
Other	0.01	0.01	0.01	0.01

Historical data on Slovenian inland gas consumption and its composition (2017-2020)

Infrastructure Standard

N-1 formula calculation

The competent authorities of relevant Member States agreed to provide the calculation of the N – 1 formula at regional level in the common risk assessment (art. 7), following the provisions of point 5 of Annex II of the Regulation.

The N – 1 formula describes the ability of the technical capacity of the gas infrastructures to satisfy total gas demand in the calculated area in the event of disruption of the single largest gas infrastructure during a day of exceptionally high gas demand occurring with a statistical probability of once in 20 years (D_{max}).

As provided for by Annex II of the Regulation, for the calculation of the "N – 1 formula at regional level", the single largest gas infrastructure of common interest shall be used; the single largest gas infrastructure of common interest for the Eastern gas supply risk group Ukraine is Velké Kapušany-Uzhgorod interconnection point.

The formula used for the calculation of the "N – 1 formula at regional level" is the one provided by the point 4 of Annex II "*Calculation of the N – 1 formula using demand-side measures*":

$$N-1[\%] = \frac{EP_m + P_m + S_m + LNG_m - I_m}{D_{\max} - D_{eff}} \times 100, N-1 \geq 100\%$$

Table 10: The terms of the formula have been calculated as follows:

EP_m	*Technical capacity of entry points (in GWh/d), other than production, LNG and storage facilities covered by Pm, LNGm and Sm, means the sum of the technical capacity of all border entry points capable of supplying gas to the calculated area.*
P_m	*Maximal technical production capability (in GWh/d) means the sum of the maximal technical daily production capability of all gas production facilities which can be delivered to the entry points in the calculated area.*
S_m	*Maximal technical storage deliverability (in GWh/d) means the sum of the maximal technical daily withdrawal capacity of all storage facilities which can be delivered to the entry points of the calculated area, taking into account their respective physical characteristics.*
LNG_m	*Maximal technical LNG facility capacity (in GWh/d) means the sum of the maximal technical daily send-out capacities at all LNG facilities in the calculated area, taking into account critical elements like offloading, ancillary services, temporary storage and re-gasification of LNG as well as technical send-out capacity to the system.*

I_m	*Technical capacity of the single largest gas infrastructure (in GWh/d) with the highest capacity to supply the calculated area. When several gas infrastructures are connected to a common upstream or downstream gas infrastructure and cannot be separately operated, they shall be considered as one single gas infrastructure.*
D_{max}	*The total daily gas demand (in GWh/d) of the calculated area during a day of exceptionally high gas demand occurring with a statistical probability of once in 20 years.*
D_{eff}	*The part (in GWh/d) of Dmax that in the case of a disruption of gas supply can be sufficiently and timely covered with market-based demand-side measures.*

Tables below are calculated taking into account the following hypothesis:

- interruption of Velké Kapušany-Uzhgorod entry point as the single largest infrastructure (Im) as requested by the SOS regulation;
- total disruption of Russian gas. Even if not requested by the Regulation, this is the relevant scenario which we may incur in;
- forthcoming LNG regasification plants sensitivity.

As provided by the Regulation, the N-1 formula has been computed taking into account the 100% of underground storage working gas volume.

Even if in each case the index results far above the 100%, given the actual rerouting of the main gas supply flows following the February 2022 invasion of Ukraine by Russia, the result doesn't mean that regional gas infrastructures are properly dimensioned in order to cover maximum demand of the involved Member States.

However, N-1 index doesn't take into account possible existence of internal bottlenecks or problems induced by malfunctioning of internal interconnection points or due to lack of available capacity to attract gas. All these risks are evaluated in the following risk analysis.

The following table summarises the data set used for N-1 formula calculation.

Table 11: N-1 calculation and results

					With forthcoming LNG			
	2022	**2022-09**	**No RU* 2022**	**No RU* 2022-09**	**2022**	**2022-09**	**No RU* 2022**	**No RU* 2022-09**
N-1	**189,7%**	**191,7%**	**179,5%**	**180,9%**	**194,6%**	**196,6%**	**184,4%**	**185,9%**
D_{max}	7362,32	7362,32	7362,32	7362,32	7362,32	7362,32	7362,32	7362,32

EP_m	8830,60	8978,20	8079,30	8185,60	8830,60	8978,20	8079,30	8185,60
P_m	435,09	435,09	435,09	435,09	435,09	435,09	435,09	435,09
S_m	5715,64	5715,64	5715,64	5715,64	5715,64	5715,64	5715,64	5715,64
LNG_m	897,60	897,60	897,60	897,60	1260,58	1260,58	1260,58	1260,58
I_m	1913,60	1913,60	1913,60	1913,60	1913,60	1913,60	1913,60	1913,60
D_{eff}	0	0	0	0	0	0	0	0

* In this particular case, capacities of IPs that carried mostly Russian gas no longer have physical flow (Orlovka) were removed and they were not considered as the largest regional infrastructure. It should be noted that the Velké Kapušany-Uzhgorod (UA-SK) point still show flows and remains the largest capacity infrastructure.