FGSZ LTD.

NATURAL GAS TRANSMISSION
MEMBER OF THE MOL GROUP

Development Proposal Consultation Document

2016-2025

2016.

FGSZ NATURAL GAS TRANSMISSION PRIVATE COMPANY LIMITED BY SHARES
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Content

Preambulum

The Development Proposal 2016 presents the analysis of the most important data from the past, the expected trend in natural gas utilisation for the next 10 years, and also contains the proposals of the infrastructural investments required to satisfy future natural gas demand, increasing the security of supply and developments required to cross border deliveries. The investment proposal elaborated based upon the capacity analysis of the transmission grid is harmonised with the latest regional plans[1] (GRIP CEE, GRIP SC) and with the TYNDP[2] drafted by the ENTSOG[3] for the year 2017. Final investment decisions have not been made yet with respect to the investigated projects.

In accordance with Regulation (EU) No. 347/2013, certain projects are part of the EU list of so called Projects of Common Interest. The investigated Hungarian developments include several projected infrastructural investments that have been awarded the PCI status, thus they are foreseen to improve the more efficient utilization of the European Union's energy infrastructure.

FGSZ Ltd. has been prepared to face the challenges, the tasks and the requirements for years by now, deriving from the establishment of a market which is integrated, diversified regarding its resources and liquid, and which the European Union intends to achieve. FGSZ Ltd. as a Transmission System Operator (TSO) is interested in creating a more efficient gas market that rests on several pillars, by contributing to the development of a highly interconnected natural gas transmission network that is interoperable in all directions within the region.

FGSZ Ltd. has set the goal of guaranteeing the possibility to import natural gas from every direction in the interest of security of supply, and of making the domestic gas market an integral part of the surrounding region by implementation of bi-directional cross-border connections. Hungary's gas supply will be set on more solid foundation with available gas sources from southern and south-eastern, eastern, northern and western directions.

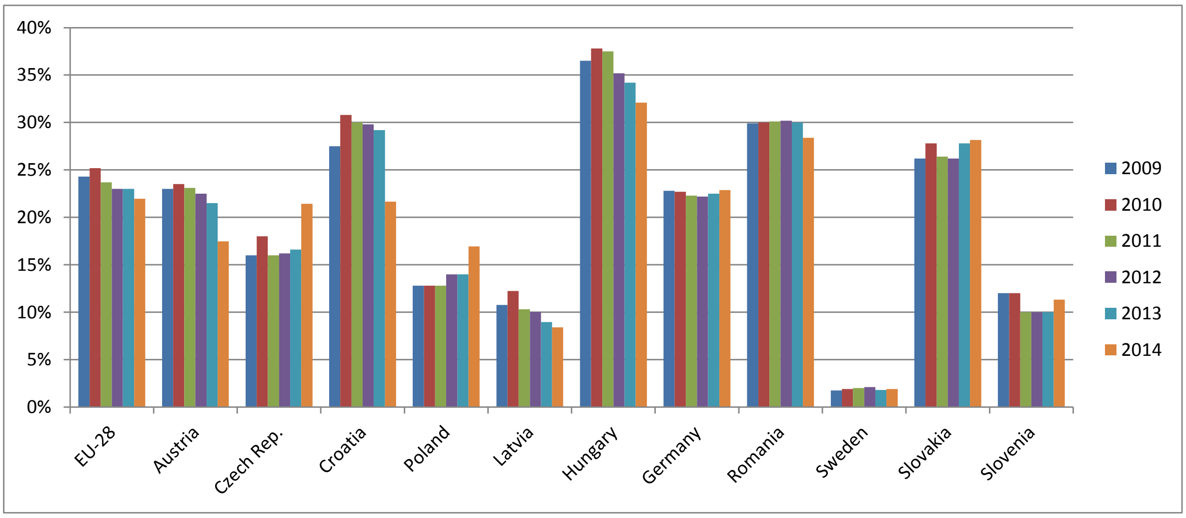
János László Fehér
Chief Executive Officer

Zoltán Gellényi
Director of System Operation and Capacity Trade

[1] GRIP CEE (**G**as **R**egional **I**nvestment **P**lan **C**entral-**E**astern **E**urope) and GRIP SC (**G**as **R**egional Investment **P**lan **S**outhern **C**orridor)
[2] TYNDP **-** **T**en **Y**ears **N**etwork **D**evelopment **P**lan
[3] ENTSOG **-** the **E**uropean **N**etwork of **T**ransmission **S**ystem **O**perators for **G**as

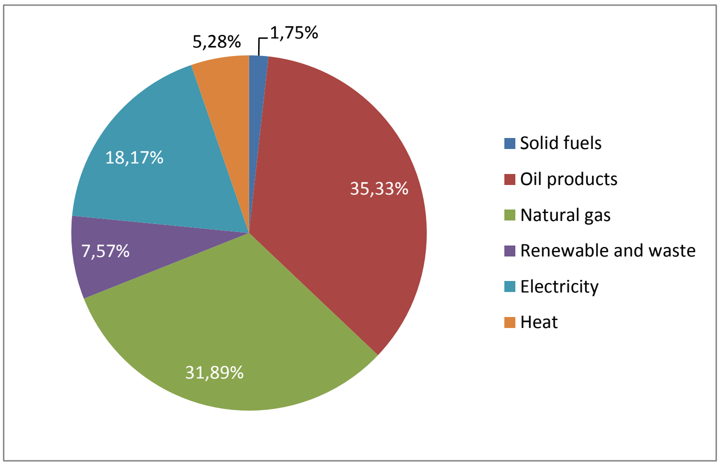
Introduction

Pursuant to Act XL on Natural Gas Supply FGSZ Ltd. as transmission system operator has an obligation to submit its 10-year national development proposal to the regulatory authority every year after a consultation with the connected system operators, in order to ensure the suitability of system and the security of supply within it subject to the existing and new consumption demand, and also the entry capacities available. The 10-year national development proposal describes the development of the infrastructure based on the investigations conducted with respect to the period between 2016 and 2025.
In development proposal our Company takes into consideration the information related to Hungarian production, the expected domestic consumption, the results of the consultations held with the neighbouring countries.
As far as primary energy use is concerned the proportion of natural gas used as primary energy in Hungary is relatively high if we compare it to its proportion in Europe, and although in the last few years its share has been gradually decreasing, in 2014 it is still at 32 %.



Source: Eurostat, EIA

The following chart shows the distribution of domestic primer energy consumption for 2014:



Source: Eurostat

Share of natural gas in total consumption decreased to 31 percent according to IEA survey.

Definitions

The unit of measurement most often used in the development proposal is the so-called standard cubic metre which means the standard physical status at the temperature of 15 degrees Celsius and under the pressure of 1.01325 bars. Considering that EU materials use the units of measurement GWh or kWh, in many cases data are also indicated in these units.
In converting the different units, we used either the weighted average heat of combustion (kWh/cm) defined for the year 2014 in the document „Quality accounting rules of the entry and exit points of the natuaral gas transmission system for gas year 2015-2016” or the average heat of combustion of natural gas in the Hungarian system, i.e. 11.34 kWh/cm.

1. Consultation process

1.1. Consultation with the network users

As required by the effective law, Network Users delivered their long-term consumer's forecasts for the next 10 years by 31 March 2016. FGSZ Ltd. as transmission system operator reviewed the consumer's forecasts and the capacities available as entry with the connected system operators (natural gas distribution licensee, direct industrial and power plant users directly connected to the natural gas transmission network, natural gas storage licensees, natural gas producers). Our Company regularly consults with the transmission system operators in the neighbouring countries. In this year was the first time, when currently and prospective network users could give a non-binding capacity demand to the cross border points, for the whole or part of 2019/20-2034/2035 period.

1.2. Consultation with NRA (MEKH), distributors and the direct connected power plat and industrial customers.

Network Users' forecast for their 10-year demand has been reviewed by our Company in consultation with natural gas distribution licensees connected to the transmission network and users directly connected to the natural gas transmission network. On 28 June 2016 we participated at a personal consultation with the Hungarian Energy and Public Utility Regulatory Authority and the natural gas distribution licensees, with some industrial and power plant users. As a result of the consultation the 10-year transmission demand was established as required for further investigations.

1.3. Consultation with TSOs.

In connection with the natural gas transmission within the RO-HU-AT corridor, a capacity increase is expected at the Hungarian-Romanian cross-border point. Therefore, we are in regular communication with the Romanian transmission system operator, Transgaz to ensure the 1.75 bcm/year, 4.8 Mcm/day, 200.000 cm/h firm capacity both directions at the cross-border point. In case of further demand (e.g. if the production from the Black Sea is transmitted to West Europe) the cross-border point may need to be further extended to 4.4 bcm/year, 12.0 Mcm/day, 500,000 cm/h capacity.

In connection with the natural gas transmission within the RO-HU-AT corridor, capacity increase is expected at the Hungarian-Austrian cross-border point. Therefore, we are in regular communication with the Austrian transmission system operator, Gas Connect Austria to ensure the 5.2 bcm/year, 14.4 Mcm/day, 600,000 cm/h firm capacity at the cross-border point.

The Hungarian part of the Croatian-Hungarian interconnection line has been installed pursuant to the agreement of the transmission system operators, the Hungarian system is suitable for the bi-directional transmission of 800,000 cm/h. Considering the capacity restrictions of the Croatian network, consultations regarding the development of the Croatian network are currently under way, as a result of such development it will become possible to increase the non-interruptible entry and exit point capacities at the cross-border point.

Currently, at Beregdaróc 800 (HU>UA) point of the Ukrainian-Hungarian interconnection line there is only interruptible capacity of 700,000 cm/h available. The sale of firm capacity towards Ukraine requires developments in Hungary.

At the moment the Hungarian natural gas transmission network is connected to all neighbouring networks except for the Slovenian one. FGSZ Ltd. and the Slovenian transmission system operator, Plinovodi have been continuously working on establishing and making available the required interconnection infrastructure. According to the preliminary meeting we examined 1.3 bcm/a, 3.6 Mcm/day, 150,000 cm/h (50,000 cm/h firm and 100,000 cm/h interruptible). This requires a survey of the market demand then can be defined what capacities need to be set up.

2. Demand and Supply in the Natural Gas Transmission System

2.1. Existing network points of the Natural Gas Transmission System

As of 1 October 2016 the network of FGSZ Ltd. consists of 5783 kilometres natural gas transmission pipelines with diameters of DN50 - DN1400 and pressure levels PN6-PN75, 392 national exit points, and 4 international exit points (Kiskundorozsma (HU>RS), Csanádpalota (HU>RO), Drávaszerdahely (HU>CR), Beregdaróc 800 (HU>UA)) and 4 international import entry points (Beregdaróc 1400 (UA>HU); Mosonmagyaróvár (AT>HU), Csanádpalota (RO>HU), Drávaszerdahely (CR>HU), and also 14 production and 5 storage entry points. The exit pressure stipulated in contracts is ensured by the natural gas transmission network with the help of 6 compressor stations.

Domestic transmission system points can be classified with the following method:

chart 1

Entry point - FGSZ Ltd.		
Sum	**24**	
Cross border entry points	4	Beregdaróc 1400 (UA>HU), Mosonmagyaróvár (AT>HU) Csanádpalota (RO>HU) Drávaszerdahely (CR>HU)
Connection point	1	Vecsés 4 (MGT>FGSZ)
Dromestic production points	14	
Storages	5	
Exit point		
Sum	**407**	
Cross border exit points	4	Beregdaróc 800 (HU>UA), Kiskundorozsma (HU>RS) Csanádpalota (HU>RO) Drávaszerdahely (HU>CR)
Connection point	1	Vecsés 4 (FGSZ>MGT)
Domestic exit - FGSZ Ltd.	**392**	
DSO points	355	10 DSO
Directly connected industrial consumer	17	
Directly connected power plants consumer	15	
Points related to production facilities	3	
Other	2	
Other points	**10**	
Mixed points to producers	5	
Storage points	5	2 Storages

Neighbouring Network Operators connecting to the Natural Gas Transmisson System:

chart 2

		Market participant	Connecting physical points
1.	**Natural gas distribution licensees**		**355**
	1.	TIGÁZ DSO Kft.	144
	2.	ÉGÁZ-DÉGÁZ Földgázelosztó Zrt.	104
	3.	E.ON Közép-dunántúli Gázhálózati Zrt.	39
	4.	E.ON Dél-dunántúli Gázhálózati Zrt.	29
	5.	FŐGÁZ Földgázelosztási Kft.	16
	6.	Magyar Gázszolgáltató Kft.	15
	7.	OERG Kft.	4
	8.	Csepeli Erőmű Kft.	2
	9.	ISD POWER Kft.	1
	10.	NGS Kft.	1
2.	**Natural gas storage licensees**		**6**
	1.	Hungarian Gas Storage Ltd.	4
	2.	MMBF Ltd.	1*
3.	**Natural gas producers ****		**14**
	1.	MOL Nyrt.	13
	2.	Folyópart Kft.	1

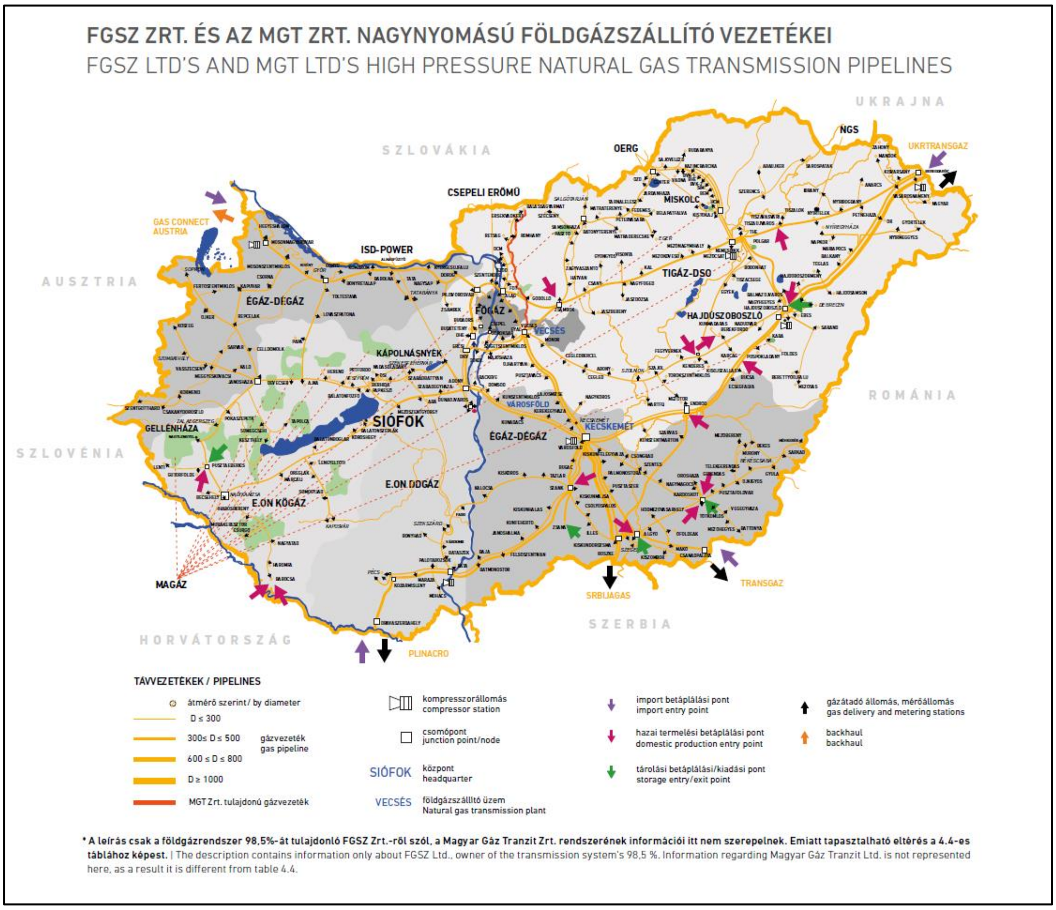
* Including the strategic storage
** Producers without own entry point: Magyar Horizont Ltd. and OGD Centrál Ltd.

As of 01.10.2016 the system of the other Hungarian Transmission System Operator, Magya Gáz Tranzit Ltd. (MGT Ltd.) contains 91 km DN800, PN75 bar pipeline and one compressor station (Szada).

The MGT Ltd. transmission system points can be classified with the following method:

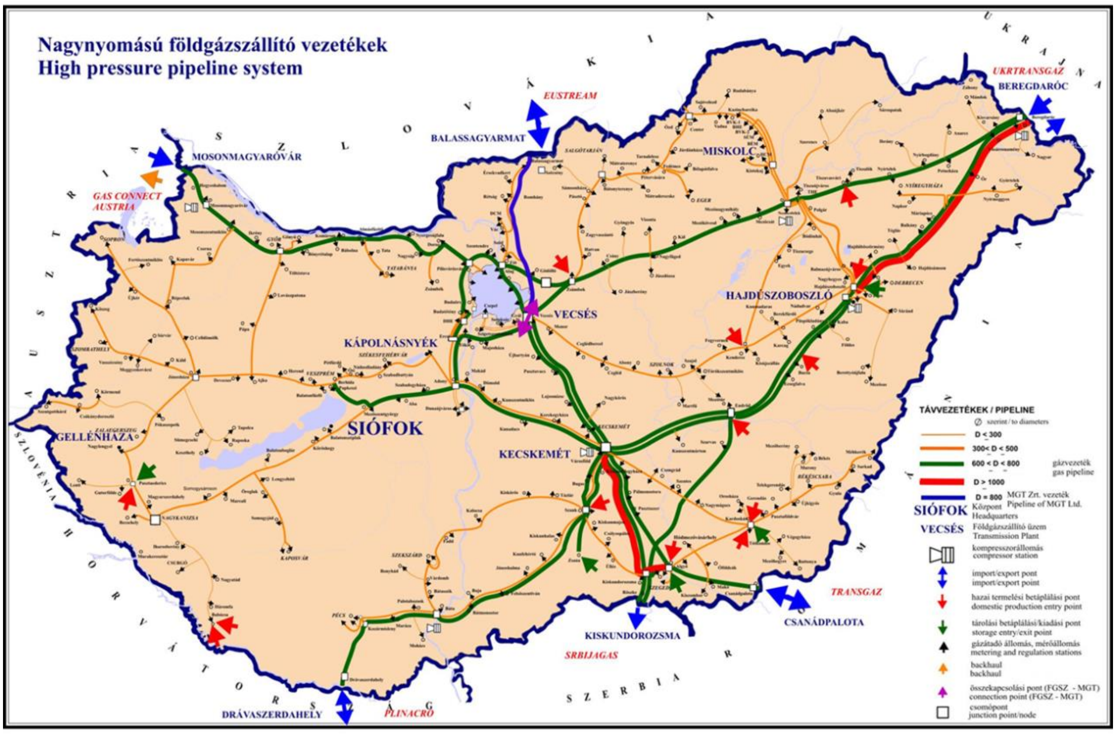
Entry points - MGT Ltd.	2	
Cross border entry points	1	Balassagyarmat (SK>HU)
Connection point	1	Vecsés 4 (FGSZ>MGT)
Kiadási pont - MGT Zrt.	2	
Cross border exit points	1	Balassagyarmat (HU>SK)
Connection point	1	Vecsés 4 (MGT>FGSZ)

The Hungarian natural gas transmission system's pipeline and the operational area of DSO's can be found the following graphic.



Source: Statistical data of the Hungarian natural gas system 2014

Hungarian Natural Gas Transmission System		As of 1 October 2016
Transmission pipelines	Sum	5 873 km
	DN 1400 pipeline	5 km
	DN 1000 pipeline	203 km
	DN 800 pipeline	958 km
	DN 700 pipeline	369 km
	DN 600 pipeline	718 km
	DN 400-500 pipeline	1 427 km
	DN 300-350 pipeline	1 113 km
	DN 125-250 pipeline	867 km
	pipeline up to DN 100	122 km
	DN800 Pipeline owned and operated by MGT Ltd.	91 km
Additional facilities	Compressor stations	Beregdaróc, Mosonmagyaróvár, Városföld, Nemesbikk, Hajdúszoboszló, Báta, Szada (MGT Ltd.)
	Cross border points	Beregdaróc, Mosonmagyaróvár, Kiskundorozsma, Csanádpalota, Drávaszerdahely, Balassagyarmat (MGT Ltd.)


Nagynyomású földgázszállító vezetékek
High pressure pipeline system
MOSONMAGYARÓVÁR
GAS CONNECT AUSTRIA
BALASSAGYARMAT
EUSTREAM
UKRTRANSGAZ
BEREGDARÓC
MISKOLC
HAJDÚSZOBOSZLÓ
VECSÉS
KÁPOLNÁSNYÉK
SIÓFOK
KECSKEMÉT
GELLÉNHÁZA
KISKUNDOROZSMA
SRBIJAGAS
CSANÁDPALOTA
TRANSGAZ
DRÁVASZERDAHELY
PLINACRO
TÁVVEZETÉKEK / PIPELINE
D < 300
300< D < 500
600 < D < 800
D > 1000
D = 800
gázvezeték gas pipeline
MGT Zrt. vezeték Pipeline of MGT Ltd.
SIÓFOK Központ Headquarters
VECSÉS Földgázszállító üzem Transmission Plant
kompresszorállomás compressor station
import/export pont import/export point
hazai termelési betáplálási pont domestic production entry point
tárolási betáplálási/kiadási pont storage entry/exit point
gázátadó állomás, mérőállomás metering and regulation stations
backhaul backhaul
összekapcsolási pont (FGSZ - MGT) connection point (FGSZ - MGT)
csomópont junction point/node

2.2. Entry side of the natural gas transmission network

The total firm capacity of the entry points is 142 million cubic meters per day; 5.9 million cubic metres per hour.

	Entry points			
	Capacity Mm^3/day (15 °C)	**Capacity Mm^3/day (15 °C)**	**Capacity GWh/day*** (25/0 °C)**	**Capacity GWh/day*** (25/0 °C)**
	firm	interruptible*	firm	interruptible*
Ukrainian/Hungarian border indigenous (DN1400)	45,0	15,0	483,8	161,3
Ukrainian/Hungarian border transit	11,3	---	121,5	---
Austrian/Hungarian border	12,1	2,26	129,7	24,2
Romanian/Hungarian border	0,24	4,56	2,7	52,1
Croatian/Hunagrian border	0,0	19,2	0,0	199,5
Slovak/Hungarian border (MGT)	12,0	0,0	127,1	0,0
Sum of domestic production	7,9	0,0	82,3	0,0
Underground storages	67,5	26,5**	695,8	282,9
Sum	**141,70**	**67,55**	**1 508,2**	**719,96**
Strategic storage	**20,0**	**---**	**214,0**	**---**

Note: * interuptible capacity
** contains Algyő Szőreg UGS 20 Mcm/day interuptible commercial capacity which is available if strategic UGS does not operate.
***GCV based, calorific value according to Order of Natural Gas Quality Accounting document

The total firm capacity of the cross-border exit points is 30 million cubic metres per day; 0.8 million cubic metres per hour.

	Cross border - exit point			
	Capacity Mm^3/day (15 °C)	**Capacity Mm^3/day (15 °C)**	**Capacity GWh/day*** (25/0 °C)**	**Capacity GWh/day*** (25/0 °C)**
	firm	interruptible*	firm	interruptible*
Hungarian/Serbian border	13,2	---	142,1	---
Hungarian/Ukrainian border (DN800)	---	16,8	---	181,0
Hungarian/Romanian border	4,8	---	51,6	---
Hungarian/Croatian border	7,2	12,0	77,1	128,5
Hungarian/Slovak border (MGT Ltd.)	4,8	---	50,8	---
Sum	**30,0**	**28,8**	**321,6**	**309,5**

The total firm capacity of the Hungarian exit points is 203.1 Mcm/day; 8.4 Mcm/h.

	Indigenious exit points*	
	Capacity Mm^3/day (15 °C)	**Capacity GWh/day (25/0 °C)**
Distributors	167,9	1 785,9
Industry	10,3	107,0
Power Plant	24,5	250,5
Other	0,46	4,8
Sum	**203,1**	**2 148,3**

* without exit point for blending and storage points

As a result of the merger of gas delivery exit points there were 309 commercial exit points announced out of the 392 exit points.

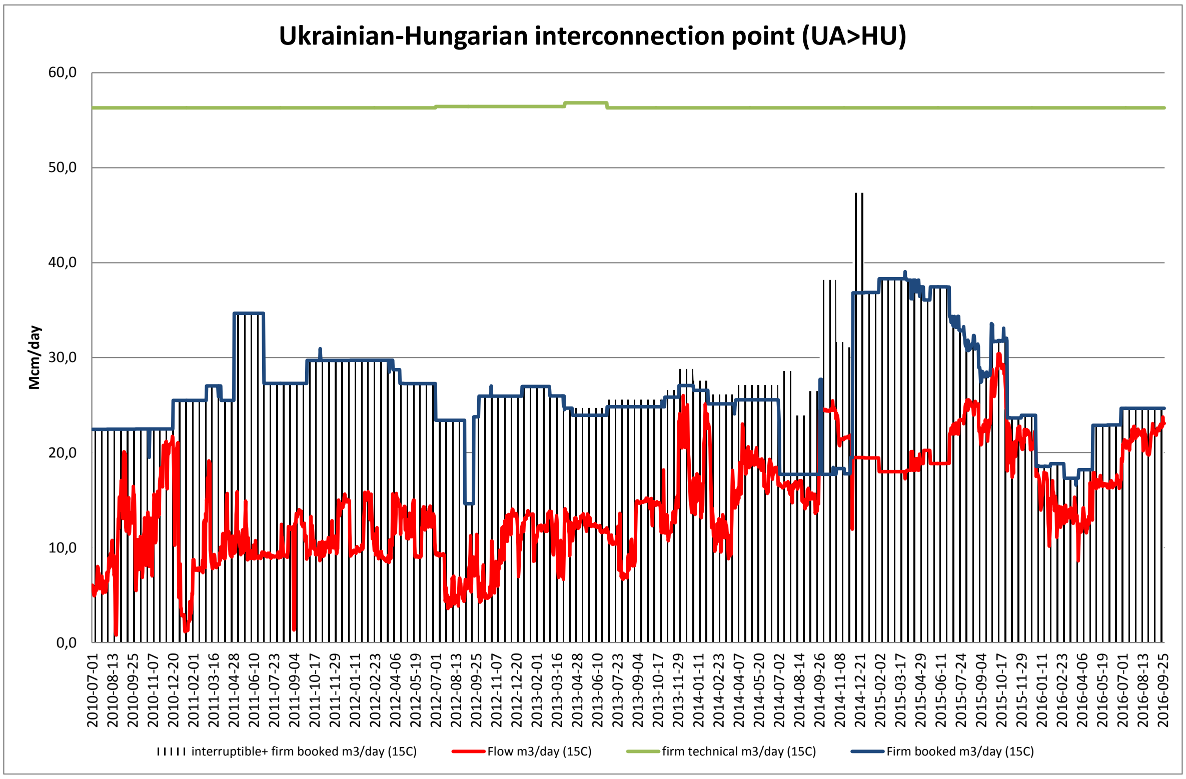
2.2.1. Available and studied capacities at the entry points

2.2.1.1. Capacities available at cross-border points and analysis

2.2.1.1.1. Ukrainian-Hungarian cross-border point

The firm capacity of the Ukraine-Hungary border entry point is 20.5 bcm/a, 56.3 Mcm/d, 2,345,800 cm/h, plus it has an interruptible capacity of 15 Mcm/d. The capacity requested for the Ukraine-Hungary border entry point is significantly less than the 56.3 Mcm/d firm capacity currently available to meet demand.

The following chart shows the capacity booking and utilization between 1 July 2010 and 25 September 2016.

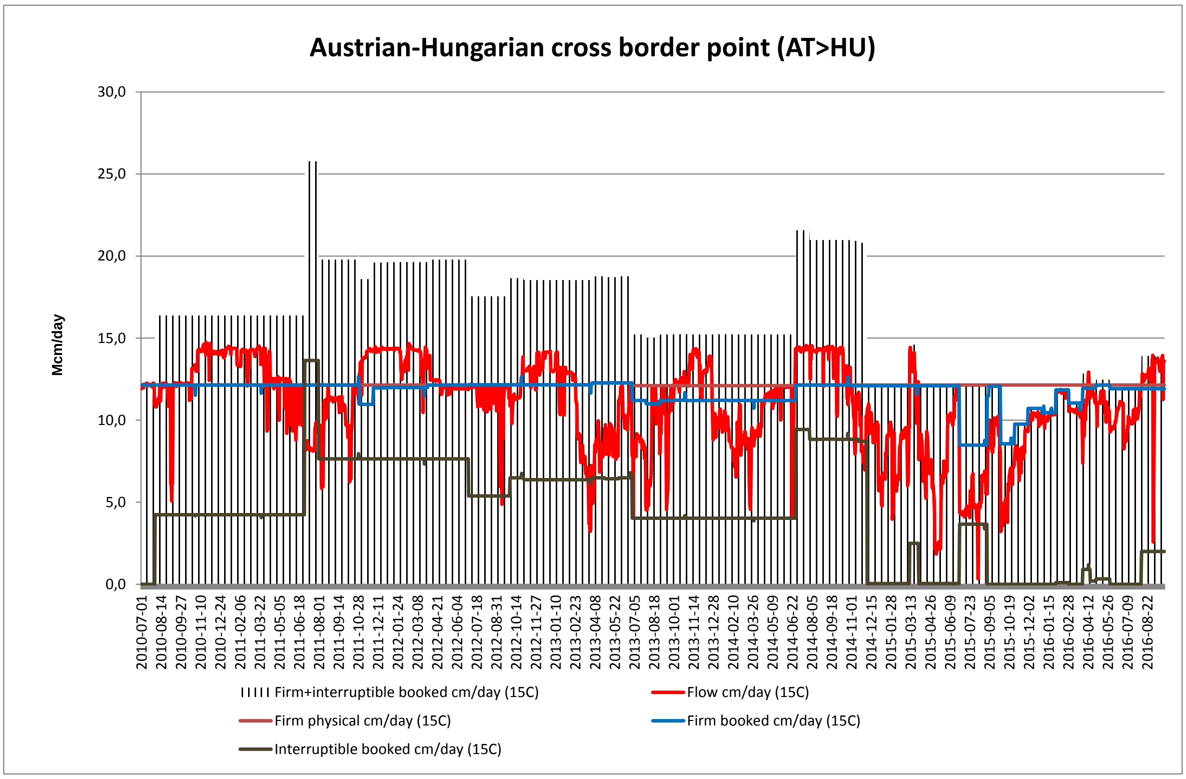


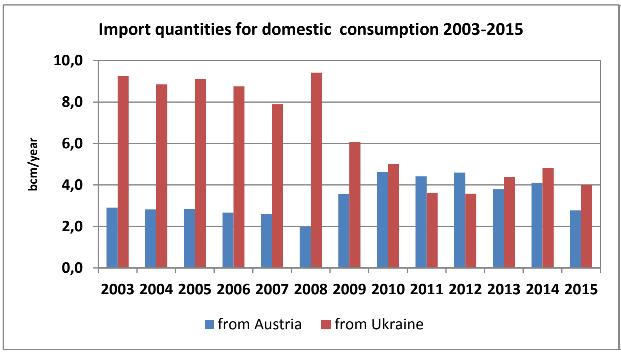
2.2.1.1.2. Austrian-Hungarian border entry point

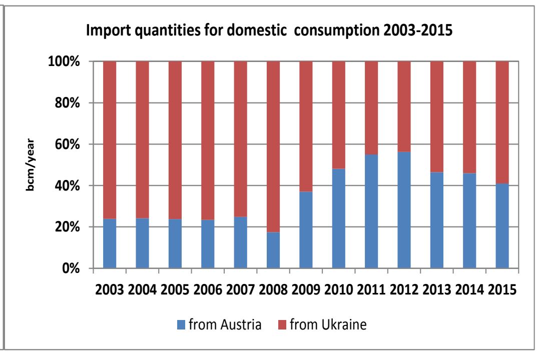
The firm capacity of the Austrian-Hungarian border entry point is 12.1 Mcm/day, 505,000 cm/h. Subject to consumption in the Transdanubian region, the maximum available capacity towards Hungary is 14.4 Mcm/day, 600.000 cm/h, thus the annual transmittable volume is 4.4-5.2 bcm/a.

Lately, the capacity requested at the Austrian-Hungarian border entry point does not exceed the available capacity.

The chart below shows the booked capacities and the actually transmitted capacities in the period between 1 July 2010 and 22 August 2016.





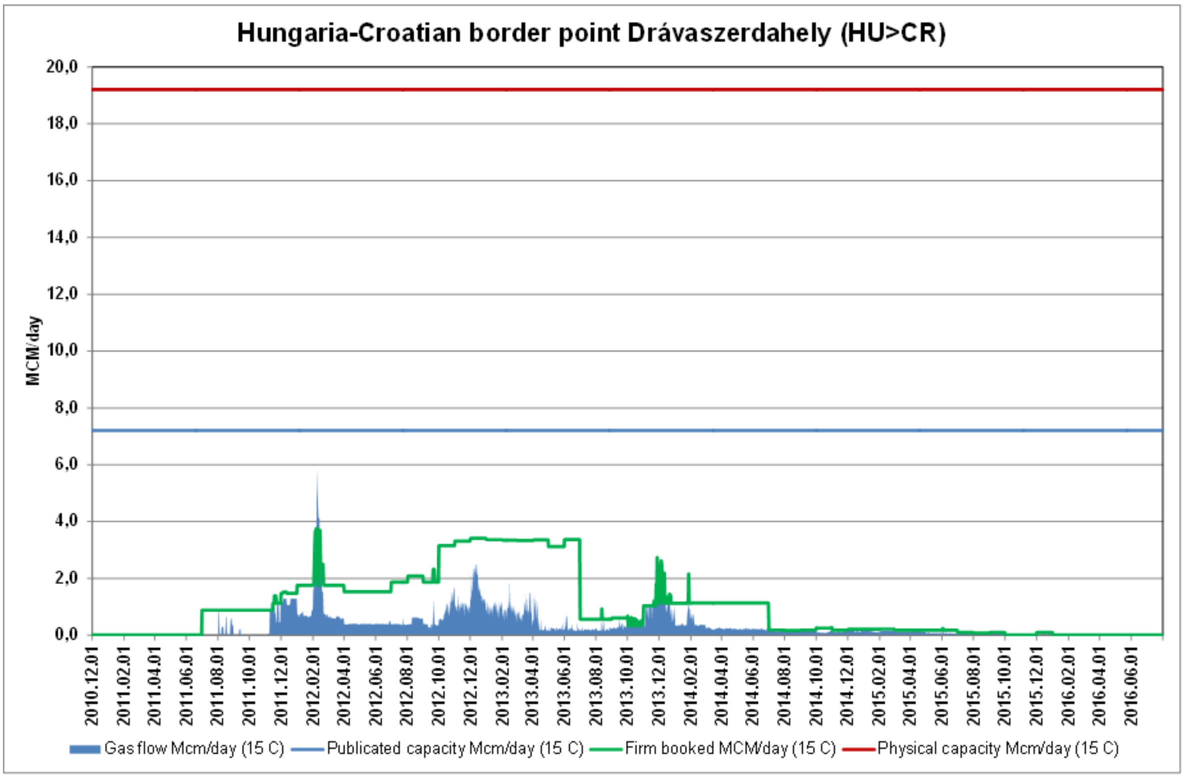


As you can see on the diagrams, the volume of gas from Ukraine significantly dropped until 2010, while the volume from Austria increased during the same period. Between 2011 and 2012 more natural gas for domestic use was received from Austria than from Ukraine, then the volume of natural gas from Ukraine exceeded again that from Austria.

2.2.1.1.3. Croatian-Hungarian border entry and exit points

The network of FGSZ Zrt. is suitable for the Croatian-Hungarian bi-directional transmission with its maximum capacity being 7.0 bcm/a, 19.2 Mcm/day and 800,000 cm/h. Since December 2012 because of capacity restriction in the Croatian network, at the Croatian-Hungarian border only interruptible capacity is available to network users. The Krk LNG terminal is currently under preparation, and it is expected to permit LNG gas purchase for users in Hungary and the neighbouring countries starting from around 2020, according to our current information, in the first phase up to 2 bcm/a volume, which in a later phase can be increased up to a maximum capacity of 6 bcm/a. Among other things, the establishment of the terminal is subject to the Hungarian and other regional network users' capacity demand. Therefore the LNG terminal will only be available only after the construction of the LNG terminal is completed, and subject to the capacity of the Slovenian-Croatian cross-border point the maximum capacity from Croatia available to Hungarian and, through Hungary, to Slovak, Romanian, Ukrainian and Serbian users, will be 7 bcm/a, 19.2 Mcm/day, 800.000 cm/h through the connected natural gas transmission networks.

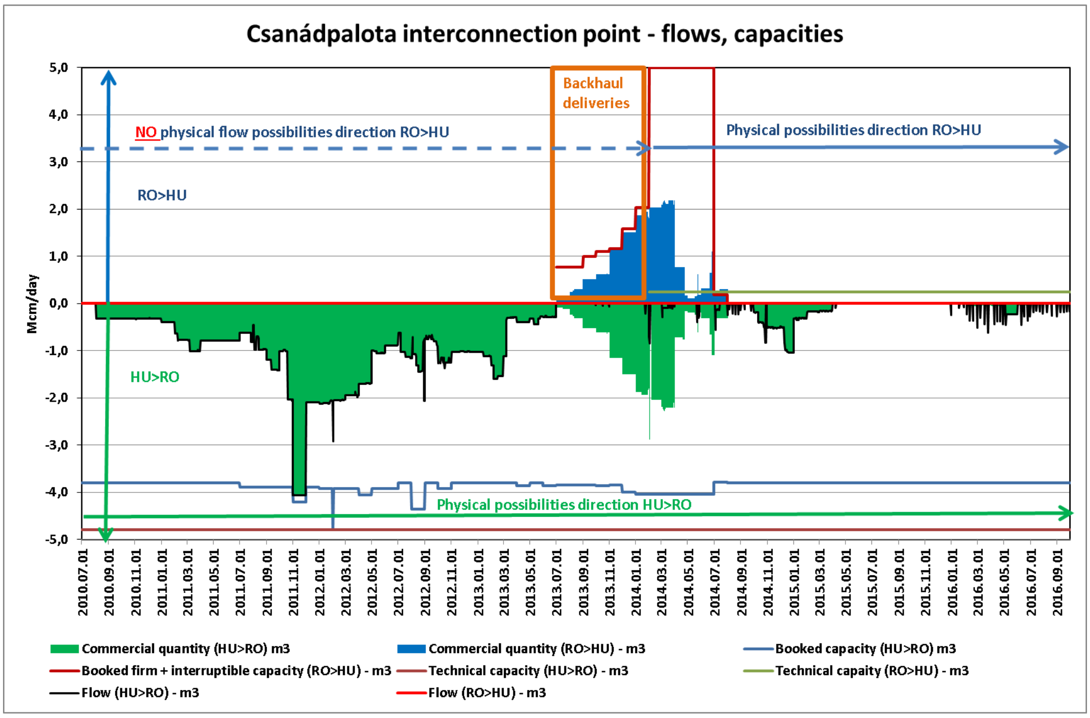
According to the agreement between the two neighbouring transmission system operators, because of the further development needed within the Croatian network, temporarily the firm capacity from Hungary to Croatia is maximum 2.6 bcm/a, 7.2 Mcm/day, 300.000 cm/h, while firm capacity from Croatia to Hungary is currently not available, the volume of interruptible capacity available depends on the Croatian transmission system operator, the volume of available interruptible capacity within the Hungarian network is 7.0 bcm/a, 19.2 Mcm/day, 800.000 cm/h. In the direction from Croatia to Hungary there is no capacity booking or gas flow either.



2.2.1.1.4. Romanian-Hungarian border entry and exit points

The interconnection pipeline between Romania and Hungary is suitable for bi-directional transmission with a maximum capacity of 1.75 bcm/a and 4.8 Mcm/day. The transmission on the pipeline is primarily from Hungary to Romania with the maximum natural gas transmitted being 200,000 cm/h. The current infrastructure is already suitable for transmitting maximum 50,000 cm/h natural gas to Hungary, under a temporarily reduced border pressure of 20 bars, of the capacity available the firm capacity offered is 0.09 bcm/a, 0.24 Mcm/day and 10,000 cm/h.

The following chart shows the booked capacities and actual flows.



2.2.1.1.5. Slovakia-Hungary border entry point

The commercial operation of the Slovak-Hungarian interconnection pipeline has been started on 1 July 2015.

The theoretical annual capacity of the pipeline is 5.2 bcm/a, 14.4 Mcm/d and 600,000 cm/h.

Considering the connected networks and the built-in compressor power at Szada the currently available entry capacity from Slovakia to Hungary is maximum 4.4 bcm/a, 12.0 Mcm/d, 500,000 cm/h, while from Hungary to Slovakia it is maximum 1.75 bcm/a; 4.8 Mcm/day; 200,000 cm/h.

2.2.1.2. Available and studied capacities at cross border entry points and analysis

Of the currently used cross-border entry points, capacity increase is expected at the Austria-Hungary and at the Romania-Hungary cross-border points as a result of the implementation of the RO-HU-AT transmission corridor.

Subject to market demand the maximum capacity at the Austrian-Hungarian cross-border point, in both directions, can be 5.2 bcm/a; 14.4 Mcm/d; 600,000 cm/h.

Subject to market demand the maximum capacity at the Romanian-Hungarian cross-border point, in both directions, can be 4.4 bcm/a, 12.0 Mcm/d, 500,000 cm/h once a compressor station is included in the network.

Besides that can capacity increasing the following cross border points:

Subject to market demand the maximum firm capacity at the DN800 Ukrainian-Hungarian cross-border point, in both directions, can be 6.1 bcm/a, 16.8 Mcm/d; 700,000 cm/h.

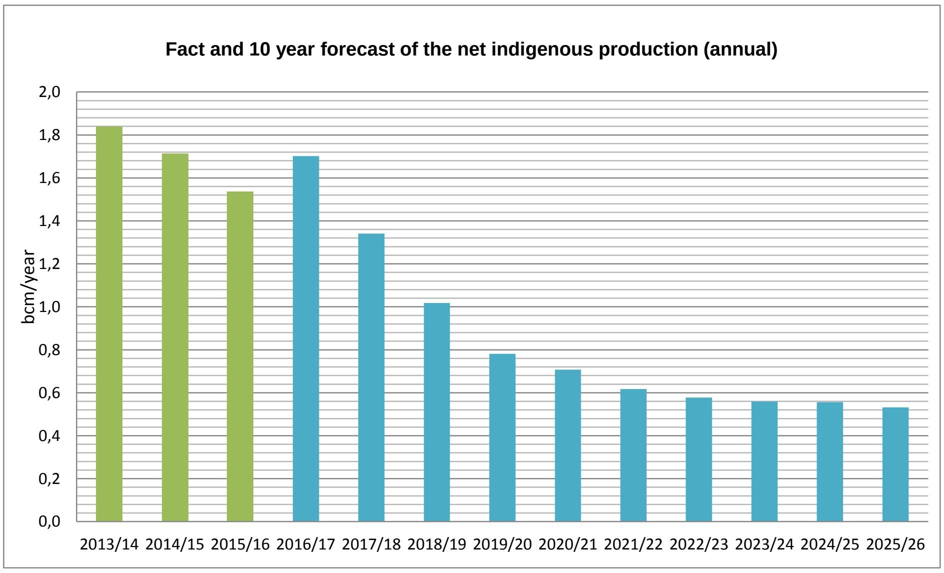
Subject to market demand the maximum capacity at the Slovenian-Hungarian cross-border point, in both directions, can be 1.3 bcm/a, 3.6 Mcm/per day, 150,000 cm/h (1/3 non-interruptible; 2/3 interruptible) once a compressor station is included in the network.

2.2.2. Available and studied capacities at the production entry points

2.2.2.1. Available and planned capacities at production entry points and analysis

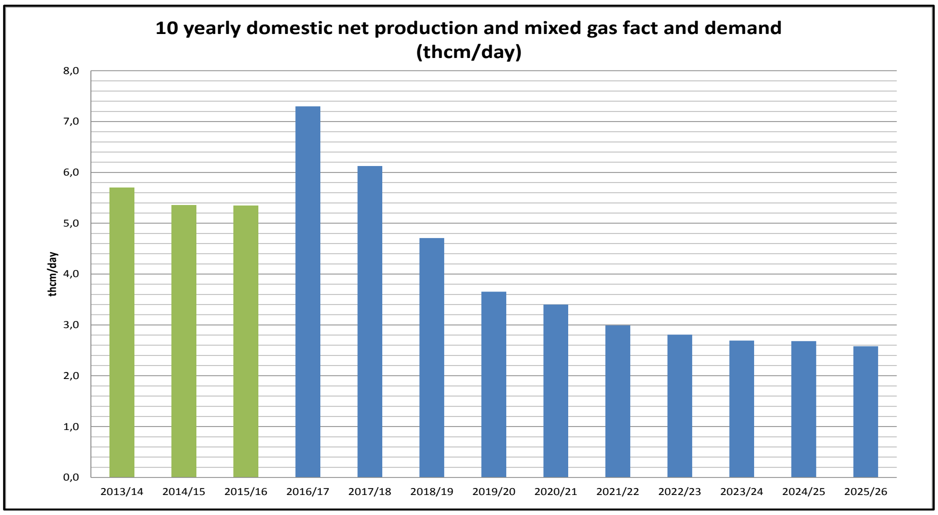
The diagrams show the entered gas into natural gas transmission system and also into the distribution system.

The forecasted annual net production data showed on the following chart:



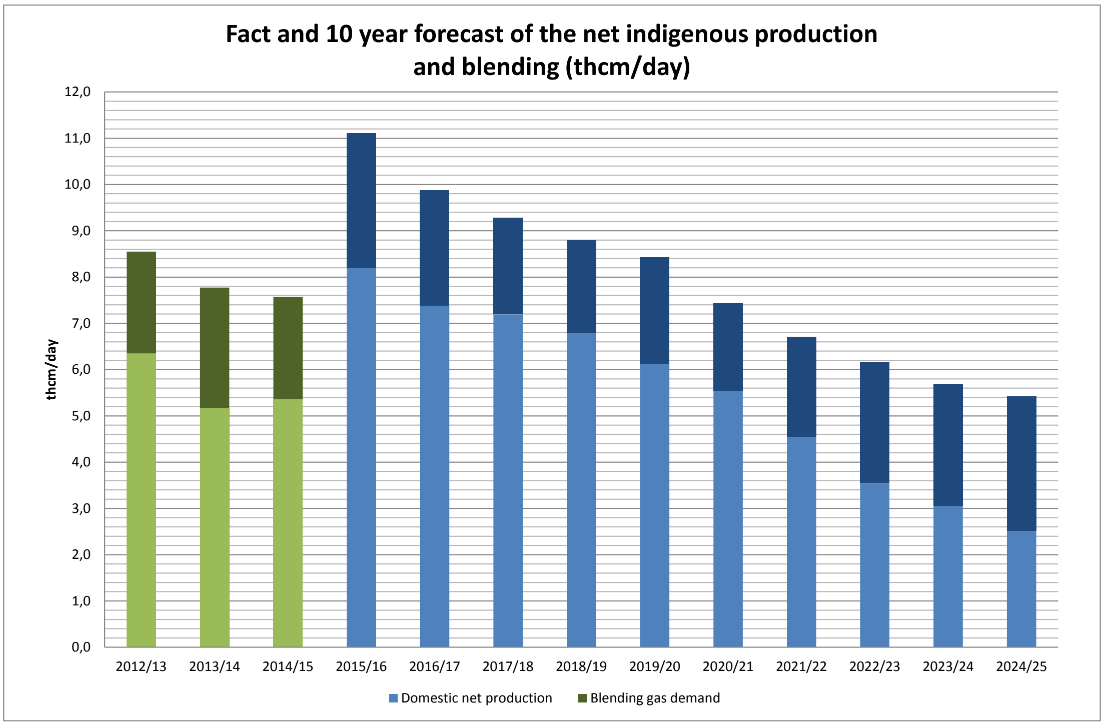
During the studied period the available capacity is expected to decrease from 1.7 bcm/a to 0.53 bcm/a, i.e. 1.17 bcm/a compared to the forecasted capacity in gas year 2016/2017.

The forecasted daily net production data are showed on the following chart:



During the studied period the forecasted capacity is expected to decrease from 7.3 Mcm/d to 2.6 Mcm/d, i.e. 4.7 Mcm/d compared to the forecasted capacity in gas year 2016/2017.

So, clearly both the annual and daily production is continuously decreasing because of the exhaustion of the certain production reserves, and the volume of such decrease has to be made up from import resources.



The chart above shows that in the next 10 years the proportion of blending for production will increase in comparison to the net production. The significant volume of blending will be required because of an increase in the volume of natural gas will contain more and more inert content.

2.2.2.2. Studied capacities at production entry points

In the next 10 years the startup of the following entry points is expected according to demands recorded:

Entry point	Expected start of operation	Max.capacity	
Quantities, capacities 15 °C		(cm/h)	(cm/day)
New entry point	2017 Q1	10,000	240,000

2.2.3. Available and studied capacities at storage entry points

2.2.3.1. Available and studied capacities at storage entry points and analysis

Based on the cooperation agreements between FGSZ Zrt. and storages, in case of the right level of load of storages and withdrawal during standard operation the total firm capacity is 53.1 Mcm/d, while in crises the capacity available is 79.6 Mcm/d.

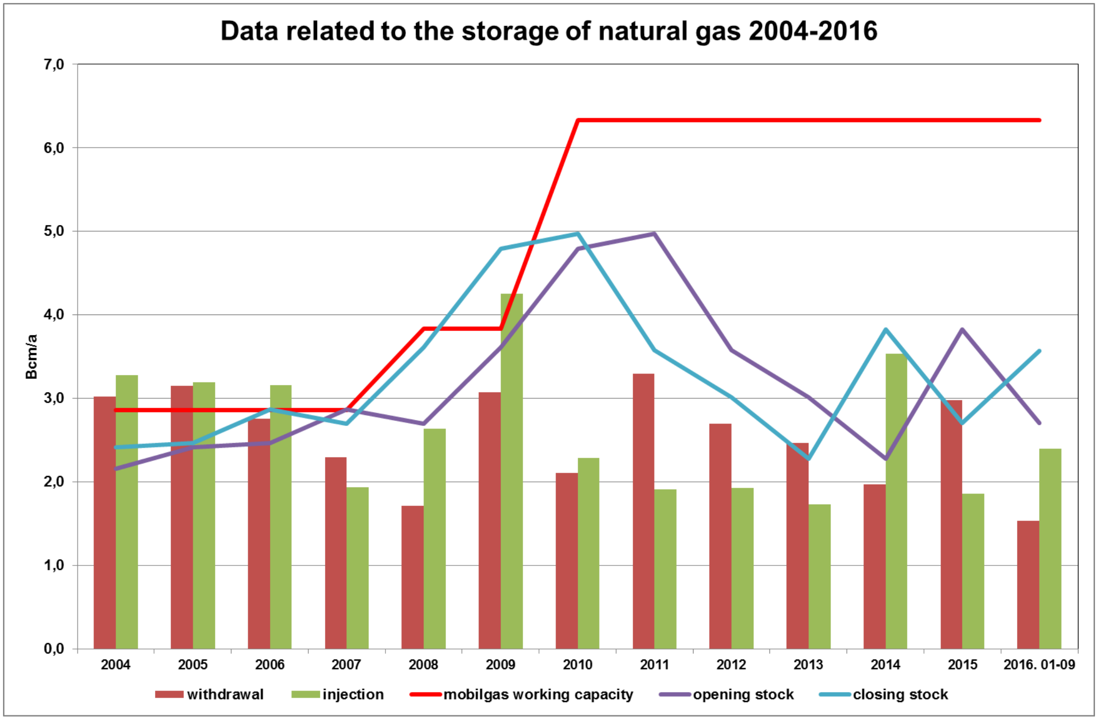
Source: gie.eu (GIE Storage Map, version May 2015)

Storage facilities	Maximum technical storage		Withdrawal	Injection
			FGSZ's point of view	
	Mcm		Mcm/day	Mcm/day
Kardoskút	280		2,9	2,16
Pusztaederics	340		2,9	2,88
Hajdúszoboszló	1 640		20,8	10,3
Zsana	2 170	firm	21,5	17,0
		interruptible*	6,5	--
Szőreg – 1	1 900**	firm*	5,0	2,7
		interruptible*	20,0	12,7
Sum	**4 160**		**79,6**	**47,7**

Note:

*the firm and interruptible capacities from commercial point of view.
**includesthe strategic storage, which is currently 915 Mcm

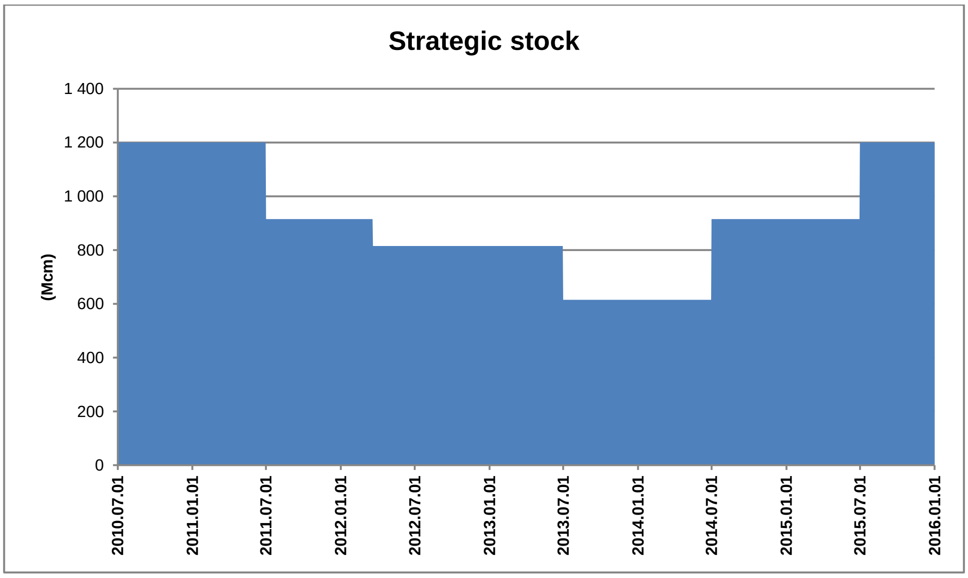
The following chart shows the withdrawal and injection data of the storages.



Note: Data for 2016 include data before end of September

Strategic storage

Pursuant to the decree on the extent of strategic natural gas storage (Decree No. 13/2015. (III. 31.) of the Minister of National Development in effect), the amount of strategic inventory stored is 915 million cubic metres. The diagram below shows the changes of the inventory during the last few years.



2.2.3.2. Studied capacities at storage entry points

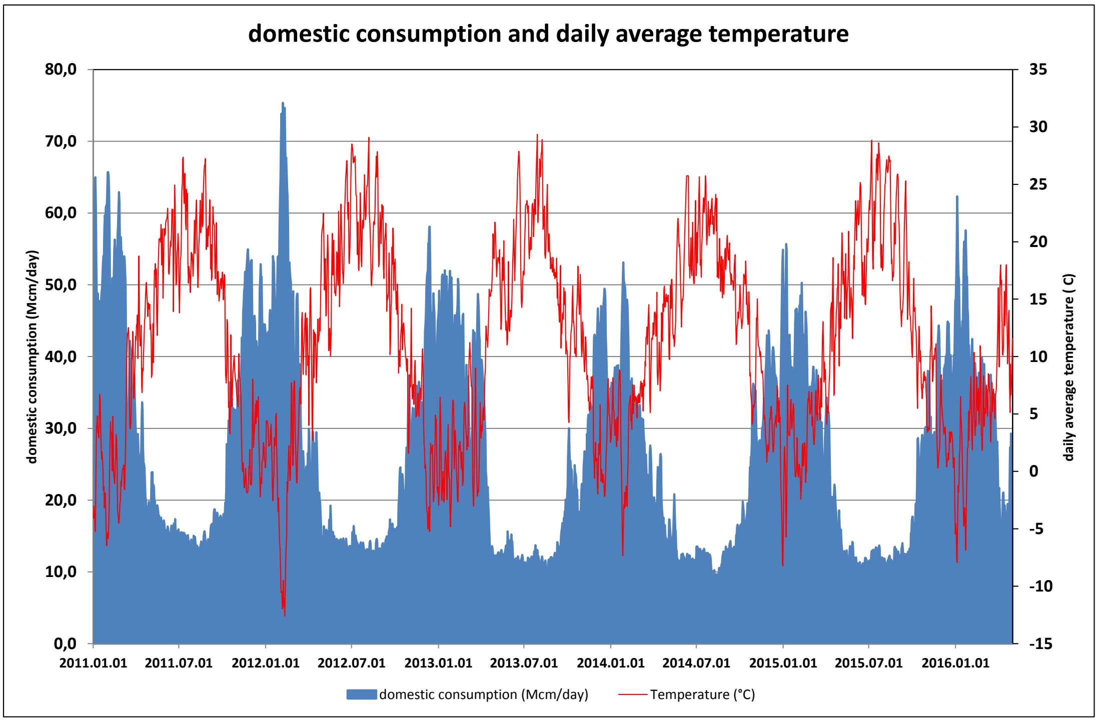
Based on the development proposals of the storage system operators, the annual and daily capacities of the storages will not change during the studied period.

2.3. Exit side of the natural gas transmission network

2.3.1. Available and studied capacities at cross-border exit points

Analysis of consumption in the period between 1 January 2010 and 31 October 2016

The chart below shows the consumption - daily average mean temperatures correlation data with respect to the total national consumption.

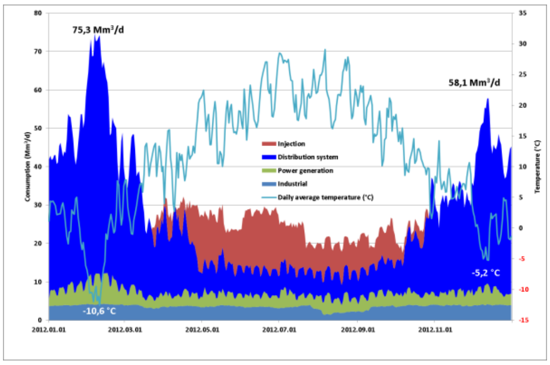


As you can see on the diagram the proportion of winter and summer consumption within the national consumption is 9.6 (with winter maximum being 75.3 Mcm/d (on 6 February 2012) and the summer minimum being 7.8 Mcm/d (on 10 August 2013). During the winter period consumption mainly depends on which day of the week we are looking at, from Monday to Friday consumption is close to even, however, during weekends consumption drops by 15-20 percent compared to the weekly average.

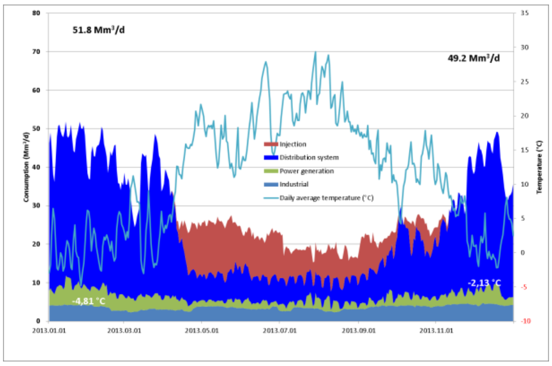
During the winter period consumption largely depends on temperature and on whether the day in question is a weekend or a weekday because during the week consumption is higher even if temperature is the same. On the day of the national peak consumption, i.e. on 6 February 2012 which was a Monday, the daily consumption reached 75.3 Mcm with the average mean temperature being -10.6 degrees Celsius.
Between 1 February 2012 and 8 February 2012 the lowest daily average temperatures of the past few years were metered, and consequently consumption reached the highest level in the past few years.

The diagrams below show the detailed consumption data of the past 4 years. These data include those of the year 2012 when temperatures were lower than average, and also the data from the year 2014 when the winter season was milder than usual.

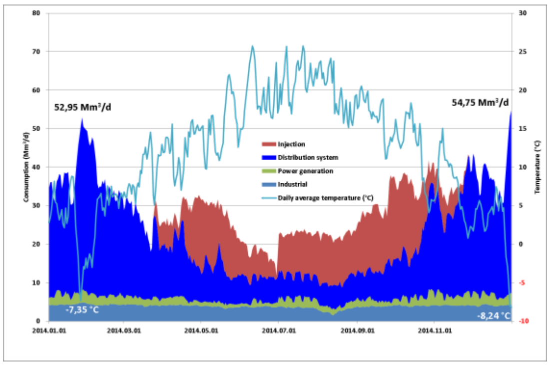
2012



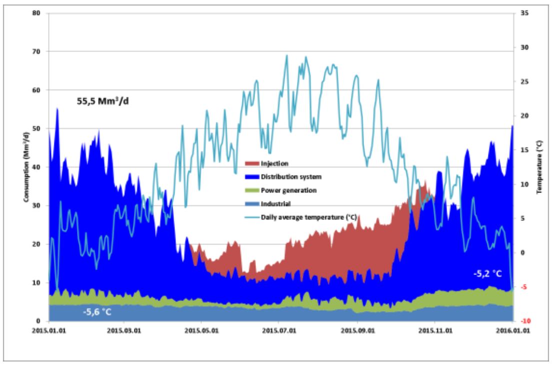
2013

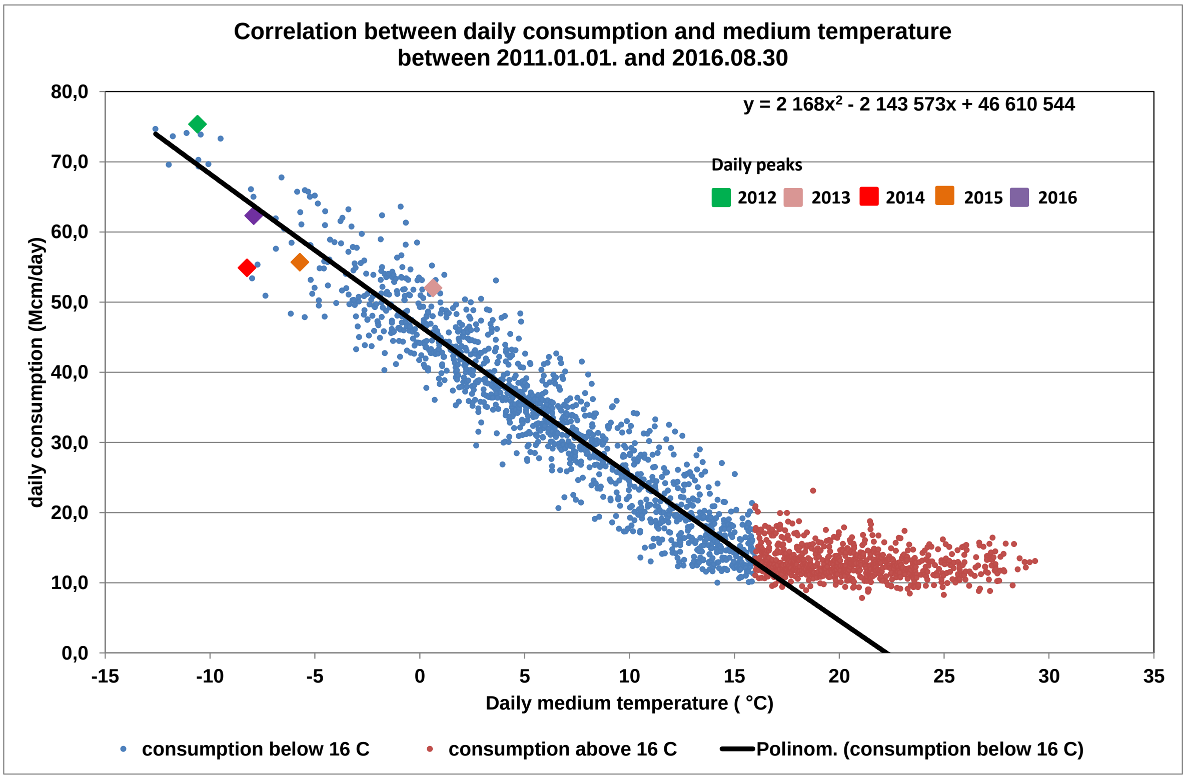


2014



2015

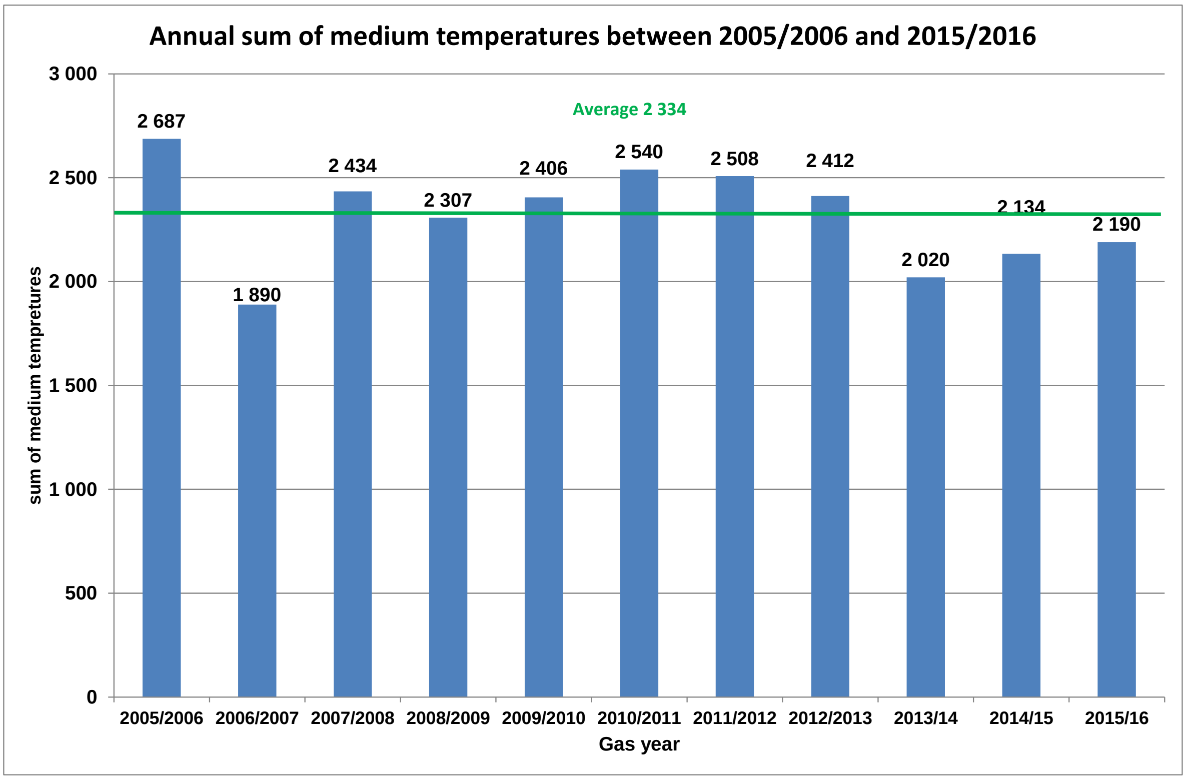




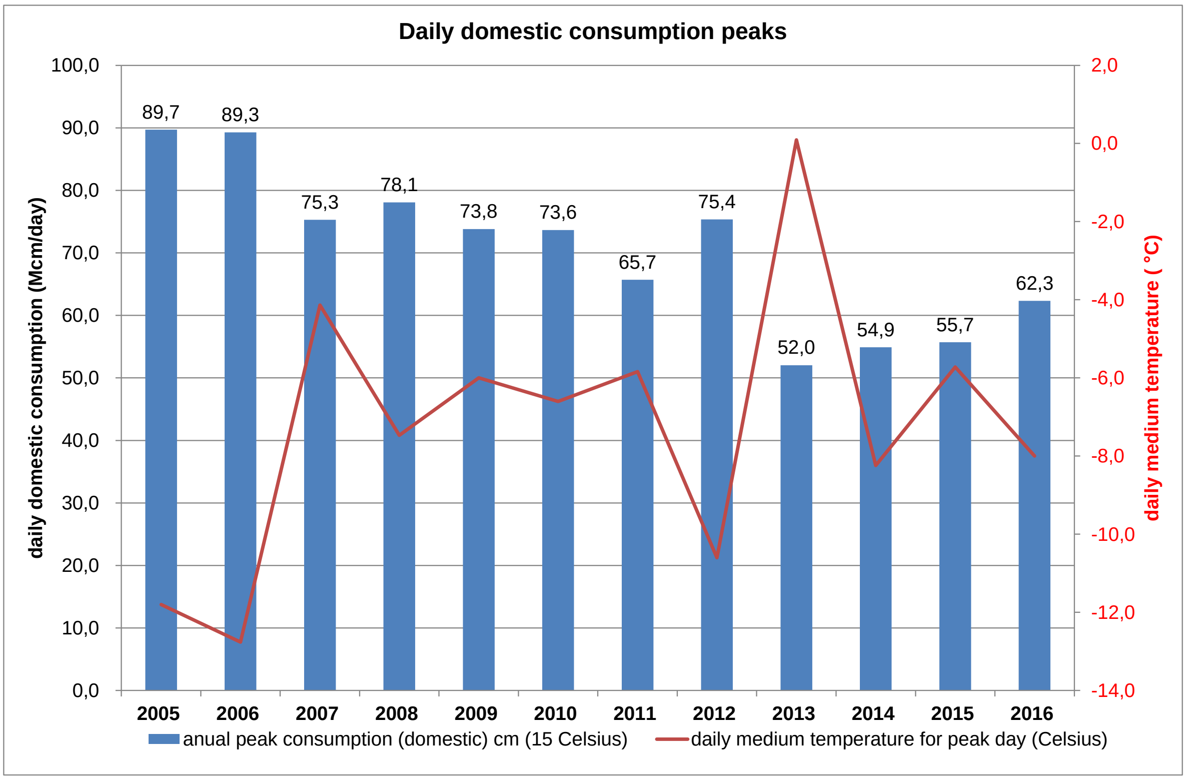
The chart above shows the temperature correlation of the national consumption for the period between 1 January 2011 and 31 August 2016. According to the trend function plotted to consumption value allocated to temperatures below the 16 °C heating limit, at a temperature of -12 °C the daily gas consumption is expected to be 73.4 Mcm which is 2.5 per cent lower than the actual gas consumption was on the coldest day of the period in question (on 5 February 2012, 75.3 Mcm/d, the average daily temperature was -10.6 °C).

If we take the equation of the trend line shown in the diagram, then if we use the average mean temperature defined with the so-called "1 in 20" principle and we calculate with the lowest daily average mean temperate that occurs once every 20 years which will be -15.3 ^{o}C, then the expected consumption is 80.9 Mcm/d (the ±5 per cent of which ranges between 76.9 and 84.9 Mcm/d).

Please note that on the winter peak days the consumers directly connected to the natural gas transmission network did not used up their booked capacities, thus in the past 4 years, on a Sunday under weekend consumption circumstances at a -10.6 ^{o}C national daily average temperature, the peak consumption would have reached **84.6 Mcm/day** had the industrial and power plant users directly connected used up all their booked capacities.



Based on the above and looking at the annual sum of medium temperatures the last few gas years may be considered milder than average.



Pursuant to Section 96(2) of the Implementation Decree of the Gas Supply Act

(2) The system operator shall verify by calculation, on an annual basis, the technical availability of the network based on the demands submitted. During the verification it shall take into consideration that the supply of registered contracted users and of the users who initiated registration should be ensured up to -12 °C.
Pursuant to Hungarian law, according to this the natural gas transmission network has to be prepared for a temperature of -12 °C. According to EU regulations the “1 in 20” principle shall be applied, however, this will produce an even lower value.

We have examined the consumption, if we use a „1 in 20” temperature, method according to 994/2010/EC (which use by most of European TSO), which is -15,3 °C.

Please note that during the 100 years in question 12 January 1987 was the day with the 4th coldest daily average mean temperature, which was -16.5 °C.

2.4. Changes in the data regarding the Hungarian distribution network in the past few years

The number of customers changed as follows within the distributor's area:

User categories/year	*2011*	*2012*	*2013*	*2014*	*2015*
Household consumers without gas meters	411 838	411 440	409 723	406 083	405 073
Household consumers with gas meters below 20 cm/h	2 923 863	2 891 754	2 807 677	2 827 035	2 824 750
Household consumers with gas meters above 20 cm/h	2 381	2 405	2 658	2 647	2 449
Total household consumption	3 295 760	3 250 000	3 220 058	3 235 405	3 232 272
Non-household consumers with gas meters below 20 cm/h	149 952	158 535	189 569	188 710	196 457
Non-household consumers with gas meters between 20-100 cm/h	16 584	15 120	13 772	13 573	13 367
Non-household consumers with gas meters between 101-500 cm/h	2 999	2 989	2 966	2 965	3 025
Non-household consumers with gas meters above 500 cm/h	521	498	485	501	502
Total non household consumers	212 378	212 000	206 792	205 749	213 351
Total	**3 508 138**	**3 462 000**	**3 426 850**	**3 441 154**	**3 445 623**

Data source: NNOs' data publication

From 2011 to 2015 the number of users decreased with 1.8 per cent (i.e. 62 515 entities).

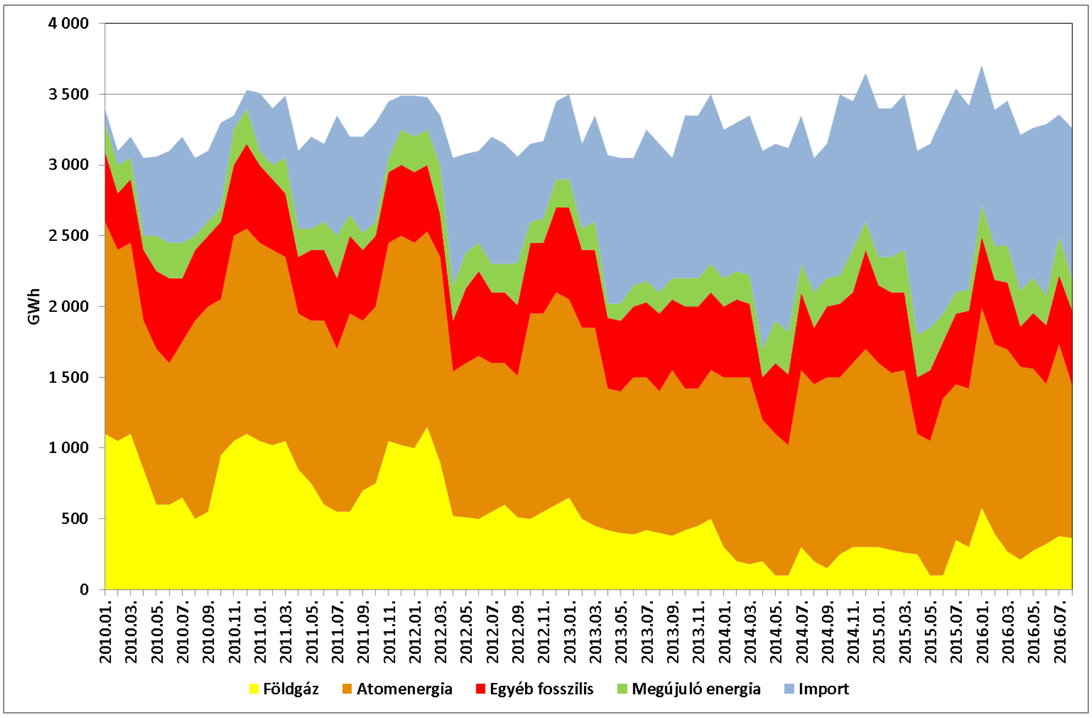
The gas volume accepted for distribution (given in thousand cubic metres) changed as follows within the distributor's area:

User categories/year	*2011*	*2012*	*2013*	*2014*	*2015*
Household consumers without gas meters	64 526	64 161	63 771	62 683	62 723
Household consumers with gas meters below 20 cm/h	3 372 123	3 122 784	3 086 342	2 686 076	2 997 512
Household consumers with gas meters above 20 cm/h	164 011	148 652	142 610	134 528	147 518
Total household consumption	3 600 660	3 335 597	3 292 723	2 883 287	3 207 753
Non-household consumers with gas meters below 20 cm/h	409 419	382 060	374 574	362 964	405 248
Non-household consumers with gas meters between 20-100 cm/h	575 323	549 314	563 639	477 091	510 533
Non-household consumers with gas meters between 101-500 cm/h	777 024	698 443	686 036	756 345	679 156
Non-household consumers with gas meters above 500 cm/h	2 289 688	2 136 834	2 035 234	1 892 260	1 979 830
Total non household consumers	4 051 455	3 766 651	3 659 483	3 488 661	3 574 767
Total	**7 652 115**	**7 102 248**	**6 952 206**	**6 371 948**	**6 782 520**

Between 2011 and 2015 the gas volume consumed from the distribution network went down by 11.36 per cent (869,595 thousand cubic metres). Between 2011 and 2015 the total gas volume accepted for household use went down by 10.91 % (392,907 thousand cubic metres), the gas volume consumed by non-household decreased with 11.77 % (476,688 thousand cubic metres) whereof i.e. 65.00 % (309,859 thousand cubic metres) gas volume decreased in case of non-household consumers of 500 cubic metres per hour and above.

2.5. Natural gas consumption for power generation

In recent years there has been a gradual decrease in natural gas consumption, the primary reason of this was that the demand for natural gas in electricity generation has dramatically dropped. The use of natural gas for electricity generation and the extent of electricity import in the period between 1 January 2010 and 31 July 2015 are shown in the diagram below:



Data source: ENTSOE and MAVIR

In the studied period the proportion of natural gas in electricity generation fell back significantly, while between 2010 and 2012 its average proportion amounted to 28.83 per cent (peaking at 37.52 per cent in February 2012), from 2013 it has gradually lost its importance and its average proportion dropped to 12.49 per cent (in the period between January 2013 and July 2015).

The following table clearly shows the increase in the proportion of imported electricity:

2010	11,73%
2011	15,10%
2012	18,04%
2013	27,96%
2014	33,47%
2015	36,26%
2016*	30,70%

*between 01/2016-08/2016 estimated

As you can see in the diagram, the natural gas has not been substituted by other energy sources, rather the missing volume of electricity was supplied by imported electricity.

The possible reason behind this is that at the moment the Hungarian natural gas based electricity production cannot compete with the imported electricity.

2.6. Gas consumption between the gas years 2011-2012 and 2015-2016

Between the gas years 2011-2012 and 2015-2016 the annual consumption of the natural gas distribution licensees, industrial and power plant users was as follows.

bcm/year	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**
DSO	7,3	6,9	6,2	6,4	7,0
Industry	1,3	1,4	1,4	1,4	1,4
Power plant	2,0	1,3	0,8	0,7	0,7
Total	**10,6**	**9,6**	**8,4**	**8,5**	**9,1**

The data in the table clearly shows that the decrease in natural gas demand by consumers supplied by distribution licensees ceased, and in the last gas year it even increased to some extent. The gas volumes required by industrial consumers directly supplied from the natural gas transmission network have not changed much in recent years. However, we see a drastic plummeting in the gas demand of power plants which went down by 65 per cent in the period in question.

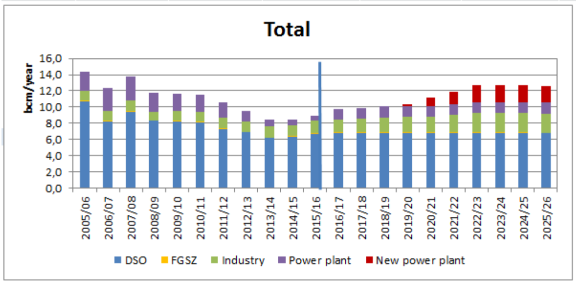
2.7. Forecast for a total national consumer demand

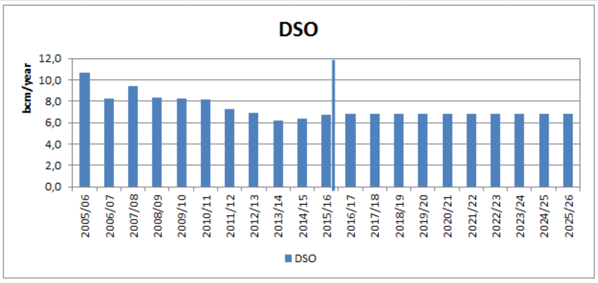
In the next 10 years the annual consumption of the natural gas distribution licensees, industrial and power plant users is expected to be as follows.

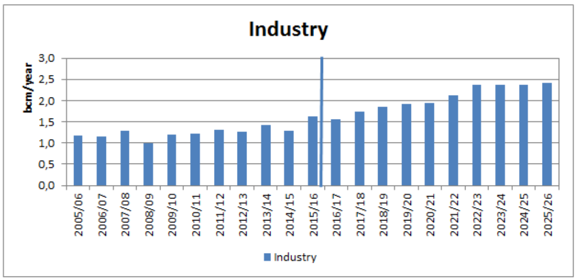
bcm	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
DSO	6,8	6,8	6,8	6,8	6,8	6,8	6,8	6,8	6,8	6,8
Industry	1,6	1,7	1,9	1,9	1,9	2,1	2,4	2,4	2,4	2,4
Power plant	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3
new power plant	0,0	0,0	0,0	0,3	1,0	1,5	2,1	2,1	2,1	2,1
Total	9,7	9,9	10	10,3	11,1	11,8	12,6	12,6	12,6	12,6

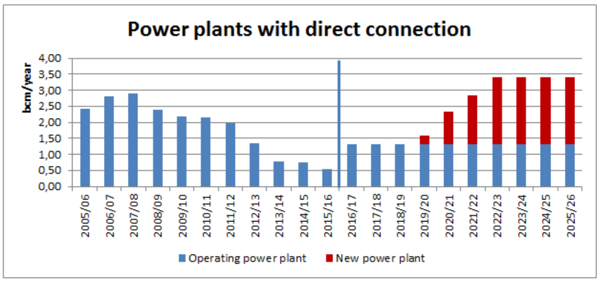
The data in the table clearly shows that the volumes demanded by consumers supplied by distribution licensees are expected to stagnate. In a few years we are expecting the gas demand of industrial consumers and power plant users directly supplier from the natural gas transmission network to start going back up.

The following charts shows the past fact data and the forcasted Hungarian exit demand









The chart shows that according to forecasts the increase in consumption will be primarily generated by new projected power plants and industrial consumers directly connected to transmission system.

2.8. Examined new entry and exit points

Entry points

Based on the demands submitted in the next 10-year period the following new entry points are expected to be commissioned:

Name of entry point	**Expected start of operation**	**Maximum capacity**	
Volumes, capacities are on 15 °C		(thcm/h)	(thcm/day)
New entry point(s)	2017 Q1	10,0 (14,0*)	240,0 (336,0*)

* The figures in brackets contain the blending/mixing gas volumes

Delivery points

Based on the demands submitted in the next 10-year period the following new delivery points are expected to be commissioned:

Name of delivery point	**Expected start of operation**	**Maximum capacity**	
Volumes , capacities are on 15 °C		(thcm/h)	(thcm/d)
New industrial point(s)	2017.01.01.	18,0	432,0
New power point(s)		256,2	6148,8

* Parties have not signed connection agreement.

2.9. Possible capacities of transmission corridors

Subject to market demand, with further developments the following volumes theoretically can be transmitted to Hungary at the relevant cross-border points.

Entry at cross border points

Annual gas demands data	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
	bcm/a	bcm/a	bcm/a	bcm/a	bcm/a	bcm/a	bcm/a	bcm/a	bcm/a	bcm/a
RO-HU-AT I. Csanádpalota (RO>HU)	0,0	0,0	0,0	0,0	1,75	1,75	1,75	1,75	1,75	1,75
RO-HU-AT II. Csanádpalota (RO>HU)	0,0	0,0	0,0	0,0	0,0	0,0	4,4	4,4	4,4	4,4
Eastring	0,0	0,0	0,0	0,0	0,0	max. 20,0	max. 20,0	max. 20,0	max. 20,0	max. 20,0

Exit at cross border points

Annual gas demands data	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
	bcm/a	bcm/a	bcm/a	bcm/a	bcm/a	bcm/a	bcm/a	bcm/a	bcm/a	bcm/a
RO-HU-AT I. Csanádpalota (HU>RO)	0,0	0,0	0,0	0,0	1,75	1,75	1,75	1,75	1,75	1,75
RO-HU-AT I. Mosonmagyaróvár (HU>AT)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
RO-HU-AT II. Csanádpalota (HU>RO)	0,0	0,0	0,0	0,0	0,0	0,0	4,4	4,4	4,4	4,4
RO-HU-AT I. Mosonmagyaróvár (HU>AT)	0,0	0,0	0,0	0,0	0,0	0,0	5,2	5,2	5,2	5,2
Eastring	0,0	0,0	0,0	0,0	0,0	max.20,0	max. 20,0	max. 20,0	max. 20,0	max. 20,0

The 10-year Development Proposal of FGSZ 31 December 2016

The 10-year Development Proposal has been drafted in consideration of Act XL of 2008 (Gas Supply Act), Government Decree 19/2009 (I.30.) (Implementation Decree), the provisions of the Business and Commercial Code (BCC), authority resolutions No. 2615/2016. A summary of the proposal is published below.

General Conditions

The developments required for the improvement of Hungarian network have been defined by FGSZ Ltd. based on the analysis of the national natural gas transmission network and the trends in capacity demands submitted to the natural gas transmission network by taking into consideration the demand of connected system operators. The major part of the Hungarian developments are necessitated by changes that occurred in local capacity demands, and are also required to increase the security of supply, and for the transmissions related the Romania-Hungary-Austria transmission Corridor/Southern Corridor which if constructed by including the network of FGSZ Ltd. will require further pipeline or compressor station developments, however, as a result the Hungarian natural gas transmission network will see substantial transit of natural gas.

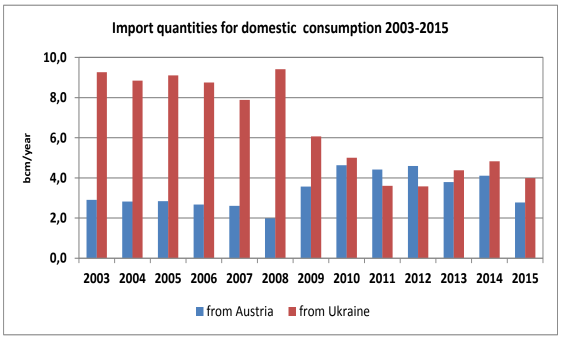
The development proposal has been compiled by FGSZ Ltd. with a view to giving the country an opportunity to take advantage of the market changes indicated by joining the European integrated market and increasing the transit gas volume transmitted through the country thus enhancing the strategic importance of Hungary on a regional and European level. With this Hungarian end-consumers will have the chance to access a more competitive network usage, and what is more important through an access to diverse natural gas sources it would be possible to receive import gas at more favourable prices.

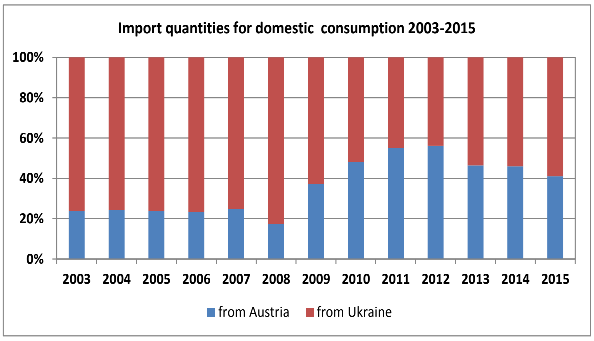
Efforts on EU level to establish a single EU gas market

The gas industry related provisions of the new EU energy package (2009/73/EC, 2009/715/EC, 2033/55/EC, 994/2010/EC, 347/213/EC) continue with the liberalisation and integration of the European gas markets as part of which natural gas transmission networks are extended and the security of supply is increased, and also the efforts of creating a liquid, uniform European gas market become more important with the aim of setting up the gas-gas competition within Europe. The validity of such aim is reinforced and confirmed by the European gas exchanges which are becoming more and more sophisticated through the infrastructure developments. The higher the number of physical gas sources used by each trading point and the larger the available gas volume are, i.e. the more liquid a hub becomes, the higher the possibility is that the positive impact of the different gas sources on competition affects to the better price of the gas traded on the hub. Furthermore, the higher the number of routes or the larger the capacity is with which such hubs are physically interconnected, the more extensive the price convergence between European hubs is, therefore the transmission distance between the hubs will have a greater impact on the collateral elements in the gas rates applied on gas exchanges.

Because of the larger number of buyers and sellers, prices are defined by trading on gas hubs subject to the current supply and demand, while the price regulating construction currently dominant mostly in the eastern part of Europe only reflects the current relations of supply and demand as far as long-term oil indexed contracts are concerned.

By ensuring unlimited access to gas hubs and gas transmission infrastructures will create a possibility for competition and an option to choose between two, differently priced gases the effect of which is felt in the volume of transmission from Austria.

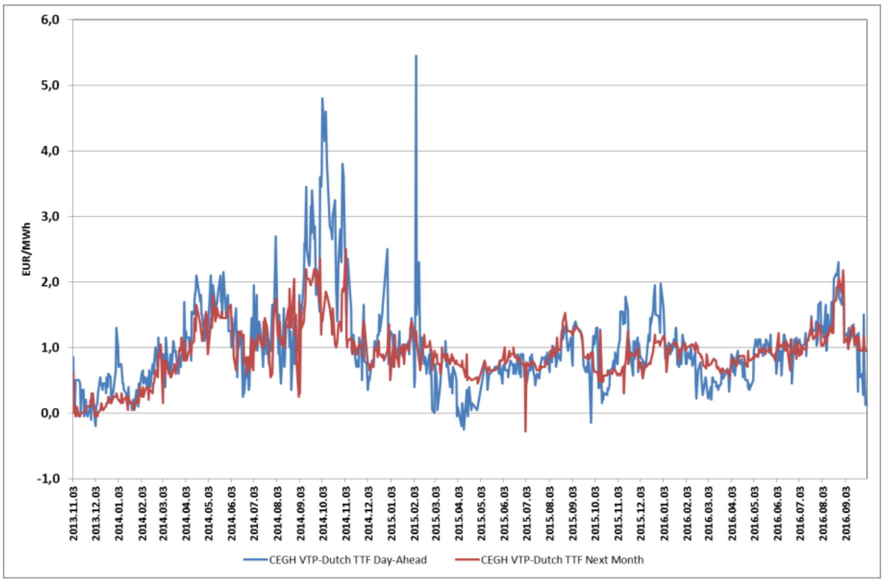




This kind of market approach is behind the new EU provisions, the European Commission is trying to create a more effective infrastructure with the Infrastructure Regulation 347/2013/EU which focuses on the identification of projects of European interest (PCI) and on setting up the financial funds required for its implementation.

However, there are still many countries in the region that cannot enjoy the benefits of spot prices to the maximum extent because of the underdeveloped infrastructure. The Eastern European member states, including Hungary, are infrastructural bottlenecks, which means that the non-diverse structure of import and their substantial dependence on Russian import prevent them from making the most of the price difference between spot prices and the prices of long-term contracts. The important difference between the western and eastern member states of the European Union is that **in the eastern member states the level of interconnectivity between networks and the capacities of interconnections are much lower than those in West Europe**, also the networks in the east are only suitable for transmitting gas from east to west which is not only not beneficial as regards the development of the gas market, but in some cases means a serious risk to the security of supply.

The following chart shows the difference between the Dutch TTF and Austrian CEGH gas prices. CEGH prices were higher during the studied period thus domestic market supplier traders payed more for sport market gas sources.



Source: FGSZ, Platts data

FGSZ Ltd.'s point of view that the ever increasing prices of gas imported to Hungary can only be reduced with market means like by involving new sources, increasing the volumes of cross border transmission and through this by setting up gas-gas competition, however this requires the availability of new gas sources and so the transmission system needs to be developed both in Hungary and the region. Considering the market-related and non-market related risks, Hungary will be able to step up its regional gas market role through the development of the natural gas transmission network, while significant savings can be realised for Hungarian consumers by making cheaper gas available through diversifying the structure of import and creating a competition between gas and gas.

3. Development Proposal

Most of the examinations were conducted on possible RO-HU-AT transmission, plan on project realisation and planning can be proposed considering the market demand survey on RO>HU direction entry and HU>AT exit demand according to the terms and conditions defined in the above mentioned NRA decree.

We studied the developments making feasible implementation of the Romania-Hungary-Austria transmission corridor with European interest (At the Hungarian-Romanian border max. 4.4 bcm/year bi-directional capacity; at the Hungarian-Austrian border max. 5.2 bcm/year bi-directional capacity) and the implementation of DN1000 pipeline from Városföld node in the Western direction. The transmission system could be able to ensure long term basis the bi-directional transmission from and to HAG pipeline and fullfill of demands on RO-HU-AT transmission route which would make the TSO to create a regional hub, and for new and existing power plant demands can be satisfied on Dunántúl Region with the implementation of these pipeline sections.

FGSZ position is that gas-gas market competition shall be favorable and transmission tariffs on domestic transsmision system would decrease as transmission volumes from entry IPs to exit IPs would increase. This volume can be increased further up to 8.8 bcm/year with additional developments.

Taking into consideration that the market and non-market risks Hungary is capable to increase its regional gas market role through development of gas transmission system in the next decade. Security of supply would become more favorable via diversification of import structure, implementation of Southern Corridor and Northern-Southern Corridor, also domestic consumers' cost reduction is available on national economy level with the help of cheaper natural gas through gas-gas market competition. We consider as a consequence that the end consumer price can be best influenced through decrease of procurement price of natural gas.

Favorable gas price comparing to current ones can be helped with new TSO projects, which make viable connection of new sources and implementation of new transmission routes.

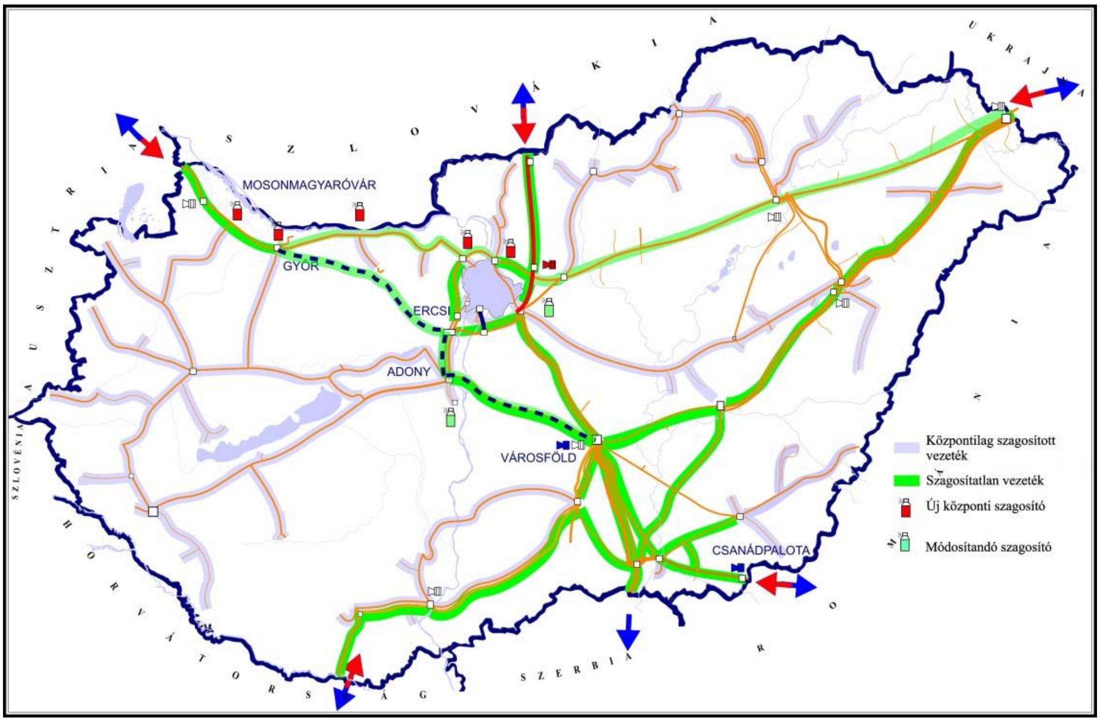
Implementation time schedule of examined projects in Development Proposal 2016:

Conducted examinations

In case RO-HU-AT corridor implementation subject to market demand the following develeopments are needed:

- Installing a 112 km DN1000, PN100 pipe between Ercsi and Győr,
- Installing a 98 km DN1000, PN100 pipe between Városföld and Ercsi,
- Installing a 11 km DN800, PN63 pipe between Ercsi and Százhalombatta,
- Extension of the compressor station in Városföld with a 5.7 MW unit,

The following chart shows the examined projects:



If the projects of the RO-HU-AT transmission corridor are implemented, then the compressor stations in Dorog and Mosonmagyaróvár do not need to be developed since these compressor stations cannot entirely ensure the security of supply in the whole of the Transdanubian region and the costs of using compressors are substantial. Therefore the implementation of those compressor station establisment and expansion only recommended if the realisation of the RO-HU-AT corridor is not possible:

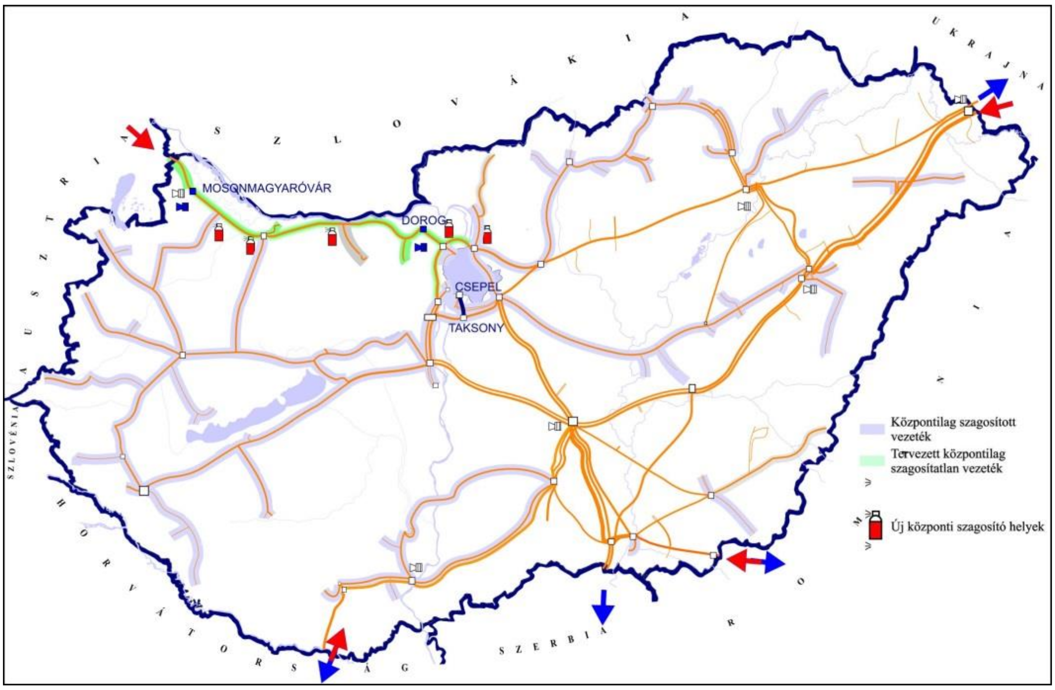
Implementation schedule:

Security of supply at Transdanubian region	**1st year**				**2nd year**				**3rd year**			
Name of projects	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Ercsi-Győr DN1000, PN100 pipeline												
Városföld-Adony-Ercsi DN1000, PN100 pipeline												
Ercsi-Százhalombatta DN800, PN63 pipeline												
Városföld comp. st. expansion with 5,7 MW unit												
Csanádpalota comp. st. (2 x 4,5 MW)												
Csanádpalota measuring st. phase II. (to 500 thousand m^3/h)												
Csanádpalota comp.st. phase II. (1 x 4,5 MW)												

In case of RO-HU-AT corridor will not be implemented the following develeopments would be needed:

- Dorog compressor station implementation,
- Mosonmagyaróvár compressor station expansion,

The following chart shows the examined projects:



Implementation schedule:

Name of project	1st year				2nd year				3rd year			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Construction Dorog compressor station 17,1 MW (with implementation of new units or relocated units)												
Build in of new unit(s) at Mosonmagyaróvár compressor station												
Replacement of pressure controller module at Mosonmagyaróvár compressor station												

Examined projects in connection with Slovenian-Hungarian interconnector can be found in chapter 6.9, ones in connection with EASTRING pipeline can be found in chapter 6.10.

4. Security of supply analysis (N-1), reverse flow between EU member states

As part of this we assess the following:

- N-1 security of supply analysis,
- Reverse flow between EU member states in the interconnection points,

4.1. N-1 security of supply analysis

The purpose of the N-1 analysis is to identify congestion risks arising in case of the failure of the largest independent natural gas infrastructure, and to define the analysis to be performed to this effect with respected to the failure of the largest infrastructure, and the assessment of the gas demand and the available sources in different scenarios. As part of this the parameters of the N-1 formula are defined pursuant to Regulation (EU) No. 994/2010, and then the N-1 formula is used to perform the calculations.

Regulation EU No. 994/2010 applied:

"(13) The failure of the single largest gas infrastructure, the so-called N-1 principle, is a realistic scenario. Using the failure of such an infrastructure as a benchmark of what Member States should be able to compensate is a valid starting point for an analysis of the security of gas supply of each Member State.

Article 6

Infrastructure standards

(1) "Member States or, where a Member State so provides, the Competent Authority shall ensure that the necessary measures are taken so that by 3 December 2014 at the latest, in the event of a disruption of the single largest gas infrastructure, the capacity of the remaining infrastructure, determined according to the N – 1 formula as provided in point 2 of Annex I, is able, without prejudice to paragraph 2 of this Article, to satisfy total gas demand of the calculated area during a day of exceptionally high gas demand occurring with a statistical probability of once in 20 years. This is without prejudice, where appropriate and necessary, to the responsibility of system operators to make the corresponding investments and to the obligations of transmission system operators as laid down in Directive 2009/73/EC and Regulation (EC) No 715/2009"

CALCULATION OF THE N-1 FORMULA

Defining the N-1 formula

The N-1 formula describes the technical capacity of the gas infrastructure by which its can satisfy the total gas demand of the calculated area in case of the failure of the single largest gas infrastructure during a day of exceptionally high gas demand occurring with a statistical probability of 1 in 20 year.

Gas infrastructure includes the gas transmission network, including the system interconnections, and the production, LNG and storage facilities related to the calculated area.

In case of a disruption of the single largest gas infrastructure the technical capacity of the remaining infrastructure (1) should equal the total daily gas demand of the calculated area that occurs during a day of exceptionally high gas demand occurring with a statistical probability of 1 in 20 year.

The result of the N-1 formula calculated as follows should be at least 100 per cent.

Calculation method of the N-1 formula

$$N-1\,[\%] = \frac{EP_m i + P_m + S_m + LNG_m - I_m}{D_{max} i}\; x\; 100, \qquad N-1 \geq 100\,\%$$

Defining the parameters of the N-1 formula:

“Calculated area” means the geographical area defined by the competent authority with respect to which the N-1 formula is calculated.

Demand-side definition

“D max i”: means the total daily gas demand (in mcm/d) of the calculated area during a day of exceptionally high gas demand occurring with a statistical probability of 1 in 20 years.

Supply-side definitions

“EP_m”: technical capacity of entry points (in mcm/d), other than production, LNG and storage facilities covered by P_m, S_m and LNG_m, 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 mcm/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 mcm/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 mcm/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”: means the technical capacity of the single largest gas infrastructure (in Mcm/d) with the highest capacity to supply the calculated area.

4.2. N-1 calculations in consideration of the existing and planned capacities

Calculations have been made with respect to the January season of the next 10 gas years. In the assessment we took into consideration the entry point at the Ukraine-Hungary border to be the largest import entry point that fails and, accordingly, the total capacity of the Austrian send-in, the storage facility removal and the forecasted maximum production.

The N-1 compliance of the transmission system may be deemed acceptable if the result of such calculation is a value exceeding 1.

With respect to the period in question we did not take into consideration the demand of the cross-border exit points.

For the purpose of the calculation, storage capacities with a stock value of up to 2.4 bcm were taken into consideration as 100 per cent which in this case means 79.6 million cubic metres per day. If the storage facility stock fell to 0.5 billion cubic metres, then the storage facility capacity should be taken into consideration as 64 per cent (65.0 million cubic metres per day).

For the purpose of the calculations the value of D_{max} was defined with the expected domestic consumption forecasts (taking into consideration the total power plant demand).

The Eastring as prospective new project was taken into consideration as a capacity at the entry point in Beregdaróc. Accordingly, the N-1 calculations are the same for the entry at Beregdaróc towards Ukraine.

Applied equation:

$$\boxed{N-1_{Téli} = \frac{\sum_{i=2}^{n} EP\_i + Sm\_STRAT + Pm}{D\max\_i} \geq 1}$$

The result of the calculations including the power plant demand (Dmax):

If there is no new entry capacity in the next 10 years.

Taking into account the existing entry capacities, version of without development

Mcm/day 15°C

	EP_1	EP_2	EP_3	EP_4	EP_5	EP_6	Sm+ Strategic*	Pm	Dmax**	N-1 Winter_1
2016/17	12,1	12,0	0,24				79,6	7,2	77,5	1,43
2017/18	12,1	12,0	0,24				79,6	6,1	78,0	1,41
2018/19	12,1	12,0	0,24				79,6	4,8	78,5	1,39
2019/20	12,1	12,0	0,24				79,6	3,8	80,9	1,33
2020/21	12,1	12,0	0,24				79,6	3,6	84,9	1,27
2021/22	12,1	12,0	0,24				79,6	2,9	87,7	1,22
2022/23	12,1	12,0	0,24				79,6	2,8	88,2	1,21
2023/24	12,1	12,0	0,24				79,6	2,7	88,2	1,21
2024/25	12,1	12,0	0,24				79,6	2,7	88,3	1,21
2025/26	12,1	12,0	0,24				79,6	2,6	88,3	1,21

EP_1- HAG entry
EP_2- Slovak entry
EP_3- Romanian entry
EP_4- Croatian entry
EP_5- Slovenian, 50thcm/h firm capacity
EP_6- Eastring entry

Sm+ strategic* Commercial and strategic storages
Pm Domestic product
Dmax** Domestic consumption with new Power demand

The result of the calculations above shows that, without development, the Hungarian system, the available entry points and the forecast demand (including the power plant demand) meet the requirements of the N-1 principle in the winter peak season.
Furthermore, forecasts indicate that without development substantial loss of security of supply is expected in the next 10 years, but even so, the transmission system will still comply with the criteria of the N-1 even in the 10th year (1.43-1.21).

Taking into account the existing entry capacities with Romanian (II. stage, BRUHA), Croatian, Slovenian and Eastring developments

Mcm/day 15°C

	EP_1	EP_2	EP_3	EP_4	EP_5	EP_6	Sm+ Strategic*	Pm	Dmax**	N-1 Winter_1
2016/17	12,1	12,0	0,24				79,6	7,2	77,5	1,43
2017/18	12,1	12,0	0,24	1,20			79,6	6,1	78,0	1,41
2018/19	12,1	12,0	0,24	11,30			79,6	4,8	78,5	1,53
2019/20	12,1	12,0	0,24	11,30			79,6	3,8	80,9	1,47
2020/21	12,1	12,0	4,80	19,20			79,6	3,6	84,9	1,55
2021/22	12,1	12,0	4,80	19,20	1,20	53,60	79,6	2,9	87,7	2,11
2022/23	14,4	12,0	12,00	19,20	1,20	53,60	79,6	2,8	88,2	2,21
2023/24	14,4	12,0	12,00	19,20	3,60	53,60	79,6	2,7	88,2	2,23
2024/25	14,4	12,0	12,00	19,20	3,60	53,60	79,6	2,7	88,3	2,23
2025/26	14,4	12,0	12,00	19,20	3,60	53,60	79,6	2,6	88,3	2,23

EP_1- HAG entry
EP_2- Slovak entry
EP_3- Romanian entry
EP_4- Croatian entry
EP_5- Slovenian, 50thcm/h firm capacity
EP_6- Eastring entry

Sm+ strategic* Commercial and strategic storages
Pm Domestic product
Dmax** Domestic consumption with new Power demand

The result of the calculations above shows that, the Hungarian system, the available entry points and the forecast demand (including the power plant demand) meet the criteria of the N-1 principle in the winter peak seasons of the next 10 years considering the Romanian, Crotian, Slovenian developments, the Romania-Hungary-Austria corridor pipeline system developments, and from the gas year 2022/23 will result in major (2.21) improvement in the security of supply (1.43-2.23).

Considering the above, the demand submitted so far the N-1 security of supply factor will be higher than 1 in the next 10 years cycle.

As a result of the assessment considering the present development proposal the previous statements were fully and completely proven as regards the security of supply factor. Apart from the reduced consumption, another reason for this is the increase in the number and volume of send-in sources, while the storage facility capacity remained the same, despite of the fact the Hungarian production is follows a trend of substantial decrease.

Accordingly, considering the available entry points and the forecast demand including power plants, and also the projected developments, the Hungary system will meet the N-1 criteria (considering the power plant demand as well) in the winter peak seasons of the next 10 years.

5. Developments of the European gas transmission networks

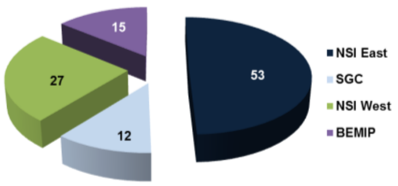
Regulation (EU) No. 347/2013 of the European Parliament and of the Council of 17 April 2013 stipulates the guidelines for trans-European energy infrastructure with respect to the strategic priority corridors which are as follows:

1. North-South gas interconnections in Western Europe (NSI West)
2. North-South gas interconnections in Central Eastern and South Eastern Europe (NSI East)
3. Southern Gas Corridor (SGC)
4. Baltic Energy Market Interconnection Plan in gas (BEMIP Gas)

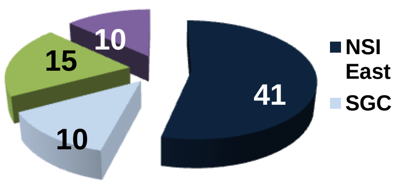
The regulations stipulates, primarily, the rules required to identify the projects of common interest (PCI), the conditions of rapid permitting procedures required for their timely implementation, the rules of cross-border cost sharing and the criteria of winning EU funding.

Our region and Hungary is involved in the priority national gas corridors 2 (NSI East) and 3 (SGC).

Pursuant to Regulation (EU) No. 347/2013 the EU list of projects of common interest (hereinafter the PCI List) shall be defined which needs to be revised every two years. The **first PCI List** is defined in the Commission Delegated Regulation (EU) No 1391/2013 which includes a total of 107 projects of common interest for the four priority gas corridors.



The **second PCI List** of projects of common interest was published on 18 November 2015. The distribution of the 76 projects from the second list in case of the four high priority gas transit routes is the following:



The benefits of PCI status for a project:

- Accelerated permitting procedure
- Better regulatory conditions
- Access to financial funding

Please find a description of the projects/project clusters listed in the second EU list which primarily affect the region and Hungary.

RO-HU-AT natural gas transmission corridor

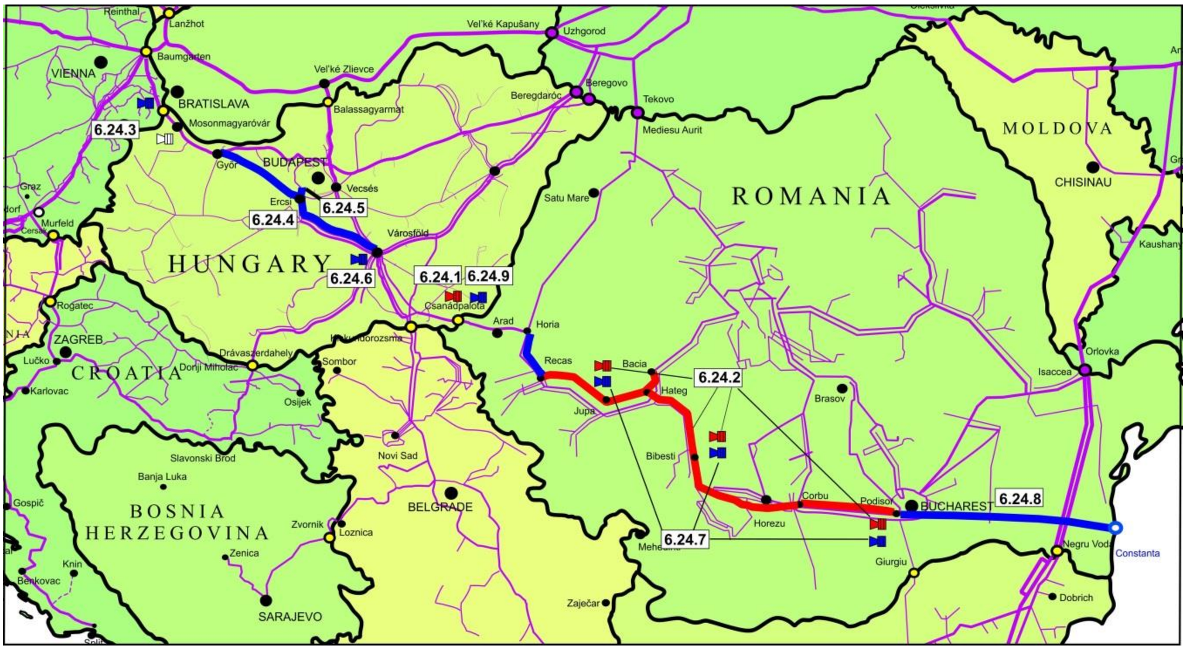
The project cluster includes a total of 9 project, 5 of which affect the area of Hungary, 3 that of Romania and 1 that of Austria. The purpose of the corridor is to ensure a bi-directional transmission capacity of 1.75 bcm/a in the 1st phase (between Romania and Hungary), and at least 4.4 bcm/a in the 2nd phase (along the total length of the corridor).

The projects included in the cluster 6.24 of the second PCI List are as follows:

- 6.24.1 Romanian-Hungarian reverse flow: Hungarian section 1st stage CS at Csanádpalota
- 6.24.2 Development on the Romanian territory of the National Gas Transmission System on the Bulgaria - Romania - Hungary - Austria Corridor - transmission pipeline Podișor - Horia GMS and 3 new compressor stations (Jupa, Bibești and Podișor)
- 6.24.3 GCA Mosonmagyarovar CS (development on the Austrian side)
- 6.24.4 Városföld-Ercsi - Győr pipeline
- 6.24.5 Ercsi-Százhalombatta pipeline
- 6.24.6 Városföld compressor station
- 6.24.7 Expansion of the transmission capacity in Romania towards Hungary up to 4.4 bcm/year
- 6.24.8 Black Sea shore - Podișor (RO) pipeline for taking over the Black sea gas
- 6.24.9 Romanian-Hungarian reverse flow: Hungarian section 2nd stage CS at Csanádpalota

Please find a detailed description of the Hungarian projects in Chapter 7.

Total track of RO-HU-AT transmission corridor and the connecting projects on the following chart:



Phase I with red, Phase II with blue

Eastring

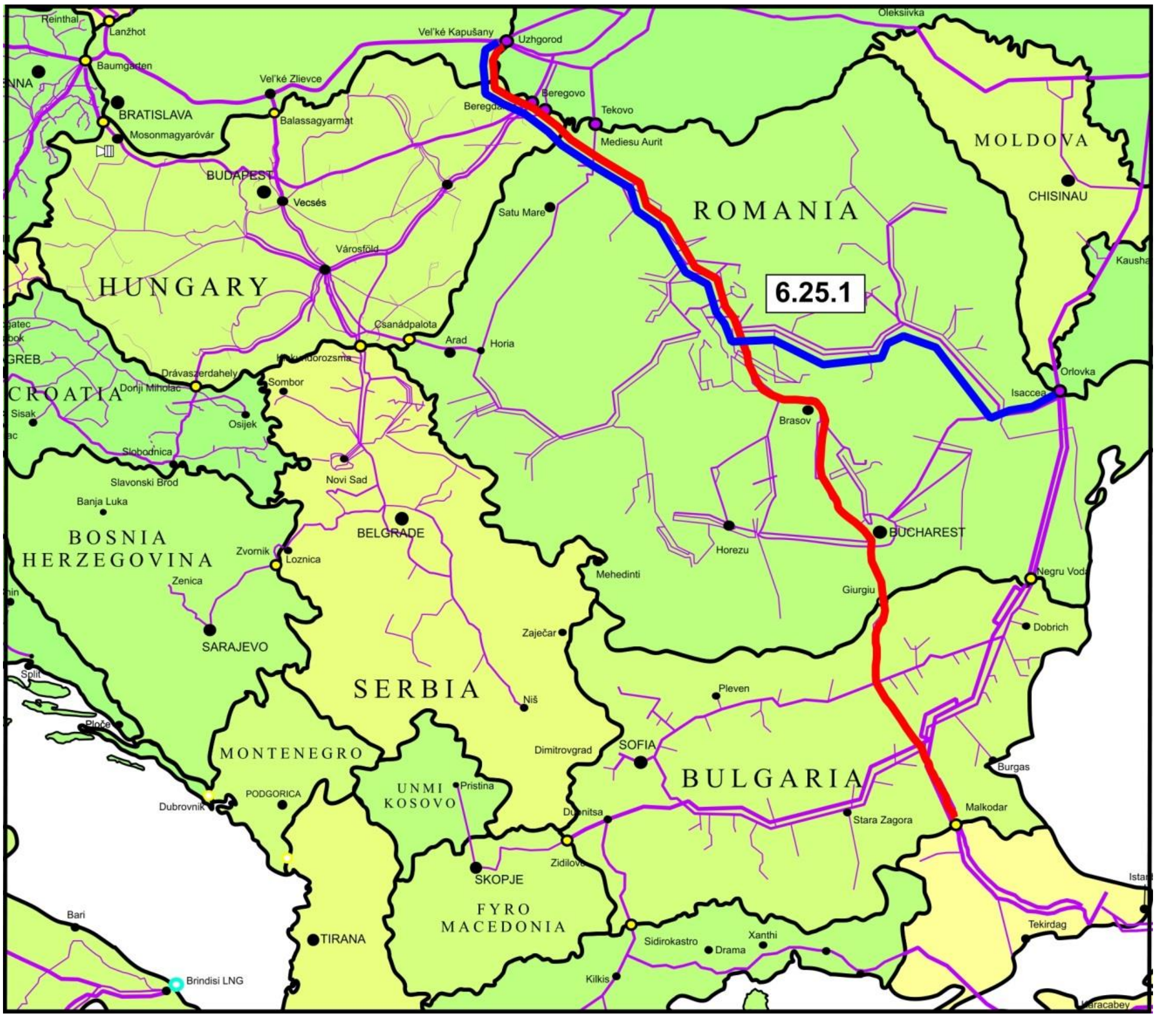
Eastring is listed in cluster 6.25 in the second PCI List, the name of the project is as follows:

- 6.25.1 Pipeline system from Bulgaria to Slovakia

The route of the project runs from the TR/GR border or optionally from the UA/RO border to Velke Kapusany, Slovakia via Bulgaria, Romania, Hungary and Slovakia for about 832-1,015 kilometres ensuring bi-directional transmission capacities for all cross-border points involved. In the 1st phase the capacity of the pipeline is 20 bcm/a, in the 2nd phase it can even increase to 40 bcm/a.

The Hungarian section of the Eastring runs from Csengersima (RO-HU border) to Zemplénagárd (HU-SK border) for about 102-112 kilometres.

The map below indicates the total route of the project:



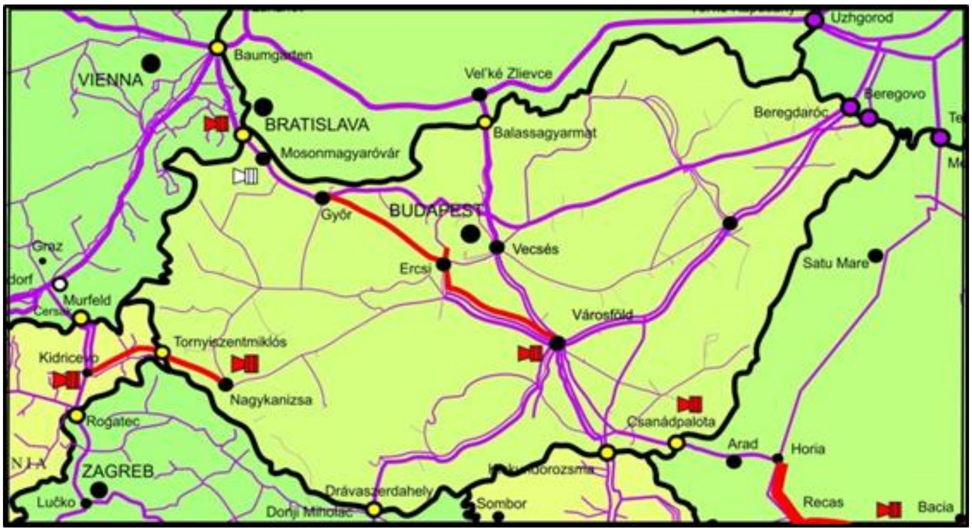
SI-HU interconnection pipeline

The Slovenian-Hungarian interconnection is listed as a separate project in the second PCI List under the following name:

- 6.23 Hungary - Slovenia interconnection (Nagykanizsa - Tornyiszentmiklós (HU) - Lendava (SI) - Kidričevo)

The purpose of the project is to implement market integration by interconnecting the natural gas transmission networks between the two countries.

Nagykanizsa-Becsehely-Tornyiszentmiklós-SL/HU border



The projected capacity of the pipeline is 1.3 bcm/a in both directions (38.4 GWh/d with 1/3 firm and 2/3 interruptible capacity).

The Hungarian section is 41 kilometres long.

6. Main characteristics of the studied projects depending on the market demand.

6.1. Reverse flow Ro/Hu Csanádpalota compressor station

1. The main aim of studied compressor station

Currently the Hungarian-Romanian border-crossing point at Csanádpalota is an exit point of the Hungarian system with 4,8 Mcm/day capacity. There is measuring station, which is prepared for bi-directional deliveries with 200,000 cm/h capacity located at the border-crossing point between the gas transmission systems. The border delivery pressure is 40 bar. Establishment of new compression station is necessary in the region of Csanádpalota in order to ensure the transmission from Romania to the direction of Hungary.
The implementation of the projects was examined in two phases:

In phase I: 2 new compressor units shall be installed (4.5 MW), in phase II: further 1 new compressor unit installation is needed (4.5 MW) and the expansion of the existing measuring station from 200,000 cm/h to 500,000 cm/h is necessary.

2. Location of the new compressor station in the domestic gas transmission system.

3. Description of the studied facility, main characteristics

Facility	Proposed compressor performance (MW)
Csanádpalota compressor station	3 x 4,5

3.1 Main parameters of Csanádpalota compressor station:

- New compressor station shall be established with 3x4,5 MW performance.
- From Romania to Hungary: Q_{max}= 200,000-500,000 cm/h,
- From Hungary to Romania: Qmax= 200,000-500,000 cm/h.

3.2 Csanádpalota node

Main functions, relations:

- In case of transmission from Romania to Hungary measuring shall be conducted on in-take side.
- In case of transmission from Hungary to Romania measuring the be conducted on out-take side.

4. The considered commissioning date during the study

phase I: 31.12.2019
phase II: 01.10.2022

6.2. Csanádpalota new measuring station (500,000 cm/h)

1. The main aim of studied measuring station

Expansion of existing measuring station to 500,000 cm/h.

2. Place of new measuring station in the domestic transmission system

3. Description and main characteristics of the studied facility

The currently operated filter-measuring station in the direction to TRANSGAZ at Csanádpalota shall remain capable to work in both directions, but the capacity shall be increased.

Main characteristics of the planned measuring station

Nominal pressure	PN63
Operating pressure	60 bar
Planned max. fluid flow	500,000 cm/h

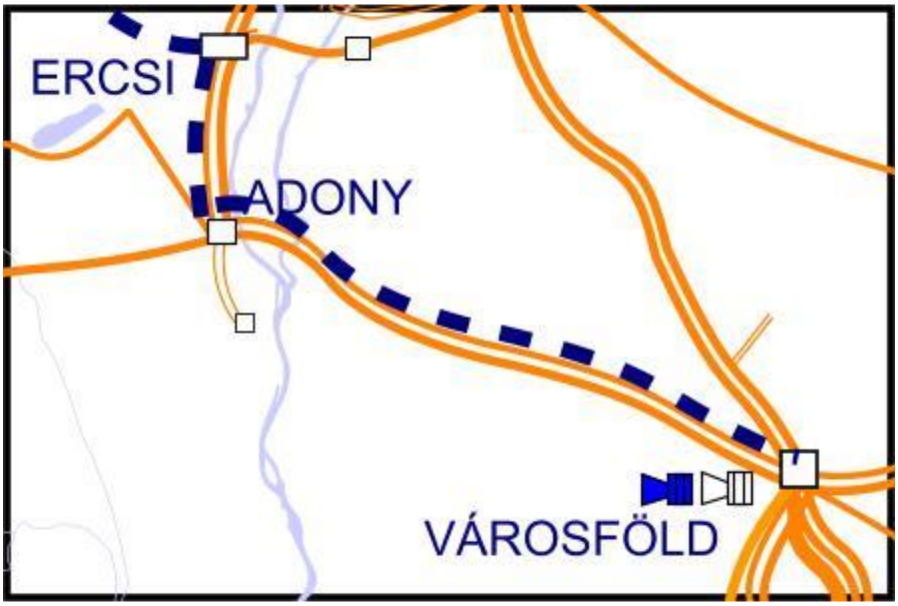
4. The considered commissioning date during the study 01.10.2022.

6.3. Városföld-Ercsi DN1000, PN100 pipeline

1. The main aim of studied pipeline

Ensuring the natural gas deliveries in RO-HU-AT natural gas transmission corridor from Városföld node to the direction of Ercsi, or receiving from the direction of Austria or delivery towards Austria according to demand. Ensuring the necessary capacity towards the existing and projected power plants in Western Hungary.

2. *Location of the planned pipeline in the domestic* natural gas transmission system.



3. Description of the studied facility, main characteristics

3.1 Main parameters of the natural gas pipeline

Nominal size	DN1000
Nominal pressure	PN100
Planned length	98 km
Block valve station:	3 pcs

Natural gas transmission on pipeline withour odorisation.

3.2 Adony node

3.3 Ercsi node, branch towards Százhalombatta

3.4 Városföld node

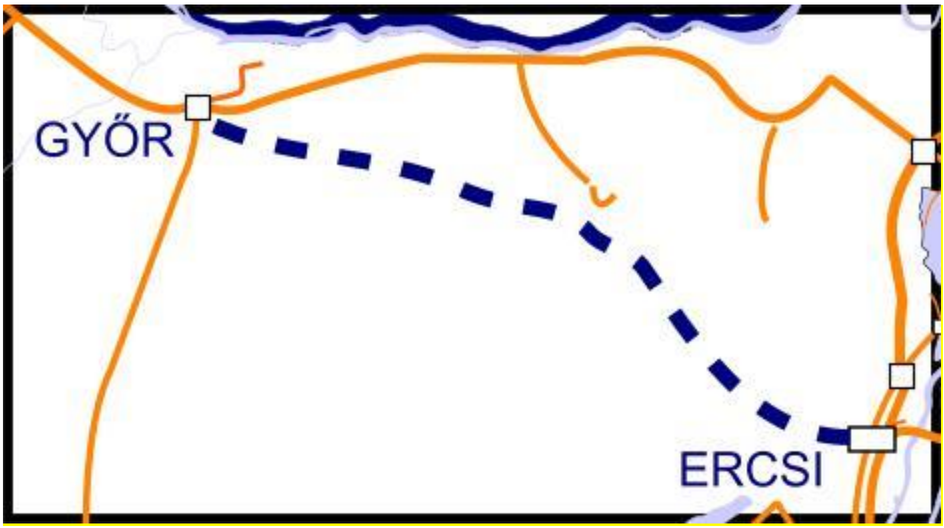
4. The considered commissioning date during the study 01.10.2022.

6.4. Ercsi-Győr DN1000, PN100 pipeline

1. The main aim of studied pipeline

Ensuring the natural gas deliveries in RO-HU-AT natural gas transmission corridor from Ercsi node to the direction of Győr, or receiving from the direction of Austria according to demand. Increasing security of supply of Transdanube region, decreasing dependence from input from HAG pipeline deliveries, ensure the existing and planned power plants with firm capacity.

2. Location of planned transmission pipeline in domestic natural gas transmission system



3. Description of the studied facility, main characteristics

3.1. Main parameters of the natural gas pipeline

Nominal size	DN1000
Nominal pressure	PN100
Planned length	112 km
Block valve station:	3 pcs

Natural gas transmission on pipeline withour odorisation.

3.2. Ercsi node

3.3 Győr node

4. The considered commissioning date during the study 01.10.2022.

6.5. Ercsi-Százhalombatta DN800, PN63 branch pipeline

1. The main aim of studied pipeline

Securing natural gas supply of planned new consumers

2. Location of the new transmission pipeline int he domestic natural gas transmission system

3. Description of studied facility, main parameters

3.1 A main parameters of the natural gas pipeline

Nominal size:	DN800
Nominal pressure:	PN63
Operating pressure:	63 bar
Planned length:	11 km
Planned max. fluid stream:	400,000-500,000 cm/h
Block valve station:	-

Natural gas transmission on pipeline without odorisation.

3.2 Ercsi node

3.3 Százhalombatta end point

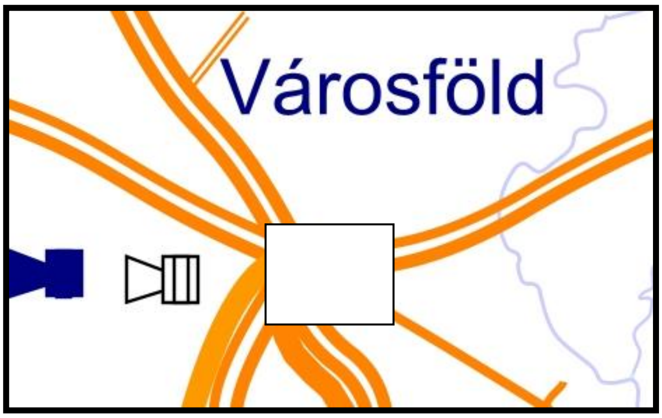
4. The considered commissioning date during the study 01.10.2022.

6.6. Expansion of Városföld compressor station

1. The main aim of studied expansion

For securing compression demands at Városföld the current station shall be expanded with one further unit.

2. Location of node for expansion in the domestic natural gas transmission system



3. Description of studied facility, main parameters

Main parameters of Városföld compressor station expansion:

Facility	Proposed operating compression performance (MW)
Expansion of Városföld comp. st. on the existing territory, PN100	**1 x 5,7**

Parameter of the unit q_{max}= 100,000-200,000 cm/h

4. The considered commissioning date during the study: 01.10.2022.

6.7. Dorog compressor station establishment

1. The main aim of studied compressor station

The establishment of Dorog compressor station would be possible to increase the security of supply in Transdanubia east-west direction and the volume of gas flow without odorization through the Győr-Dorog-Pilisvörösvár route from the direction of Austria can be increased toward inside of the country.

2. Location of node for expansion in the national gas transmission system

3. Description of studied facility, main parameters

Facility	Proposed operator+reserved compressor capacity (MW)
Dorog comp. st.	3 x 5,7

The studies made in two versions:

1st version:

3 compressors with 5,7 MW power would be relocated to compressor station from other FGSZ compressor stations. This version includes the 6.8. 1. version (Mosonmagyaróvár modification).

2nd version:

3 new units would be built into compressor station with 3 x 5.7 MW performance. Reconstruction at Mosonmagyaróvár in 6.8 part 2nd version belongs to this development.

4. The considered construction period during the study: 3 years

6.8. Mosonmagyaróvár compressor station enlargement

1. Main aim of planned enlargement

There will be opportunity to deliver 600 000 cubic metres per hour volume toward inside of the country with expansion of compressor station at Mosonmagyaróvár and to increase the volume of gas flow without odorization through the Győr-Dorog-Pilisvörösvár route and with the compressor station in Dorog from the direction of Austria toward inside of the country.

2. Location of node for expansion in the national gas transmission system

3. Description of studied facility, main parameters

We studied 2 versions:

1st version	Facility
	Mosonmagyaróvár compressor station 2 x 10 MW new units build in
	Mosonmagyaróvár compressor station replacement of 2 bundle units

2nd version	Facility
	Mosonmagyaróvár compressor station 1 x 5.7 MW new unit build in
	Mosonmagyaróvár compressor station replacement of 4 bundle units

4. The considered construction period during the study: 3 years

6.9. Slovenian - Hungarian interconnection pipeline

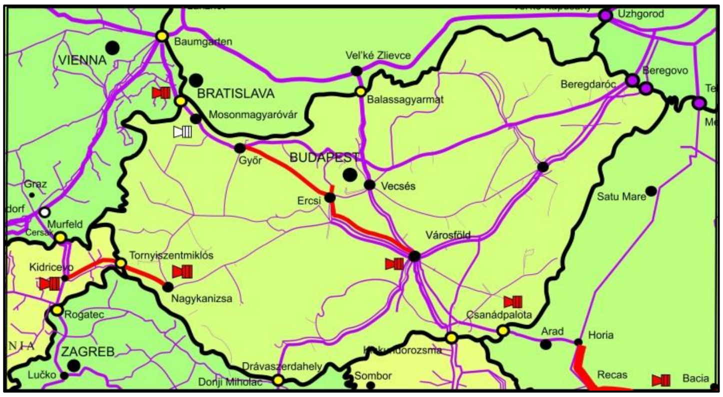
1. The main aim of the studied pipeline

The main aim of the Slovenian-Hungarian interconnector pipeline to establish physical connection between the two transmission systems that ensure the possibility of the bi-directional deliveries between the sytems.
We have consiedered two altarnative pipeline routes during the preparation of pre-feasibilty study.

6.9.1. Slovenian-Hungarian interconnector (1st version)

2. Location of node for expansion in the national gas transmission system

Nagykanizsa-Becsehely-Tornyiszentmiklós-SL/HU border



3. Description of studied facility, main parameters

3.1. New pipeline between Tornyiszentmiklós-Hungarian-Slovenian border (stage I)

Nominal size:	DN500
Operating pressure:	PN75
Planned length:	~1,0 km

3.2. New pipeline between Becsehely – Tornyiszentmiklós (stage I)

Nominal size:	DN500
Operating pressure:	PN63
Planned length:	28 km

3.3. Replacemant of existing pipeline between Nagykanizsa (stage II)

Nominal size:	DN500
Operating pressure:	PN63
Planned length:	12 km

3.4. Compressor station near the Nagykanizsa (stage III)

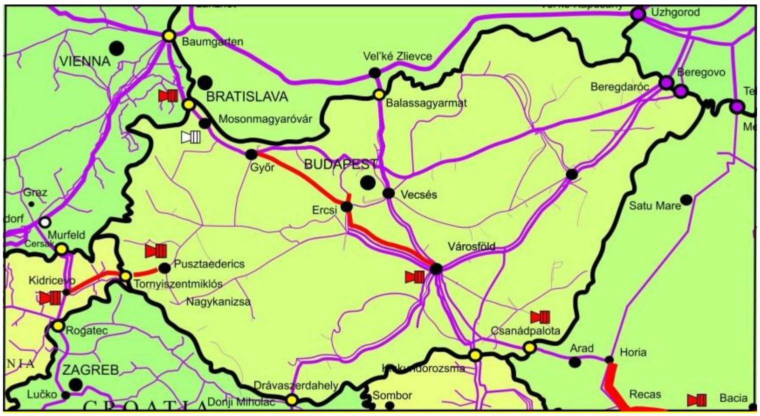
Planned power:	2x4,6 MW

4. The considered commissioning date during the study: 31.12.2021.

6.9.2. Slovenian-Hungarian interconnector (2nd version)

2. Location of node for expansion in the national gas transmission system

Pusztaederics-Lenti-Tornyiszentmiklós-SL/HU border



3. Description of studied facility, main parameters

3.1 New pipeline between Tornyiszentmiklós-Hungarian-Slovenian border (stage I)

Nominal size:	DN500
Operating pressure:	PN75
Planned length:	~1,0 km

3.2. New pipeline between Lenti – Tornyiszentmiklós (stage I)

Nominal size:	DN500
Operating pressure:	PN63
Planned length:	12 km

3.3 Replacemant of existing pipeline between Pusztaederics – Lenti (stage II)

Nominal size:	DN500
Operating pressure:	PN63
Planned length:	21,2 km

3.4 Compressor station near the Pusztaederics (stage III)

Planned power:	2x4,6 MW

4. The considered commissioning date during the study: 31.12.2021.

The capacity of the studied interconnection pipeline in case of both versions 1.3 bcm/a; 3.6 Mcm/d; 150,000 cm/h (1/3 non interruptible, 2/3 interruptible).
The leght of the pipeline in Hungarian section 41.0 km in case of version 1 and 34.2 km in case of version 2.

6.10. Eastring

1. The main aim of the studied pipeline

Eustream proposed for Romanian and Bulgarian TSOs to create a new gas transmission corridor in order to decrease their dependence on Russian gas import. Gas deliveries from Western European hubs could flow through Slovakia, Western-Ukraine or Hungary, Romania and Bulgaria. For transmission the existing network would be used in Slovakia which shall be connected with the pipelines of the neighbor contries. Planned transmission capacity would be 20 bcm annualy.

2. Location of pipeline in the South-South East and the national gas transmission system

<u>Transmission route options of Eastring pipeline in Hungary:</u>

- version 1

- Romanian/Hungarian border, Csengersima measuring station-Beregdaróc-Zemplénagárd border measuring and valve ball station, Hungarian/Slovak border

Transmission pipeline new track will be constructed between Romanian-Hungarian-border- Beregdaróc- Hungarian-Slovak border in approximately 102 km length.

- version 2

- Romanian/Hungarian border, Csanádpalota measuring station- Városföld-Hajdúszoboszló- Beregdaróc- Zemplénagárd border measuring and valve ball station- Hungarian/Slovak border

3. Description, main parameters of studied facility:

Main characteristics of gas pipeline (version 1) between Romanian/Hungarian border- Csengersima measuring station- Beregdaróc- Zemplénagárd border measuring and valve ball station- Hungarian/Slovak border pipeline points:

Nominal size: DN1400

Operating pressure: PN100

Planned length: 112 km

Planned max. fluid stream in both directions: annualy 8,0 bcm- 21,2 bcm

Beregdaróc exit/entry point (version 1)

Currently actual capacity demands are not known, thus pipeline capacity (nominal capacity) of entry/exit point branch pipeline was defined according to current Beregdaróc 1400 (UA>HU) cross-border capacity while technical capacity was defined according to current demands which can be expanded later (with installation of filter-measure-yield control bracnh pipes).

Nominal capacity: 56.3 Mcm/d, 2,345,000 cm/h

Technical capacity: 22.0 Mcm/d, 920,000 cm/h

Design pressure: PN100

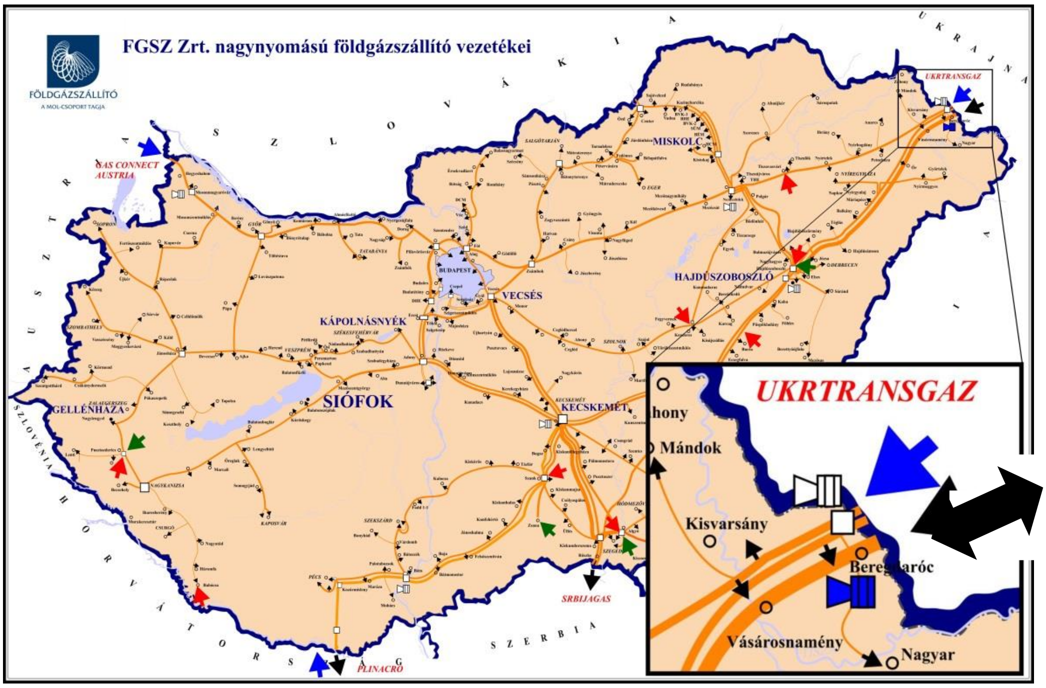
4. The considered construction period during the study: 2 years

6.11. Ukraine bi-directional deliveries at Beregdaróc 800 (HU>UA) and (UA>HU)

1. The main aim of studied expansion

Ensuring non interruptible bidirectional capacity at Beregdaróc 800 (HU>UA) and (UA>HU) interconnection points.

2. Location of node for expansion in the domestic natural gas transmission system



The maximum capacity in case of HU>UA and UA>HU direction deliveries can be 16.8 Mcm/d; 700,000 cm/h.

Name of IP	Neighbouring system operator.	Technical capacity (cm/h)
Beregdaróc 800 (HU>UA) *Beregdaróc 800 (UA>HU)*	*UKRTRANSGAZ*	*700,000*

HU > UA exit volume can be delivered to Beregdarócra 700,000 cm/h partially or entirely:

- from Városföld - Hajdúszoboszló direction,
- from Zsámbok - Nemesbikk direction,
- from DN1400, PN75 pipeline from Ukraine.

UA> HU entry: entry volume can be delivered to Beregdarócra 700,000 cm/h partially or entirely:

- from DN 800, PN63 pipeline from Ukraine

3. Description of studied facility, main parameters

3.1. NEMESBIKK

Installing piping connections and valves in the station.

3.2. VÁROSFÖLD

„D" compressor station:

- ✓ cooler (700 thcm/h),
- ✓ installing valves,
- ✓ installing control valve.

3.3. HAJDÚSZOBOSZLÓ

Installing piping connections and valves in the station.

3.4. BEREGDARÓC

Filter – measuring and control station állomás (equipment and valves)

Installing piping connections and valves in the station.

4. The considered construction period during the study: 2 years