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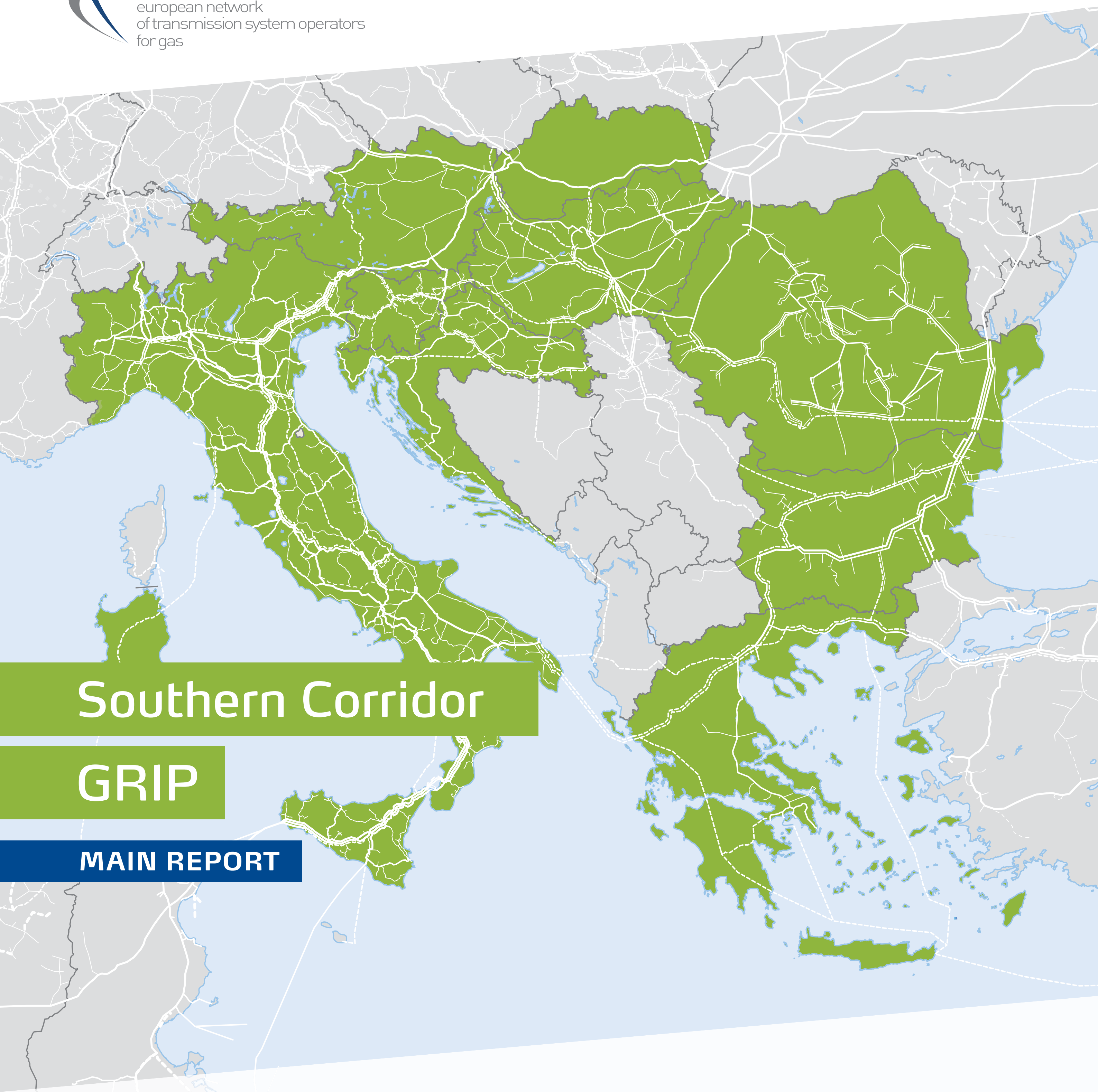
european network of transmission system operators for gas

GAS REGIONAL INVESTMENT PLAN 2014 – 2023



Southern Corridor GRIP

MAIN REPORT

B•G · GAS CONNECT AUSTRIA · TAG Trans Austria Gasleitung GmbH · BULGARTRANSGAZ · plinacro · DESFA Hellenic Gas Transmission System Operator S.A.

FGSZ LTD. · SNAM RETE GAS · Infrastrutture Trasporto Gas · TRANSGAZ Magistrala Energiei · eustream Slovak Gas TSO · Plinovodi Connected through energy

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Image courtesy of DESFA

Foreword

It is my pleasure to welcome you to the second edition of the Southern Corridor Gas Regional Investment Plan 2014 – 2023.

This edition builds on the TYNDP 2013 – 2022, published by ENTSOG in February 2013 and on the first edition of the Southern Corridor GRIP released in April 2012, bringing however a deeper view into the infrastructure developments in the Region and the role these can play in order to meet the forecasted capacity demand.

The present edition coincides with decisions that ensure the strengthening of the Region's role in the European gas scene, such as the Final Investment Decisions recently taken for the 2nd phase of the development of the Shah Deniz field and for the implementation of the Trans Adriatic Pipeline project. These are expected to lead to the addition of one more source of gas supply to Europe. Similarly, Final Investment Decisions have been taken for the Bulgarian and Serbian sections of South Stream for which however corresponding decisions in other countries are pending. At the same time the recent discoveries of natural gas in the Eastern Mediterranean basin indicate that the Region might become even more important, for the gas sector of Europe, in the future.

The GRIP is the result of close cooperation between 12 TSOs in 9 countries under the coordination of DESFA. The Region's TSOs would welcome any comments, advice or feedback that could assist in improving the effectiveness of the future editions of this report either through ENTSOG's website or with the occasion of dedicated events to be organized by ENTSOG, or by contacting Joseph Florentin, the coordinator of this report (j.florentin@desfa.gr).

Dimitrios Kardomateas
ENTSOG Board member

Division Director for Strategy, Development and Regulation

DESFA S.A.

Executive Summary

This 2nd edition of the Southern Corridor Gas Regional Investment Plan (GRIP) 2014–2023 provides information on the Gas Transmission infrastructure plans, both by TSOs and 3rd party promoters, that will shape the energy landscape in the coming decade.

The information and the analysis contained in this report are consistent with the TYNDP 2013–2022 but have been updated and more focused in the Regional issues. The network assessment is more detailed in order to show the impact of discrete large gas transmission projects or groups of projects.

The inclusion of network analysis constitutes one of the main improvements in comparison with the 1st Southern Corridor GRIP edition in 2012. Other improvements are the examination of the availability of capacity in the various entry or interconnection points and the greater detail in the presentation of supply & demand issues.

The total number of projects in the Region is 90 out of which 16 FID and 74 non-FID. These are split in the three main categories as follows:

	FID	non-FID	TOTAL
LNG	1	8	9
PIPELINE	12	55	67
UGS	3	11	14

The Region is characterized by the existence of a few very large projects, mostly competing, aiming at the transportation of Caspian and Eastern Mediterranean gas to Europe.

Following the Shah Deniz II Consortium decision and the final investment decision taken by the sponsors of TAP, in December 2013, some of the competing projects were not taken into consideration in the assessments of the present GRIP, in order to improve the reliability of the report.

In the Supply chapter, reference is made to the recent developments that have impacted the global gas market including the increase of demand in Asia and the increase of availability in the USA due to shale gas, and their result on the coal vs natural gas and the LNG vs pipe gas competition.

The network analysis shows a different image between the Eastern and Western parts of the Region.

Although in the reference case no shortages occur, under the Ukraine disruption scenarios shortages appear in Bulgaria, Romania and Hungary which are more dependent both on Russian gas supplies and on the Ukraine route. These are relieved progressively as more projects are implemented. The implementation of the PCI projects in 2023 is sufficient to meet any shortage. TAP, the South Stream project in the Eastern and Central part of the Region, and IAP in the western Balkans, the east – west gas transmission corridor between Romania and Austria and the new LNG Terminals, in the Adriatic and in Northern Greece are among the key projects contributing to the improvement of the network flexibility. However Romania remains with a low resilience level if the White Stream project is not taken into account. This would be improved in case capacity from the South Stream would be allocated to Romania.

As it could be anticipated, the dependence on Russian gas remains high in the Eastern part of the Region while the share of LNG is important in Greece, in case of a two-week peak demand occurrence, and is reduced, first from 53 % to 42 % when TAP is taken into account, and is further reduced below 20 %, in case of implementation of the East Med project supplying gas from the Eastern Mediterranean gas fields.

1 Introduction

Image courtesy of FGSZ

The present 2nd edition of the Southern Corridor Gas Regional Investment Plan provides a specific overview of the investment projects in gas infrastructure (transmission, underground storage and LNG) with Regional relevance, sponsored by either the Region's TSOs or by 3rd parties. This means that although this GRIP is consistent with TYNDP 2013–2022 (to the extent practically possible, due to the time lag between the two publications) several projects, included in the TYNDP, have been excluded from the GRIP, on the ground of lacking Regional relevance.

LEGAL BASIS

The biannual publication of a Regional investment plan is a legal obligation for European TSOs, stemming from Directive 2009/73 Article 7 and further detailed by Regulation (EC) 715/2009 Article 12.

ENHANCEMENTS OF THIS EDITION

As already announced in the chapter "Conclusion and the Way Forward" of the GRIP 2012–2021, the present edition includes a Supply & Demand analysis, supported by the modelling of more than 70 cases that were considered relevant for our Region, with the use of the same tool used for the preparation of the TYNDP 2013–2022.

Other enhancements include:

- the inclusion of more project from non-TSO sponsors, facilitated by the European Commission's PCI selection process[1)] during 2013.
- the examination of congestion issues at Interconnection Points.
- a more detailed clustering of projects for the modelling exercise. In fact due to the existence of very large and often competing project, the non-FID cluster would always give an impression of overcapacity. It was therefore considered appropriate to split this cluster to smaller ones enabling a closer focus to the impact of discrete large project.
- the reference to Regional gas prices in comparison to the ones applied in other Regions of Europe.

1) According to Regulation (EC) 347/2013 and related Commission Decision of 14.10.2013, identifying the first Union list of PCIs

STRUCTURE OF THE REPORT

- The report is structured in five main parts dealing with:
- Gas Demand: Historical data one presented and recent trends are shown, especially on the use of gas for power generation.
- Gas Supply: The gas sources supplying the Region are presented together with the trend and forecast for national production. Reference is also made to new potential gas sources in the Region as well as to non-conventional gas sources.
- Market Analysis: In this part import prices are compared among various areas of the Region and capacity reservation at IPs is presented in order for congested or potentially congested IPs to be identified.
- Role of the Region in the development of the EU infrastructure: Reference is made to the very large projects in the Region and their contribution to the EU's security of supply. Moreover smaller project are also presented mainly those included in the PCI list, adopted by the European Commission in September 2013, grouped according to their rationale.
- Network assessment: In this part the results of the network modelling are presented along with the indicators for the infrastructure Resilience Assessment and the Supply Source Dependence Assessment.

In the Appendices we present:

- Country profiles
- Project information
- Demand data

The TSOs of the Region hope that this document will help the market assess the candidate infrastructure projects and provide useful information to all stakeholders.

Image courtesy of Gas Connect Austria

This GRIP covers gas infrastructure projects and analysis from 10 countries[1]: Austria, Bulgaria, Croatia, Cyprus, Hungary, Greece, Italy, Romania, Slovakia, and Slovenia.

COUNTRY	TSO
INVOLVED TSOs	
AUSTRIA	BOG GmbH
	GAS CONNECT AUSTRIA GmbH
	TAG GmbH
BULGARIA	Bulgartransgaz EAD
CROATIA	Plinacro d.o.o.
GREECE	DESFA S.A.
HUNGARY	FGSZ Ltd.
ITALY	Snam Rete Gas S.p.A.
	Infrastrutture Trasporto Gas S.p.A.
ROMANIA	Transgaz S.A.
SLOVAKIA	eustream, a.s.
SLOVENIA	Plinovodi d.o.o.

Table 1: The list of TSOs contributing to the Southern Corridor GRIP 2014–2023

The works on the second edition of the Southern Corridor GRIP were coordinated by DESFA S.A.

1) The GRIP was prepared by the TSOs of 9 countries since Cyprus does not have a TSO and is not represented in ENTSOG.

2 Infrastructure Projects

TYNDP 2013 – 2022 Projects not included in the SC GRIP list
Projects by Country | Non-TSO (Third Party) Projects involving more or Non-EU countries

Image courtesy of Plinacro

The following list contains all projects in the Southern Corridor Region, presented in two tables by country:

- one for the projects sponsored by TSOs and
- one for the projects sponsored by 3rd parties.

One additional table includes the projects spanning over several countries.

The project code is the same as the one the projects had in the TYNDP 2013–2022. In order to ensure consistency the code has not been updated in case a project reached, in the meantime, FID status (this is for instance the case of TAP project or of the reverse flow project at the Greek/Bulgarian border). In such cases a note has been inserted. On the other hand some TSO projects in the Region have been deleted from the list as mentioned below.

2.1. TYNDP 2013–2022 Projects not included in the Southern Corridor GRIP list

The following TSO projects, that make part of the TYNDP 2013–2022, have been excluded from the GRIP list of projects, with the agreement of the sponsoring TSOs, either because they are already completed, either because they do not have Regional relevance or because they are no longer included in the TSOs' planning.

Bulgartansgaz projects:

TRA-N-145	Black Sea CNG

Moreover Bulgartransgaz requested the following projects to be excluded from this GRIP because they are completed or almost completed:

TRA-F-143	Reverse flow at the existing IP between BG and GR (Kulata/Sidirokastro)
TRA-F-144	Reverse flow at the existing IPs between RO and BG (Negru Voda I, II and III)
TRA-F-057	Interconnection Bulgaria – Romania

DESFA projects:

POW-F-028	Megalopoli pipeline

FGSZ projects:

TRA-N-019	Csepel connecting pipeline
TRA-N-065	Hajduszoboszlo CS
TRA-N-124	Local Odorisation

Plinovodi Projects:

TRA-F-104	M2/1 Rogaška Slatina – Trojane (already in operation)
TRA-N-095	CS Rogatec (up to 2 MW)
TRA-N-103	Godovič – Žiri – Škofja Loka
TRA-F-105	M5 + R51 Vodice – TE-TOL
TRA-N-106	M5 Jarše - Novo mesto
TRA-N-111	M9c Interconnector with Croatia
TRA-N-122	R21AZ Zreče Loop (Slovenske Konjice 2nd phase)
TRA-N-119	R25/1 Trojane – Hrastnik
TRA-N-121	R297B Šenčur – Cerklje
TRA-N-113	R38 Kalce – Godovič
TRA-N-118	R45 Novo mesto – Bela Krajina
TRA-N-117	R51a Jarše – Sneberje, MRS Jarše
TRA-N-116	R51b TE-TOL – Fužine/Vevče
TRA-N-115	R51c Kozarje – Vevče, MRS Kozarje
TRA-N-120	R52 Kleče – TOŠ

Transgaz Projects:

TRA-F-142	Reverse flow at Negru Voda I, II, III (same as Bulgartransgaz project TRA-F-144)

Snam Rete Gas Projects:

TRA-N-215	Panigaglia
LNG-N-216	Panigaglia LNG

2.2 Projects by country

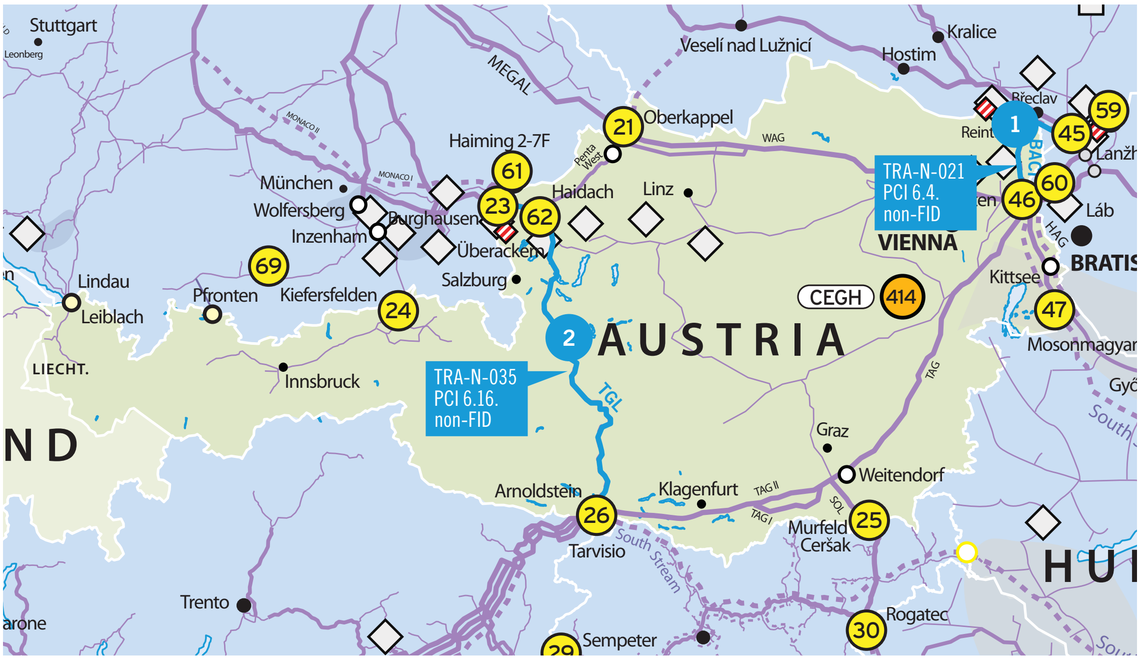
In the maps that follow the new projects belong into various categories. These categories are indicated by the following colours and symbols:

FID projects | non-FID but PCI projects | non-FID and non-PCI projects

1 Transmission projects | 1 LNG projects | 1 UGS projects

Image courtesy of DESFA

2.2.1 AUSTRIA



Please refer also to the map on page 27

NO.	PROJECT	CODE	STATUS	TSO
TSO PROJECTS				
1	Bi-directional AT-CZ interconnector (BACI formerly LBL)	TRA-N-021	non-FID PCI 6.4.	GAS CONNECT AUSTRIA B·G TAG Trans Austria Gasleitung GmbH

NO.	PROJECT	CODE	STATUS	SPONSOR	COMMENTS
THIRD PARTY PROJECTS					
2	Tauerngasleitung Gas Pipeline Project	TRA-N-035	non-FID PCI 6.16.	tgl tauern gas pipeline	In 2013, the sponsor's shareholders announced that they intended to amend the sponsor's ownership structure through a tendering process. The TGL GmbH has been finally liquidated on 11.4.2014

2.2.2 BULGARIA

Please refer also to the map on page 27

NO.	PROJECT	CODE	STATUS	TSO / SPONSOR	COMMENTS
TSO PROJECTS					
1	Construction of new gas storage facility on the territory of Bulgaria	UGS-N-141	non-FID PCI 6.20.1.	BULGARTRANSGAZ	
2	Interconnection Turkey-Bulgaria	TRA-N-140	non-FID PCI 7.4.2.		
3	Rehabilitation, Modernization and Expansion of the National Transmission System	TRA-N-298	non-FID		
4	UGS Chiren Expansion	UGS-N-138	non-FID		

2.2.3 CROATIA

Please refer also to the map on page 27

NO.	PROJECT	CODE	STATUS	TSO / SPONSOR
TSO PROJECTS				
1	Interconnection Croatia / Bosnia and Herzegovina (Slobodnica– Bosanski Brod–Zenica)	TRA-N-066	non-FID	plinacro
2	Interconnection Croatia / Serbia Slobdnica – Sotin (Croatia) – Bačko Novo Selo (Serbia)	TRA-N-070	non-FID	
3	Interconnection Croatia / Slovenia (Bosiljevo – Karlovac – Lučko – Zabok – Rogatec)	TRA-N-086	non-FID PCI 6.6.	
4	Interconnection Croatia–Bosnia and Herzegovina (Licka Jesenica – Rakovica – Trzac – Bosanska Krupa with branches to Bihać and Velika Kladuša)	TRA-N-303	non-FID	
5	Interconnection Croatia–Bosnia and Herzegovina (South)	TRA-N-302	non-FID	
6	International Pipeline Omišalj – Casal Borsetti	TRA-N-083	non-FID	
7	Ionian Adriatic Pipeline	TRA-N-068	non-FID PCI 6.21.	
8	LNG evacuation pipeline Omišalj – Zlobin – Rupa (Croatia) / Jelšane (Slovenia)	TRA-N-090	non-FID PCI 6.5.3.	
9	LNG main gas transit pipeline (Part of North-South Gas Corridor) Zlobin – Bosiljevo – Sisak – Kozarac – Slobodnica	TRA-N-075	non-FID PCI 6.5.2.	
10*	LNG Regasification Vessel	LNG-N-082	non-FID PCI 6.5.1.	

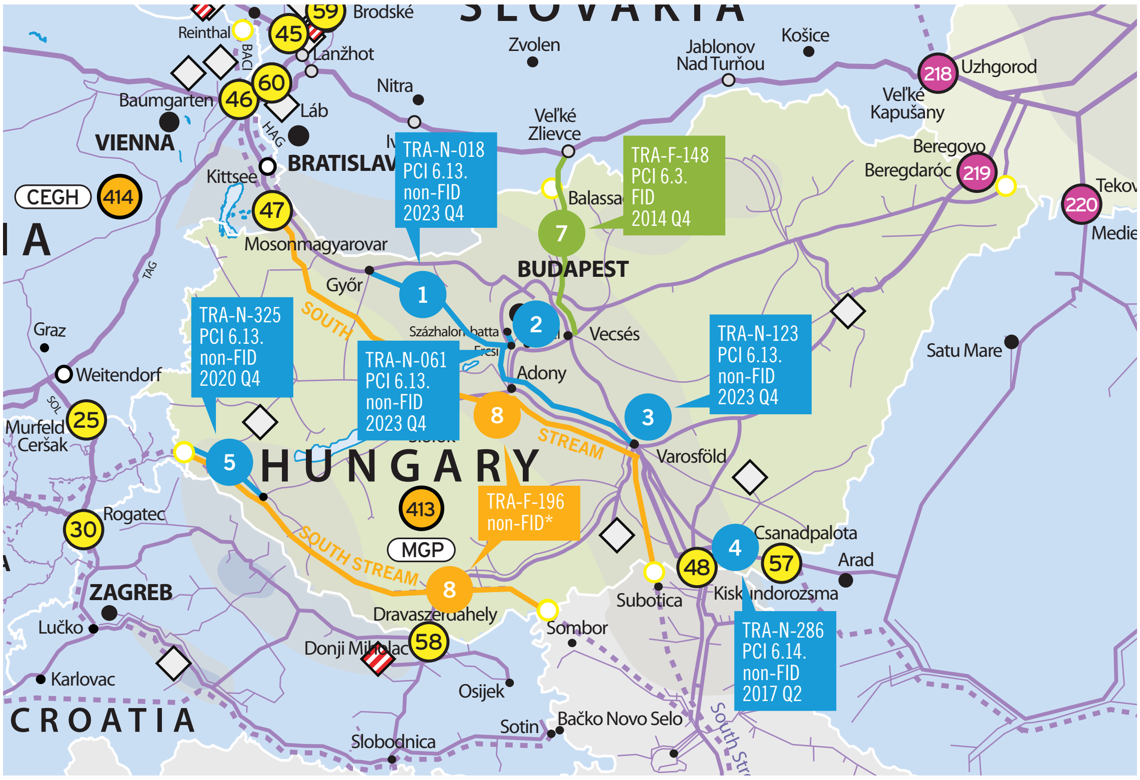
* On 28 May 2014, sponsorship of this project was transferred to LNG Hrvatska Ltd, a subsidiary of Plinacro and the Croatian Electricity Company (HEP)

Image courtesy of Plinacro

2.2.4 GREECE

NO.	PROJECT	CODE	STATUS	TSO / SPONSOR	COMMENTS
TSO PROJECTS					
1	Komotini – Thesprotia pipeline	TRA-N-014	FID PCI 7.1.4.	DESFA Hellenic Gas Transmission System Operator S.A.	This project was not considered in the network simulations of the present edition of the GRIP. DESFA has proposed to the NRA the deletion of this project from the 10 year Development Plan.
2	Compressor Station at Kipi	TRA-N-128	non-FID PCI 7.1.2. PCI 7.4.1.		
3	Bi-directional capacity at IP with BG	TRA-N-188	FID PCI 6.11.		
4	Revythoussa LNG 2nd upgrade	LNG-F-147	FID		
THIRD PARTY PROJECTS					
5	Aegean LNG Import Terminal	LNG-N-129	non-FID PCI 6.9.2.	ΔΕΠΑ	
6	Underground Gas Storage at South Kavala	UGS-N-076	non-FID PCI 6.20.3.		The project promoter is to be selected through a tender procedure
7	Alexandroupolis Independent Natural Gas System - LNG Section	LNG-N-062	non-FID PCI 6.9.1.	gastrade	
8	Alexandroupolis Independent Natural Gas System - Pipeline Section	TRA-N-063	non-FID PCI 6.9.1.		

2.2.5 HUNGARY



Please refer also to the map on page 27

NO.	PROJECT	CODE	STATUS	TSO / SPONSOR
TSO PROJECTS				
1	Városföld-Ercsi-Győr	TRA-N-018	non-FID PCI 6.13.	FGSZ LTD. NATURAL GAS TRANSMISSION MEMBER OF THE MOL GROUP
2	Ercsi-Szazhalombatta	TRA-N-061	non-FID PCI 6.13.	
3	Városföld CS	TRA-N-123	non-FID PCI 6.13.	
4	Romanian-Hungarian reverse flow Hungarian section	TRA-N-286	non-FID PCI 6.14.	
5	Slovenian-Hungarian interconnector	TRA-N-325	non-FID PCI 6.13.	
THIRD PARTY PROJECTS				
6	AGRI Pipeline	TRA-F-195	FID	MAGYAR GÁZ TRANZIT ZRT.
7	Slovak-Hungarian interconnector	TRA-F-148	FID PCI 6.21.	
8	South Stream Hungary	TRA-F-196	non-FID*	

* This project has been considered as non-FID in the preparation of this GRIP

2.2.6 ITALY

Please refer also to the map on page 27

TSO PROJECTS

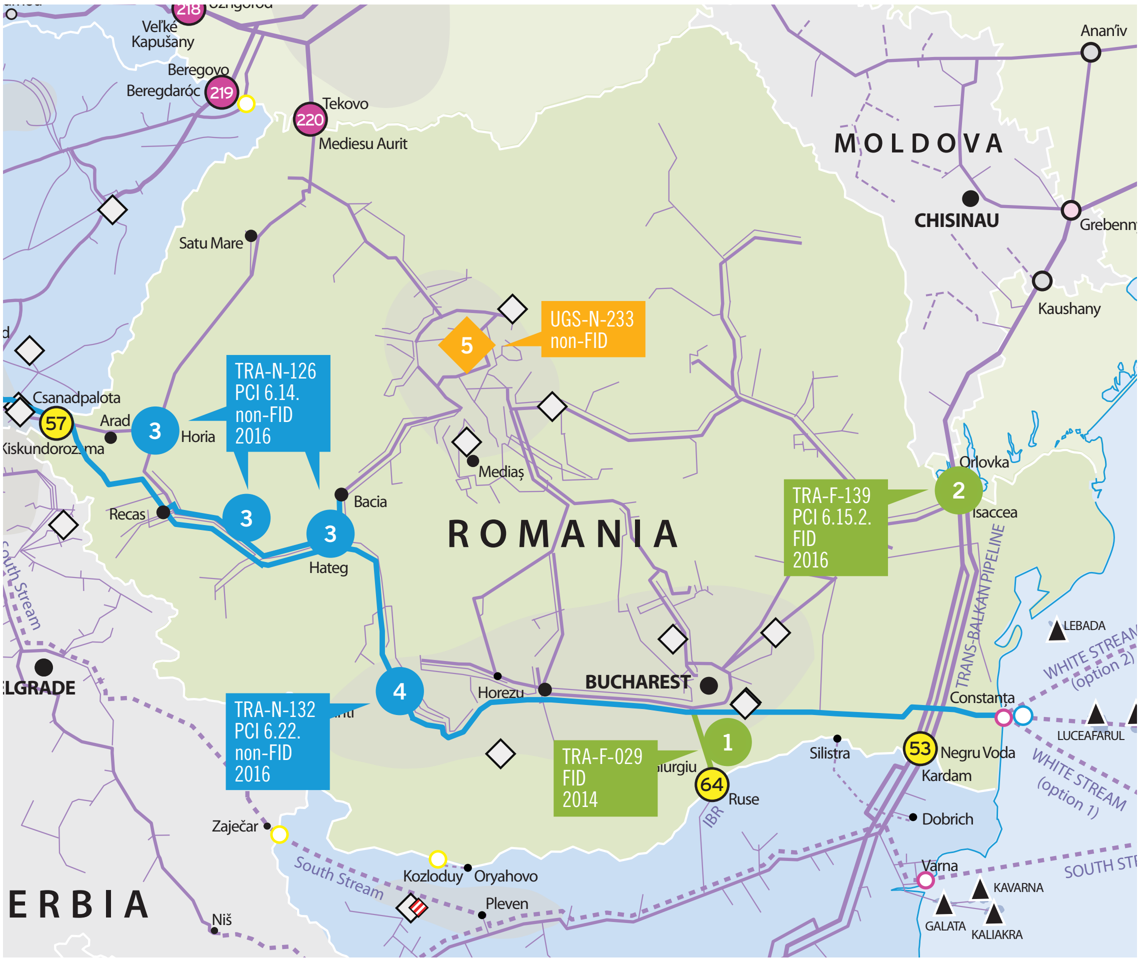
NO.	PROJECT	CODE	STATUS	TSO
1	Support to the North-West market	TRA-F-213	FID PCI 5.11.	SNAM RETE GAS
2	Support to the North-West market and bidirectional cross-border flows	TRA-F-214	FID PCI 5.11.	
3	Development for new imports from the South (Adriatica Line)	TRA-N-007	non-FID PCI 6.18.	
4	Import developments from North-East	TRA-N-008	non-FID	
5	Additional Southern Developments	TRA-N-009	non-FID	

THIRD PARTY PROJECTS

NO.	PROJECT	CODE	STATUS	SPONSOR	COMMENTS
6	Bordolano	UGS-F-259	FID	STOGIT	
7	System enhancements – Stogit-on-shore gas fields*	UGS-F-260	FID		
8	San Potito e Cotignola	UGS-F-236	FID	EDISON Edison Stoccaggio Spa	
9	Nuovi Sviluppi Edison Stoccaggio	UGS-N-235	non-FID		
10	Palazzo Moroni	UGS-N-237	non-FID		
11	LNG off-shore regasification terminal of Falconara Marittima (Ancona)	LNG-N-085	non-FID	api nòva energia	
12	GALSI Pipeline	TRA-N-012	non-FID	Galsi	
13	Zaule – LNG Terminal in Trieste	LNG-N-217	non-FID	gasNatural fenosa	
14	Porto Empedocle LNG	LNG-N-198	non-FID	nuove energie technological thinking	
15	Grottole-Ferrandina Gas Storage	UGS-N-288	non-FID	GEOGASTOCK	
16	LNG Medgas Terminal S.r.l.	LNG-N-088	non-FID	SORGENIA	
17	Cornegliano UGS	UGS-N-242	non-FID	IGS ITAL GAS STORAGE	
18	Brindisi LNG	LNG-N-011	non-FID	BG GROUP	BG announced in 2012 that it would cancel the project

* Project is not indicated on the map because it spans over several locations

2.2.7 ROMANIA



Please refer also to the map on page 27

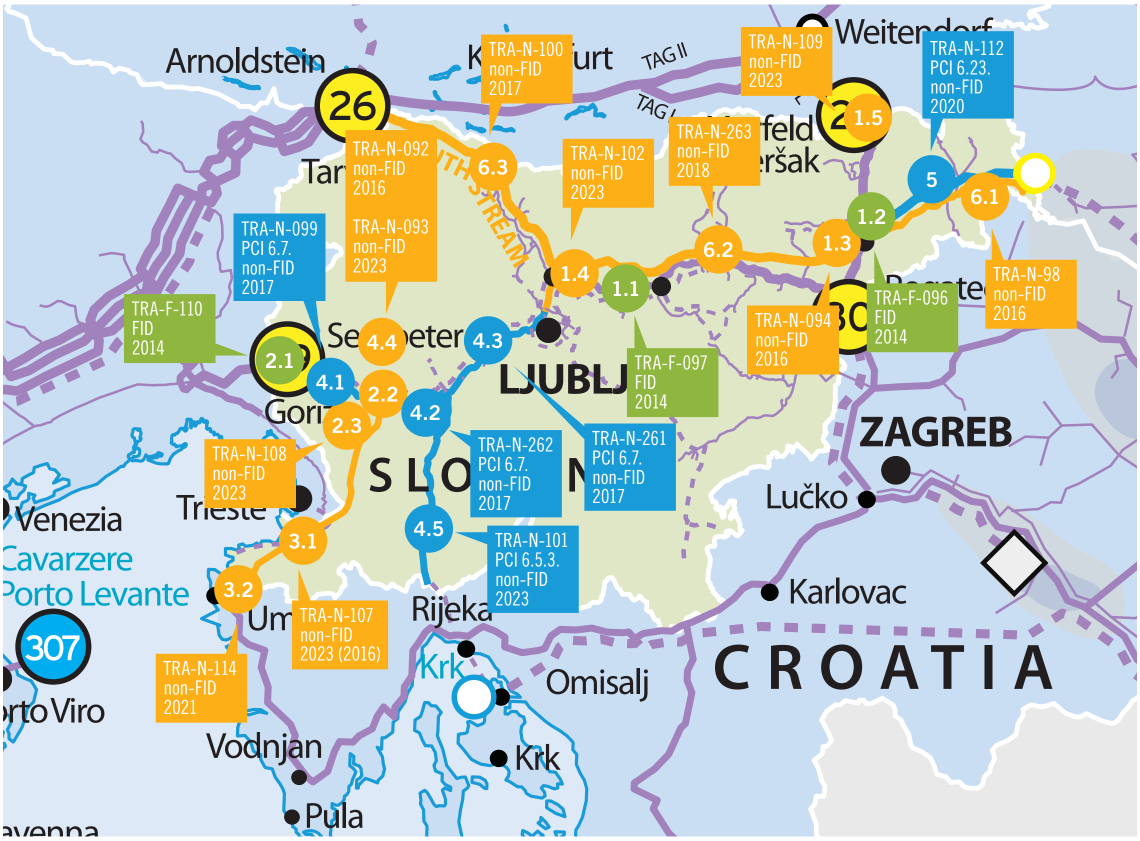
NO.	PROJECT	CODE	STATUS	TSO / SPONSOR
TSO PROJECTS				
1	RO – BG Interconnection	TRA-F-029	FID	TRANSGAZ MAGISTRALA ENERGIEI
2	Integration of the transit and transmission system – reverse flow Isaccea	TRA-F-139	FID PCI 6.15.2.	
3	Reverse flow on the interconnector Romania – Hungary	TRA-N-126	non-FID PCI 6.14.	
4	EU section of the AGRI project (East-West Pipeline)	TRA-N-132	non-FID PCI 6.22.	
THIRD PARTY PROJECTS				
5	Depomureş (RO)	UGS-N-233	non-FID	GDF SUEZ BY PEOPLE FOR PEOPLE

2.2.8 SLOVAKIA

NO.	PROJECT	CODE	STATUS	TSO / SPONSOR
TSO PROJECTS				
1	Slovakia – Hungary interconnection	TRA-F-016	FID PCI 6.3.	eustream SLOVAK GAS TSO
2	System Enhancements – Eustream	TRA-F-017	FID	
3	Poland – Slovakia interconnection	TRA-N-190	non-FID PCI 6.2.1.	


Image courtesy of Eustream

2.2.8 SLOVENIA



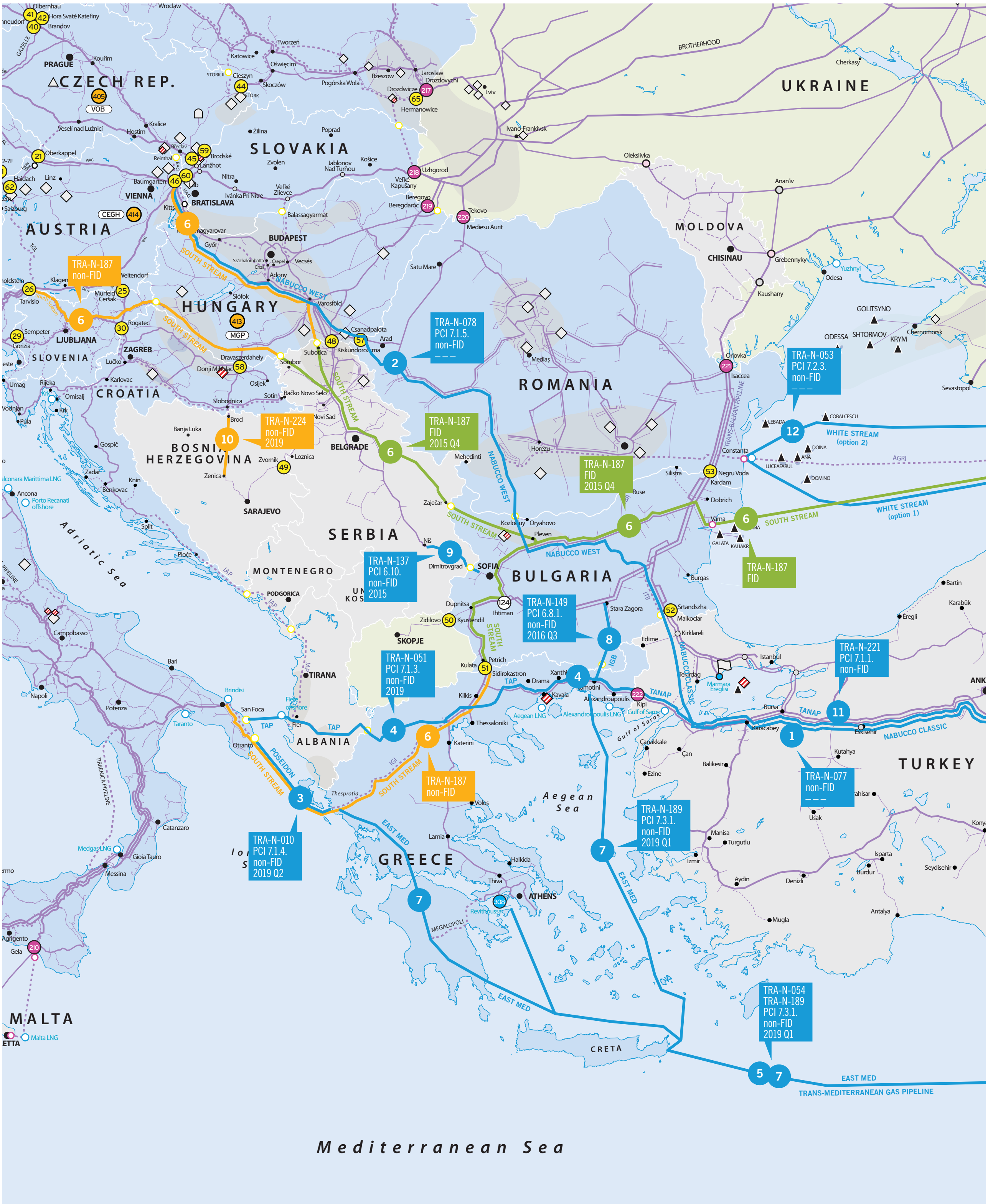
Please refer also to the map on page 27

Plinovodi projects have been grouped in six clusters:

NO.	PROJECT	CODE	STATUS	TSO
TSO PROJECTS				
1.1	M2/1 Trojane – Vodice	TRA-F-097	FID	Plinovodi
1.2	Compressor Station Kidričevo (3rd unit 3,5 MW)	TRA-F-096	FID	
1.3	CS Kidričevo (2nd phase – up to 3 units with total power up to 30 MW)	TRA-N-094	non-FID	
1.4	CS Vodice II (on M2/1 pipeline up to 3 units with total power up to 30 MW)	TRA-N-102	non-FID	
1.5	M1/3 SLO-A border crossing	TRA-N-109	non-FID	
2.1	MRS Šempeter – reconstruction	TRA-F-110	FID	
2.2	Compressor Station Ajdovščina (3rd unit)	TRA-N-092	non-FID	
2.3	M3 pipeline reconstruction from CS Ajdovščina to Šempeter/Gorizia	TRA-N-108	non-FID	
3.1	M6 Ajdovščina – Lucija (section Osp – Koper)	TRA-N-107	non-FID	
3.2	R61 Lucija – Sečovlje	TRA-N-114	non-FID	
4.1	M3/1a Gorizia/Šempeter – Ajdovščina	TRA-N-099	non-FID PCI 6.7.	
4.2	M3/1b Ajdovščina – Kalce	TRA-N-262	non-FID PCI 6.7.	
4.3	M3/1c Kalce – Vodice	TRA-N-261	non-FID PCI 6.7.	
4.4	Compressor Station Ajdovščina (2nd phase)	TRA-N-093	non-FID	
4.5	M8 Kalce – Jelšane	TRA-N-101	non-FID PCI 6.5.3.	
5	R15/1 Lendava – Kidričevo	TRA-N-112	non-FID PCI 6.23.	
6.1	M9a Lendava – Kidričevo (including CS Kidričevo 3rd phase with up to 5 units of total power up to 80 MW)	TRA-N-098	non-FID	
6.2	M9b Kidričevo – Vodice (including CS Vodice I – 4 units with total power up to 60 MW)	TRA-N-263	non-FID	
6.3	M10 Vodice – Rateče	TRA-N-100	non-FID	

2.3 Non-TSO (Third Party) Projects involving more or Non-EU countries

NO.	PROJECT	CODE	SPONSOR	COMMENTS	COMMIS-SIONING
NON-TSO (THIRD PARTY) PROJECTS INVOLVING MORE OR NON-EU COUNTRIES					
1	Nabucco Gas Pipeline Project ("Nabucco Classic")	TRA-N-077	NABUCCO GAS PIPELINE	These projects were not considered in the network simulations of the present edition of the GRIP. The sponsor of these projects, Nabucco Gas Pipeline International GmbH, entered a liquidation procedure in November 2013	– – –
2	Nabucco Gas Pipeline Project ("Nabucco West")	TRA-N-078 PCI 7.1.5.			
3	Interconnector Turkey – Greece – Italy	TRA-N-010 PCI 7.1.4.	IGI Poseidon		2019 Q2
4	Trans Adriatic Pipeline	TRA-N-051 PCI 7.1.3.	TAP Trans Adriatic Pipeline	Considered as FID in the present edition of the GRIP	2019
5	Trans-Mediterranean Gas Pipeline	TRA-N-054 PCI 7.3.1.		Same project as TRA-N-189, sponsored by DEPA	2018 Q2
6	South Stream Project	TRA-N-187	South Stream ENERGISING EUROPE	Gazprom, Eni, EdF and 6 J/V between Gazprom and local TSOs or State companies. This project also includes projects TRA-N-308, TRA-N-309 and TRA-N-310	2015 Q4
7	East Med Pipeline	TRA-N-189 PCI 7.3.1.	ΔΕΠΑ	Same project as TRA-N-054, sponsored by Cyprus Govt.	2019 Q1
8	Interconnector Greece Bulgaria – IGB	TRA-N-149 PCI 6.8.1.	IGI Poseidon; Bulgarian Energy Holding		2016 Q3
9	Interconnection Bulgaria – Serbia	TRA-N-137 PCI 6.10.	Bulgarian Ministry of Economy and Energy (MEE)		2015
10	Gaspipeline Zenica – Brod	TRA-N-224	BH-GAS	Project linked to Plinacro's TRA-N-066	2019
11	TANAP – Trans Anatolian Natural Gas Pipeline Project	TRA-N-221 PCI 7.1.1.	SOCAR		2018 Q1
12	White Stream	TRA-N-053 PCI 7.2.3.	W-Stream	The project has not shown any activity in the last few years and was not considered in the network simulations of the present edition of the GRIP	– – –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SOFIA
GREECE
ATHENS
TURKEY
MALTA
CRETA
Adriatic Sea
Aegean Sea
Mediterranean Sea
SOUTH STREAM
NABUCCO WEST
NABUCCO CLASSIC
WHITE STREAM (option 1)
WHITE STREAM (option 2)
TRANS-BALKAN PIPELINE
TAP
TANAP
IAP
IGB
IGI
POSEIDON
EAST MED
TRANS-MEDITERRANEAN GAS PIPELINE
AGRI
BROTHERHOOD
TRA-N-187
non-FID
TRA-N-224
non-FID
2019
TRA-N-078
PCI 7.1.5.
non-FID
TRA-N-187
FID
2015 Q4
TRA-N-187
FID
2015 Q4
TRA-N-053
PCI 7.2.3.
non-FID
TRA-N-187
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TRA-N-137
PCI 6.10.
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2015
TRA-N-149
PCI 6.8.1.
non-FID
2016 Q3
TRA-N-051
PCI 7.1.3.
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2019
TRA-N-221
PCI 7.1.1.
non-FID
TRA-N-077
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TRA-N-187
non-FID
TRA-N-010
PCI 7.1.4.
non-FID
2019 Q2
TRA-N-189
PCI 7.3.1.
non-FID
2019 Q1
TRA-N-054
TRA-N-189
PCI 7.3.1.
non-FID
2019 Q1

3 Demand

Annual Demand | Annual Demand Breakdown
Peak Demand | Annual and Peak Demand evolution Region
The impact of renewables on gas demand in the Southern Corridor countries

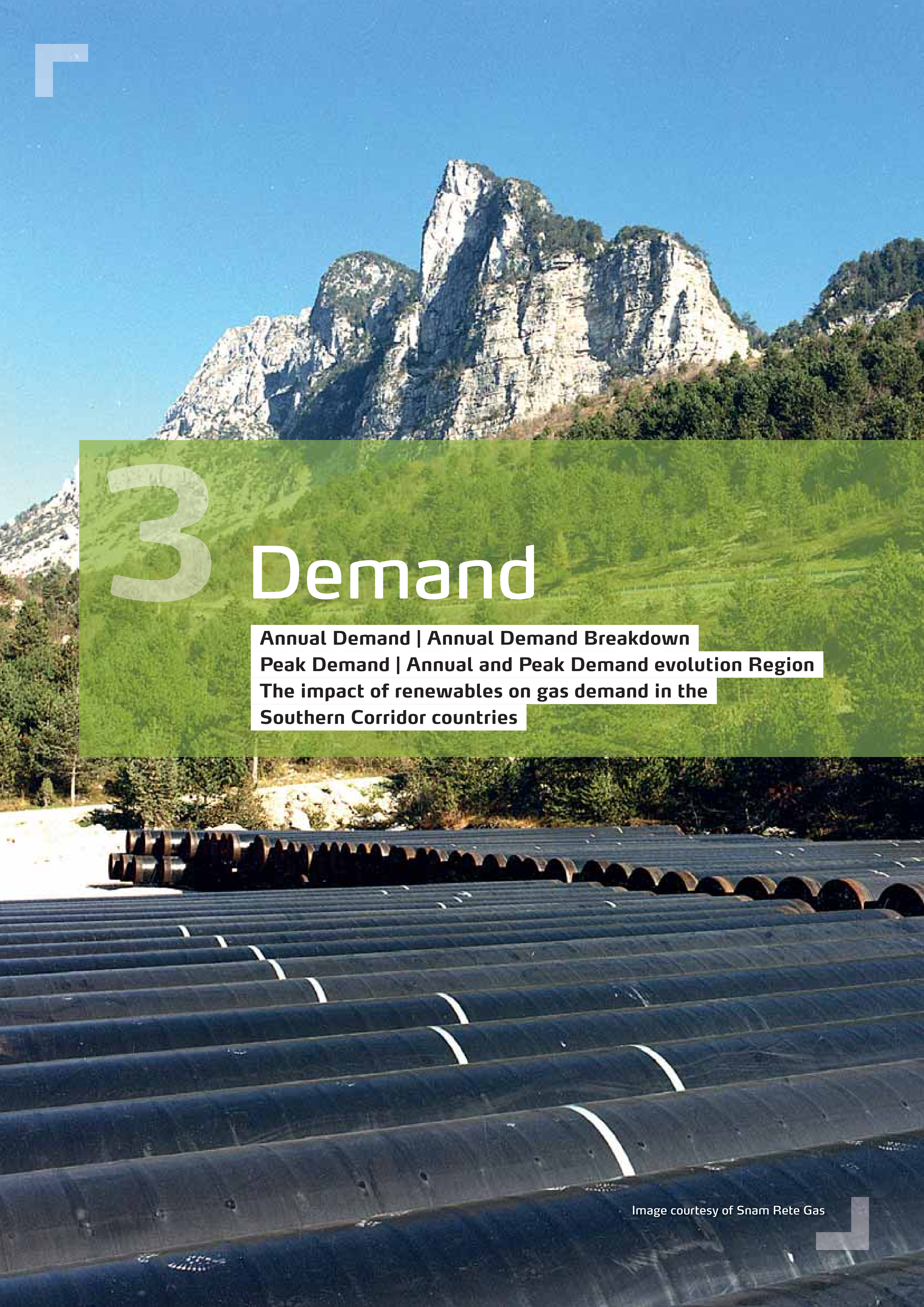


Image courtesy of Snam Rete Gas

The following chapter shows the historical and potential development of demand and supply in the Region. All figures used have been sourced from the Transmission System Operators (TSOs) of the Region in 2013, unless otherwise stated.[1)]

The following diagram shows the relative weight of the Region's countries in EU-28 related to annual natural gas demand in 2012.

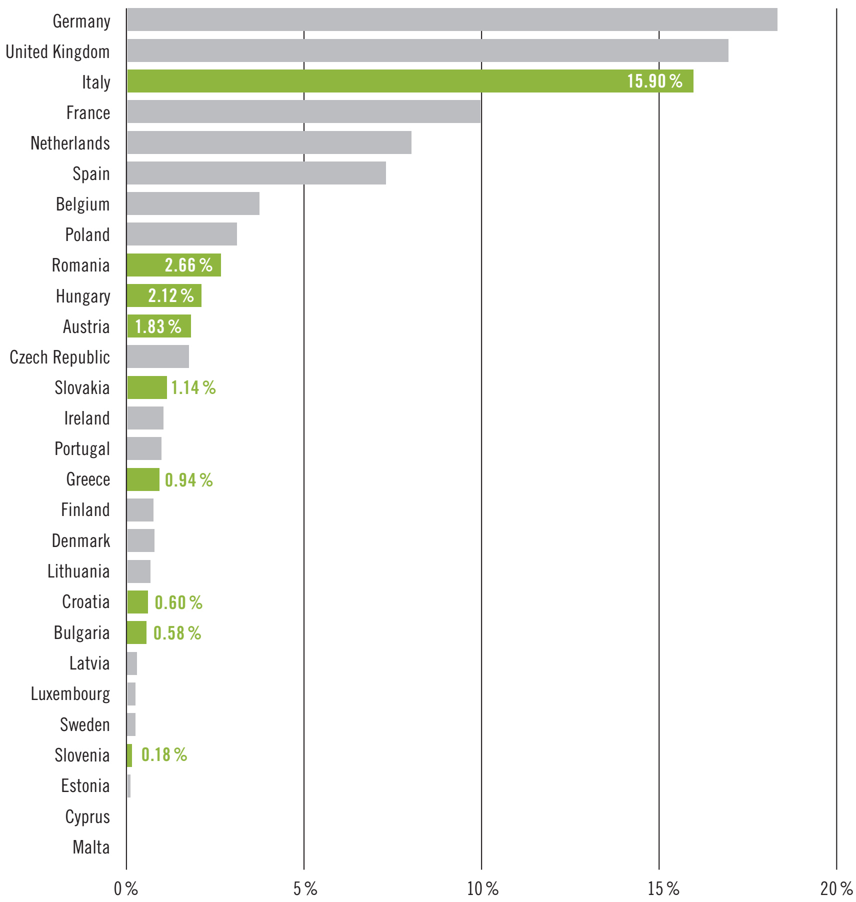


Figure 3.1 Annual gas consumption in the EU countries in 2012.

Among the countries of the Southern Corridor Italy is the largest gas consumer as it consumes 1.58 times more gas than all the other countries of the Region together.

1) Demand data refer to TSOs contributions sent to ENTSOG in August 2013 and their projections may have, in some cases, changed until the publication date.

3.1 Annual Demand

Figure 3.2 below shows the annual gas demand of the Southern Corridor Region compared to the rest of the European Union between 2013 and 2023. It shows that historically the 9 countries of the Southern Corridor Region made up around 25 % of the total EU demand.

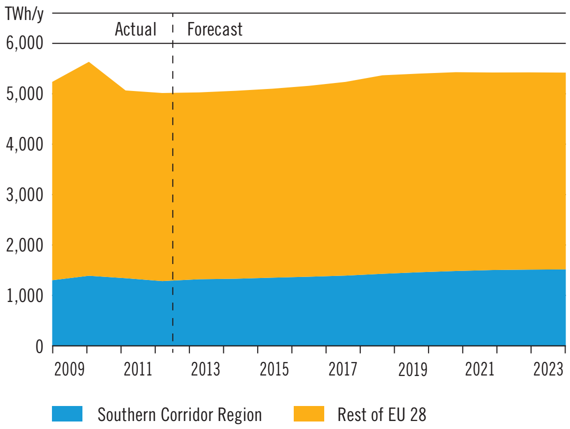


Figure 3.2: EU 28 and Southern Corridor annual gas demand

As in the rest of the European Union, the demand for natural gas is expected to rise over the next ten years. The countries of the Southern Corridor Region are expected to account for close to 28 % of the total EU gas demand over the next 10 years as shown in the following table. This increase from 24.9 % to 28.0 % reflects the present potential still to be exploited in several of the Region's gas markets and the perspectives for increase of gas demand for power generation in some of the Region's countries.

%	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
S. Corridor	24.9	24.7	26.5	25.6	26.3	26.3	26.5	26.6	26.6	26.6	27.0	27.3	27.7	27.9	28.0

Table 3.1: Forecasts for annual demand, Southern Corridor Region

Figure 3.3 below shows a comparison between the actual and forecast demand figures in the Southern Corridor GRIP 2012–2021, the TYNDP 2013–2022 and the ones provided by the TSOs for this GRIP. The chart shows the annual demand evolution of the Southern Corridor Region.

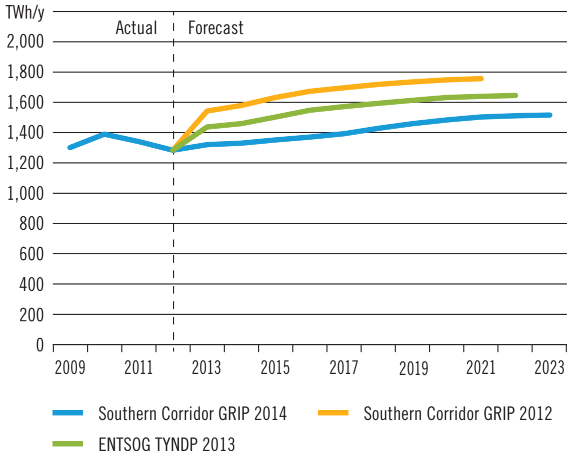


Figure 3.3: Southern Corridor annual gas demand GRIP 2014-2023 comparison TYNDP 2013–2022 & SC GRIP 2012–2021

Each forecast shows a slight increase in annual demand over the period however the consecutive demand forecasts show a steady decrease of the expected gas demand level.

The decrease between Southern Corridor GRIP demand forecast 2012–2021 and 2014–2023 is shown in the following table:

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Difference (TWh)	-222	-249	-281	-302	-303	-290	-276	-265	-253
Difference (%)	-14.4	-15.8	-17.2	-18.1	-17.9	-16.9	-15.9	-15.1	-14.4

Table 3.2: Decrease between demand forecast of Southern Corridor GRIP 2012–2021 and 2014–2023

The more contained decrease between demand forecast of ENTSOG TYNDP 2013–2022 and Southern Corridor GRIP 2014–2023, since the time span between them is shorter, is shown in the following table:

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Difference (TWh)	-117	-129	-151	-177	-179	-165	-154	-148	-136	-134
Difference (%)	-8.1	-8.8	-10.1	-11.5	-11.4	-10.4	-9.6	-9.1	-8.3	-8.2

Table 3.3: Decrease between demand forecast of ENTSOG TYNDP 2013–2022 and Southern Corridor GRIP 2014–2023

3.2 Annual Demand Breakdown

Figure 3.3 shows the annual demand breakdown of the Southern Corridor Region for the last four years together with their percentage evolution. The chart is broken down into Residential, Commercial and Industrial (RCI) demand compared to Power Generation demand. We may see the result of the economic conditions applying these last years on the gas-fired power generation sector. On one hand cheap coal combined with low carbon prices from the EU Emission Trading Scheme (ETS) have made it recently attractive to burn coal instead of gas. On the other hand the progression of the use of renewable energy sources has decreased the use of gas in power generation.

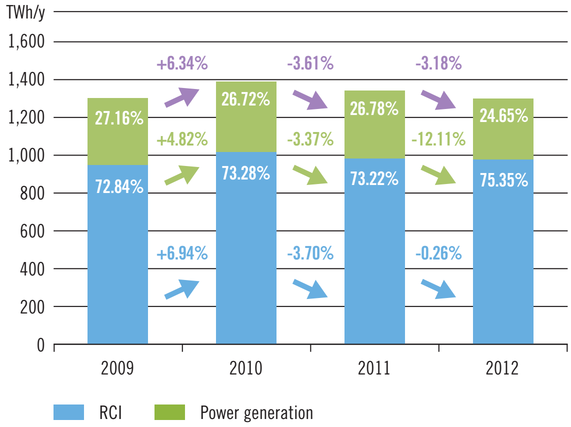


Figure 3.3: Evolution of Southern Corridor yearly demand in the period 2009 – 2012 and its breakdown

The historical data in figures 3.4 and 3.5 illustrate, that annual temperatures and economic downturn also heavily influence gas demand. This is due to the high percentage of households (in most countries) that rely on gas for heating, as demand increases when outdoor temperatures decrease. Since annual weather conditions cannot be forecasted, such extremes are not included in annual demand forecasts. In the same way, economic growth rates can only be reasonably assumed during forecasting, without the possibility to anticipate negative or positive unexpected shocks. This should be borne in mind when comparing actual data and forecasts.

Figure 3.4 shows a quite significant increment in Power Generation demand over the next ten years. It is important to stress the considerable amount of uncertainty around the Power Generation figures. Power Generation is market based and is heavily influenced by fuel prices and by incentives provided to renewable sources.

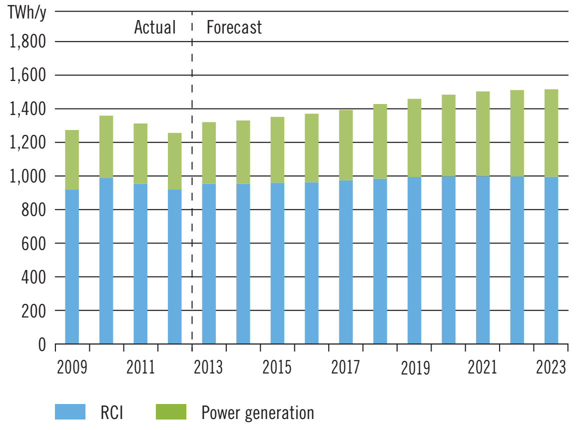


Figure 3.4: Southern Corridor Yearly Demand Breakdown (historical and forecast)

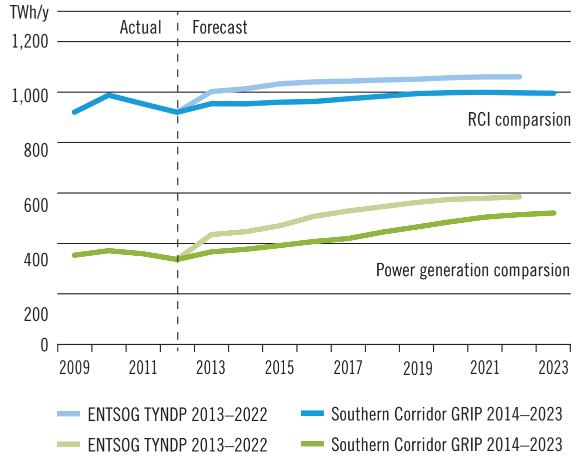


Figure 3.5: TYNDP 2013 – 2022 vs. SC GRIP 2014 – 2023 comparison for RCI and Power Generation

Figure 3.5 shows the demand breakdown between RCI demand and gas fired power generation demand comparing this GRIP data and the TYNDP 2013 – 2022 figures. The GRIP RCI demand, over the period to 2023, is expected to increase by 4.5 %. The Power Generation forecast demand shows slower increase, in comparison with the TYNDP 2013 – 2022 data, but reaches practically the same level at the end of the period. The change in the power generation demand shows a 44 % increase over the period 2013-2023.

The reasons for the higher expected increase in the power generation sector are the relative immaturity of gas fired power generation sector in several countries (see figure 3.9 on the following pages) and the complementarity with renewable energy sources that CCGT power plants can offer. The maps in the Figures 3.6 to 3.8 below depict the demand evolution per country in total and broken down to Residential-Commercial-Industrial (RCI) and Power Generation[1].

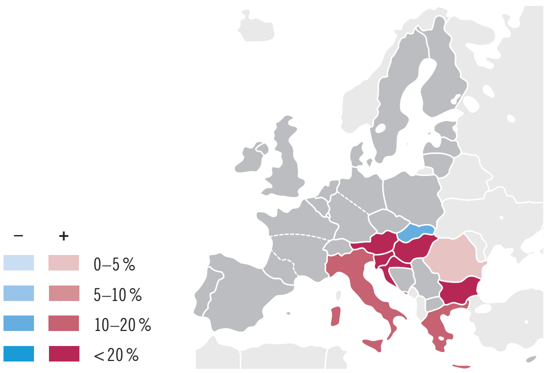


Figure 3.6:
Southern Corridor countries annual demand evolution over the period 2013 – 2023

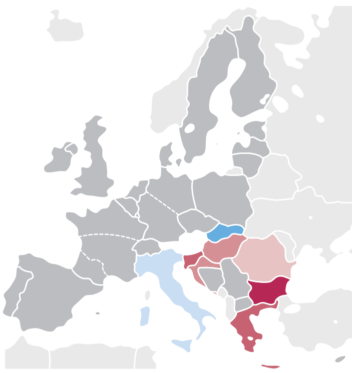


Figure 3.7:
Southern Corridor countries RCI annual demand evolution over the period 2013 – 2023

Figure 3.8:
Southern Corridor countries annual gas demand for power generation evolution over the period 2013 – 2023

1) Figures 3.7 and 3.8 do not contain information on Austria as its demand breakdown between RCI and power generation is not available.

3.3 Peak Demand

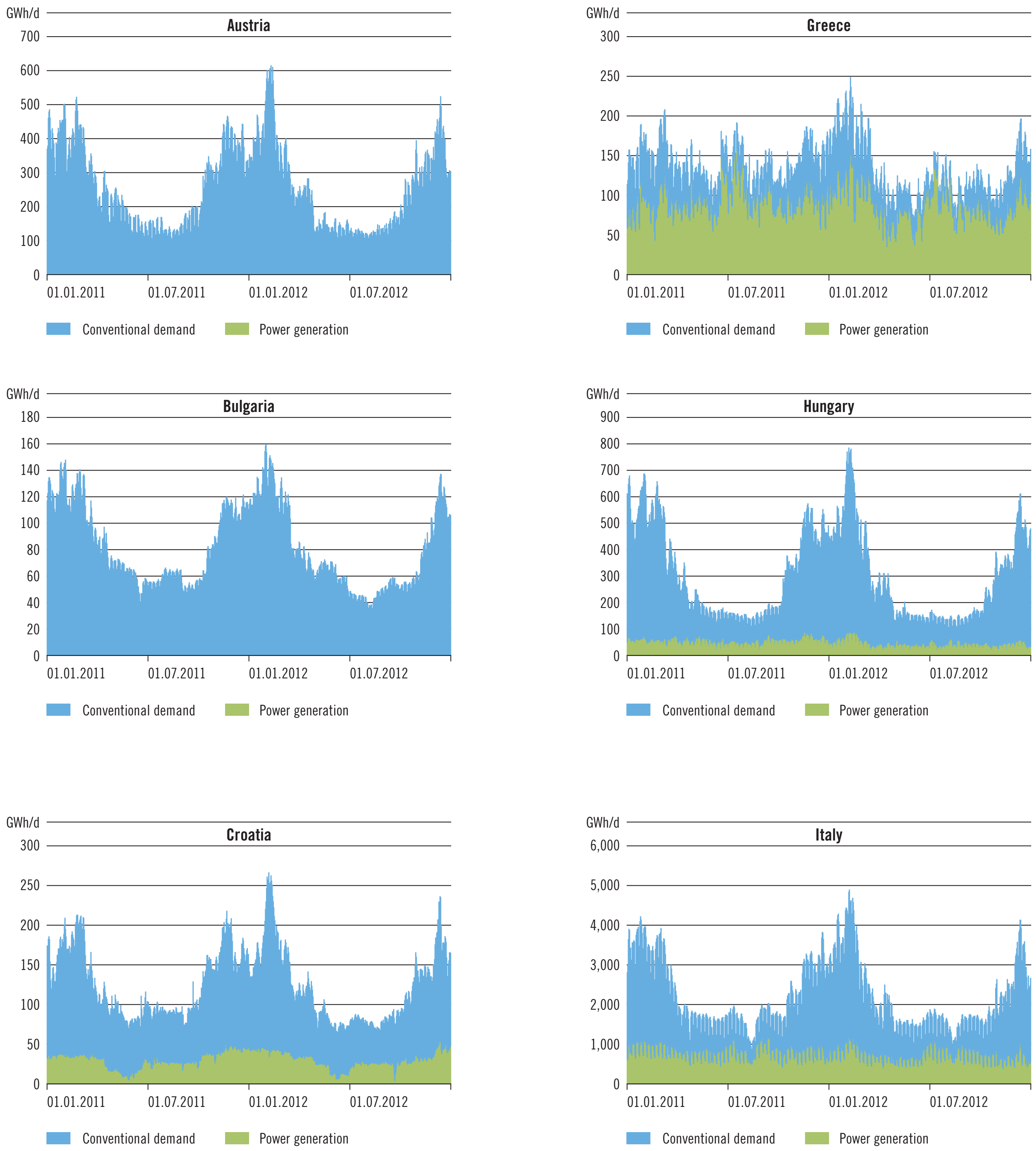
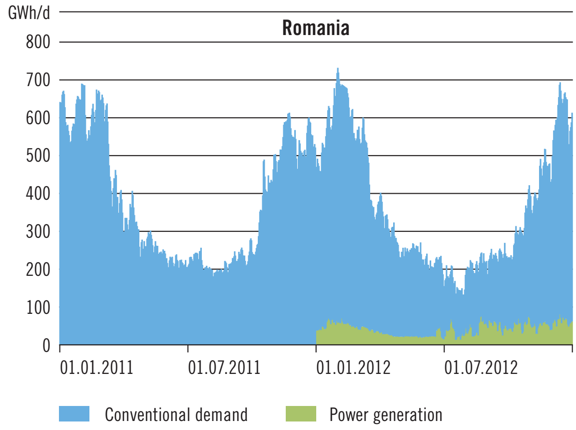
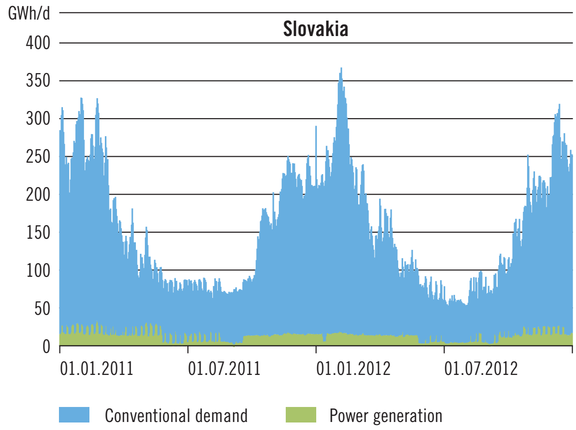
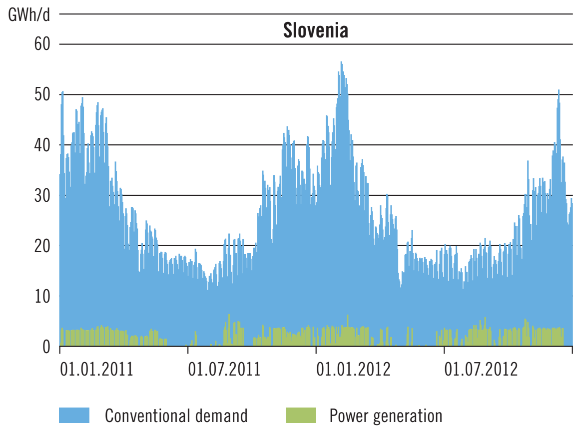


Figure 3.9: Demand profile per country in 2011 and 2012







3.3.1 DEMAND MODULATION

The graphs of figure 3.9 to the left show the daily demand during 2011 and 2012 in every country as well as the part of it attributed to power generation.

It results, from the graphs, that countries with less use of gas for power generation and subject to a more continental climate have lower load factor[1]. Greece which combines the higher rate of gas use for power generation and the milder climate as well as a still immature residential market, has the more flat demand profile.

These graphs also show that most of the gas demand for power generation comes from Italy, followed, far behind, by Greece, Hungary, Romania and Croatia[2] and that there is an important potential for increase of this type of demand in the Region.

They, moreover, show that the highest daily demand remained at comparable level, across the period considered, in all countries, being mainly affected by winter demand. This signal is particularly important for gas infrastructure operators in order to keep the performance of gas systems, and the related underlying assets ready to face peek requirements. This is the main prerequisite to guarantee adequate security of supply standards to domestic, and to a higher level, Regional energy system.

1) Defined as the ration between the average daily demand (in a year) over the maximum daily demand
2) No data for the use of gas in power generation are available for Austria and Bulgaria

3.3.2 FORECAST PEAK DAILY DEMAND

Daily peak demand is of vital importance, as it is the main criterion for network design. The chart below shows the historical Regional aggregated peak demand over the last 4 years. This demand is the sum of national peak demand days during the last four years that may have occured on different days in each country. The tables below show the comparison between the Southern Corridor GRIP 2012–2021, TYNDP 2013–2022 and Southern Corridor GRIP 2014–2023 data. It results that the forecasted peak demand steadily decreases in the three consecutive investment plans.

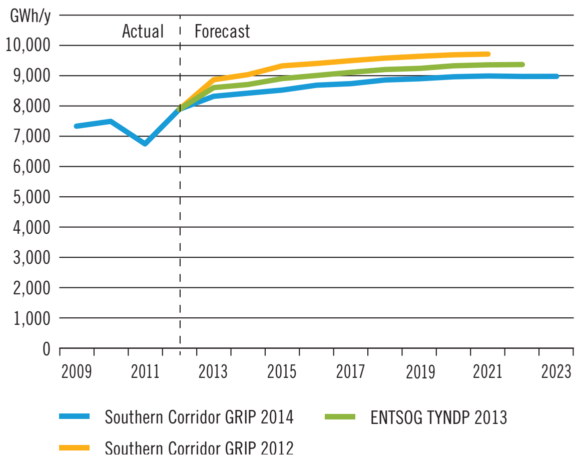


Figure 3.10: Southern Corridor peak demand comparison between the SC GRIP 2012–2021, TYNDP 2013–2022 and SC GRIP 2014–2023

Peak demand forecasts show a decrease consistent with annual demand revisions, but their contractions are relatively less important as the percentage decreases of peak demand are about half of the corresponding reductions of the total demand.

This outcome confirms also for the future the findings derived studying the historical peak demand on the unaltered importance of guaranteeing gas system security of supply through an adequate network design.

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Difference (GWh)	-548	-612	-800	-717	-760	-723	-741	-725	-723
Difference (%)	-6.2	-6.8	-8.6	-7.6	-8.0	-7.5	-7.7	-7.5	-7.4

Table 3.4: Decrease of peak daily demand forecasts for Southern Corridor GRIPs between 2012 – 2021 and 2014 – 2023

The decrease between peak daily demand forecasts of ENTSOG TYNDP 2013–2022 and Southern Corridor GRIP 2014–2023 is shown in the following table:

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Difference (TWh)	-117	-129	-151	-177	-179	-165	-154	-148	-136	-134
Difference (%)	-8.1	-8.8	-10.1	-11.5	-11.4	-10.4	-9.6	-9.1	-8.3	-8.2

Table 3.5: Decrease between peak daily demand forecasts of ENTSOG TYNDP 2013–2022 and Southern Corridor GRIP 2014–2023

The graph in Figure 3.11 shows the update of the three demand scenarios (daily Design Case, daily Uniform Risk and 14-days average) used in ENTSOG TYNDP 2013–2022[1]. The TSOs of the Southern Corridor countries view the Design Case as the primary high daily demand scenario among them, as it ensures the most robust development of the network.

In the Southern Corridor countries both the evolution of high daily demand and annual demand decreased, compared to the Southern Corridor GRIP 2012–2021 and TYNDP 2013–2022.

It is remarkable that in this Region the peak demands related to both the Design Case and the Uniform Risk scenarios are almost identical.

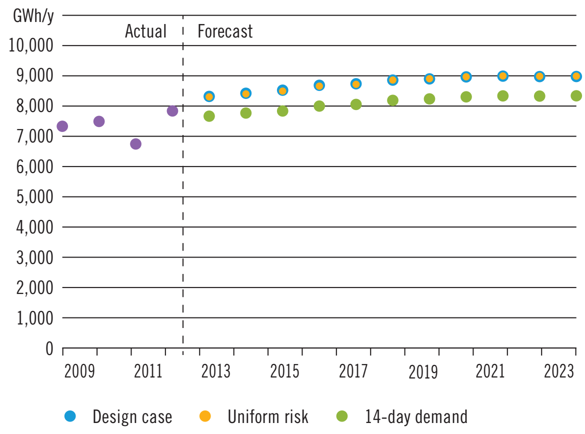
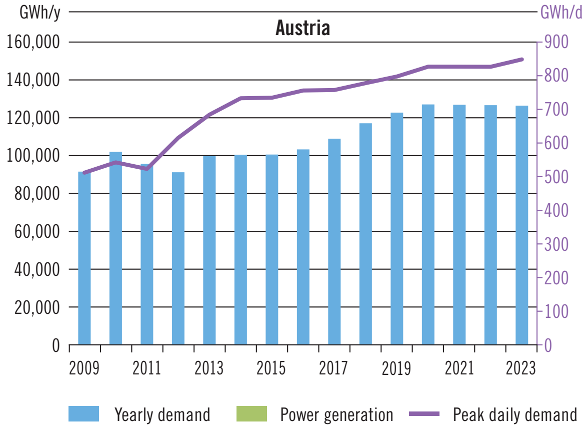


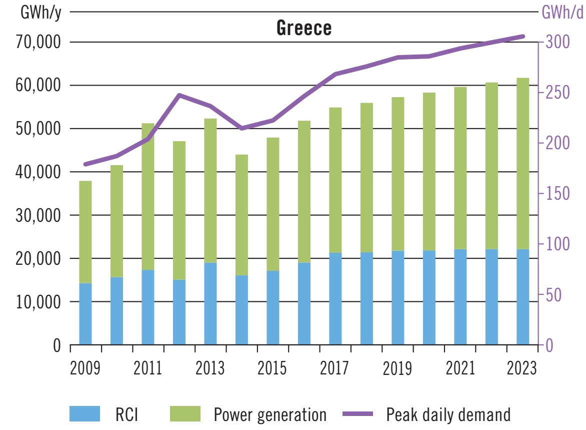
Figure 3.11: Southern Corridor Region Daily Peak Demand Outlook

1) For further information on the different methodological descriptions please see the TYNDP 2013–2022 pp. 31-36.

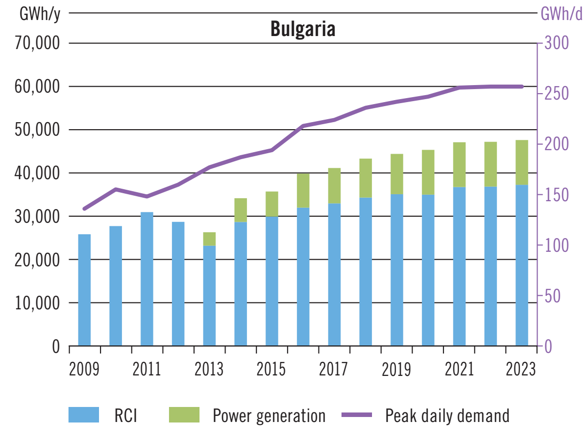
3.4 Annual and Peak Demand evolution



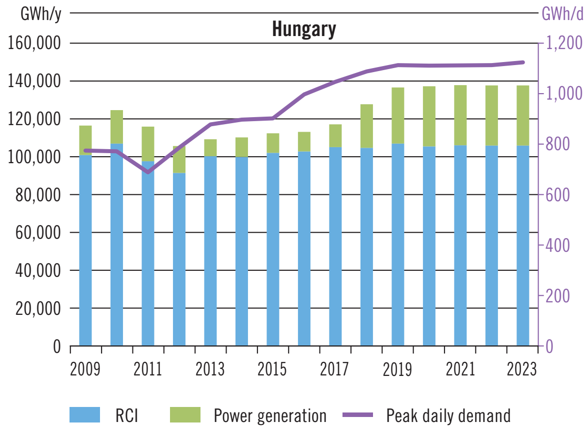
Evolution of annual demand (%): 26.8
RCI / Power / Total (%): 0 / 0 / 27 [2)]
Evolution of peak demand (%): 24



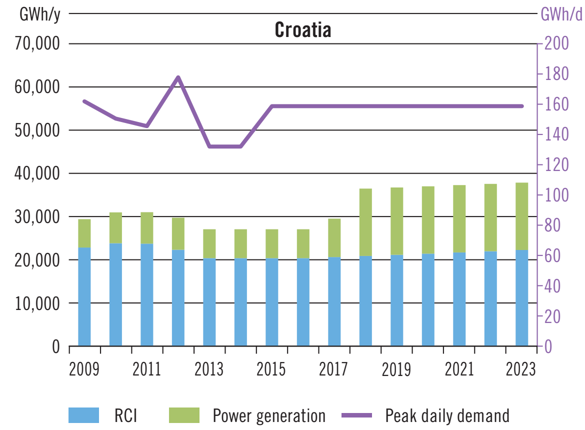
Evolution of annual demand (%): 18.0
RCI / Power / Total (%): 16 / 19 / 18
Evolution of peak demand (%): 27



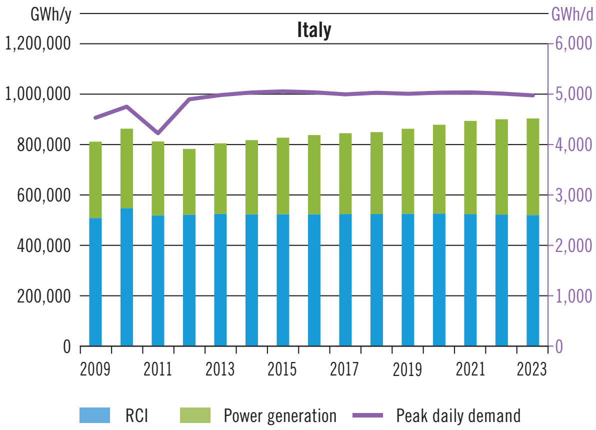
Evolution of annual demand (%): 81.8
RCI / Power / Total (%): 61 / 233 / 82
Evolution of peak demand (%): 45



Evolution of annual demand (%): 26.0
RCI / Power / Total (%): 6 / 255 / 26 [3)]
Evolution of peak demand (%): 28

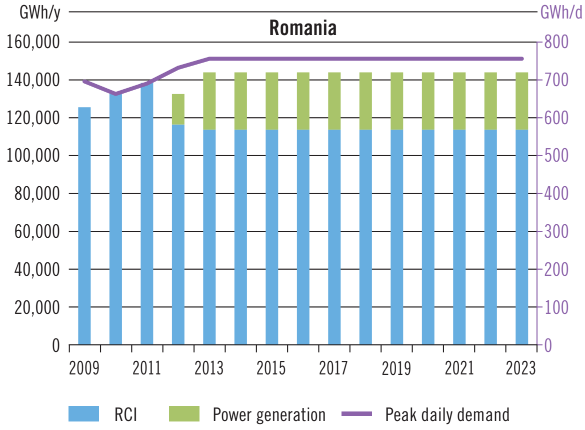


Evolution of annual demand (%): 39.9
RCI / Power / Total (%): 9 / 133 / 40
Evolution of peak demand (%): 20

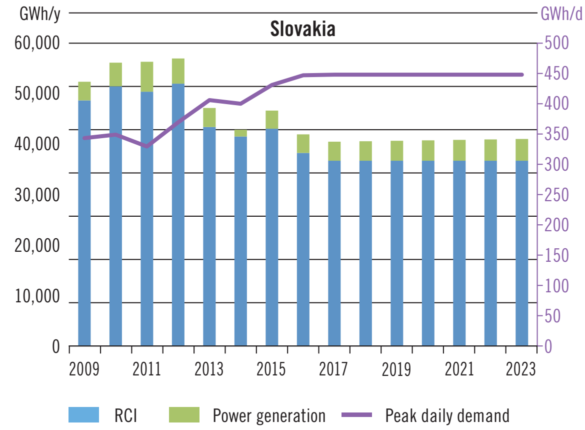


Evolution of annual demand (%): 12.3
RCI / Power / Total (%): -1 / 37 / 12
Evolution of peak demand (%): 0

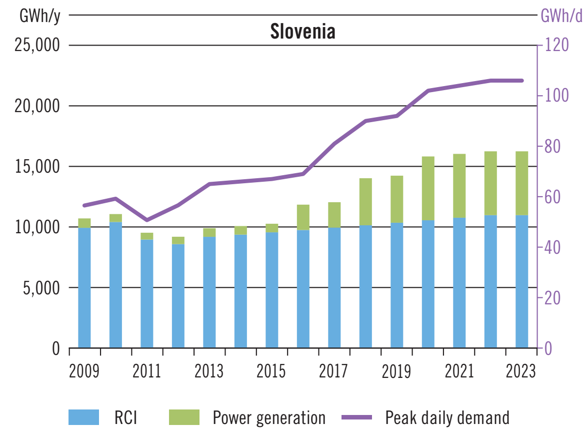
Figure 3.12: Evolution of actual and forecast gas demand per country



Evolution of annual demand (%): 0.0
RCI / Power / Total (%): 0 / 0 / 0
Evolution of peak demand (%): 0



Evolution of annual demand (%): -13.0
RCI / Power / Total (%): -3 / 14 / -13
Evolution of peak demand (%): 10



Evolution of annual demand (%): 64.2
RCI / Power / Total (%): 19 / 643 / 64
Evolution of peak demand (%): 63

In this paragraph we present the historical (up to and including 2012) and forecasted data of annual and peak daily demand country by country. The Regional increase in annual demand is expected to be 14.8 %. From the graphs of figure 3.12 result that Bulgaria, Greece, Croatia, Hungary, Italy and Slovenia expect an increase in gas demand for power generation.

Moreover it is shown that in several countries the increase percentage of the daily peak demand is expected to exceed the one of the yearly demand. This may be attributed to the increase of intermittency of the CCGT operation due to the increase in the use of renewable energy sources.

The evolution of the annual demand refers to the period 2013 – 2023[1)].

Please note that the peak demand line corresponds to the right-hand vertical axis. Therefore the distance of this line from the bars representing the annual demand (read on the left-hand axis) does not have any significance.

The graphs on the left provide an additional sign on the importance of peak demand requirements in terms of disaggregated analysis per country. Peak daily demand is growing in the majority of Regional States, providing an indication for potential infrastructure development needs. This conclusion is particularly relevant for those countries having still an important potential ahead. For mature markets peak demand is more stable and infrastructure enhancements could be more linked to the changing evolution of demand and supply patterns and to the necessity to adequately refurbish gas system components and equipment.

1) Demand data refer to TSOs contributions sent to ENTSOG in August 2013 and their projections may have, in some cases, changed until the publication date.
2) Figures 3.12 does not contain information on the demand breakdown between RCI and power generation in Austria as this is not available.
3) The Hungarian RCI data also contains the gas forecast demand of power generation facilities connected to the distribution system.

3.5 The impact of renewables on gas demand in the Southern Corridor countries

According to the Directive 2009/28/EC renewable sources should cover at least 20% of total gross final energy consumption[1] in the whole EU by 2020. Each member state has to achieve at least an agreed rate of energy production from renewable sources.

In the Southern Corridor Region there are no available yearly data in all countries about the usage of renewable sources in primary energy production over the next ten year. We can assume that most of the renewable technologies will appear in the power generation sector and that this might reduce the gas demand for power generation or will, at least, reduce the growth of gas demand for power generation.

Although this assumption is reasonable in terms of possible negative impacts on the overall gas demand, the same is not true for peak demand requirements, due to the inherent intermittent nature of RES.

Image courtesy of Snam Rete Gas

1) Gross final consumption of energy is defined, in Directive 2009/28/EC on renewable sources, as energy commodities delivered for energy purposes to final consumers (industry, transport, households, services, agriculture, forestry and fisheries), including the consumption of electricity and heat by the energy branch for electricity and heat production and including losses of electricity and heat in distribution and transmission.

Indeed, a sustainable and reliable growth of green electricity sources is heavily dependent on the back-up solutions put in place to substitute the renewable electricity streams when wind is not blowing or sun not shining.

As natural gas is the fossil fuel having the least impact in terms of CO_2 emission, CCGTs represent the most appropriate solution to fulfil RES back-up function without running the risk to waste the environmental gain provided by green energy sources.

The situation in several selected countries is presented below.

3.5.1 GREECE RENEWABLES

In Greece the renewables have an important share in power generation, about 14.1% (2012), with hydropower being the most important.

The share of renewables in power generation is expected to reach 29.6% by 2023 and, according to the forecast, wind and solar will contribute most to this increase. The difference between the historical value in 2012 and the forecasted value in

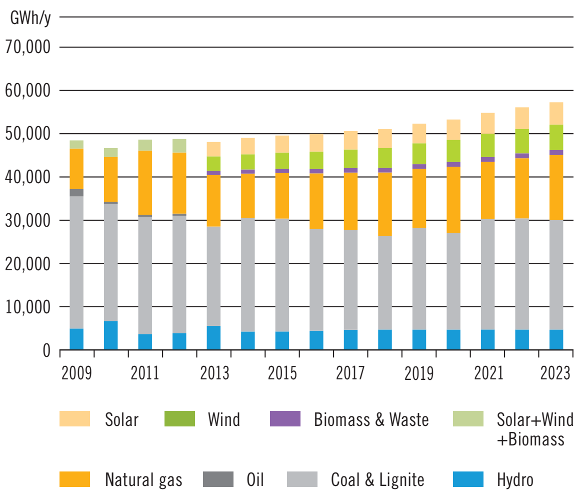


Figure 3.13: Power generation of Greece by source (historical and forecast)

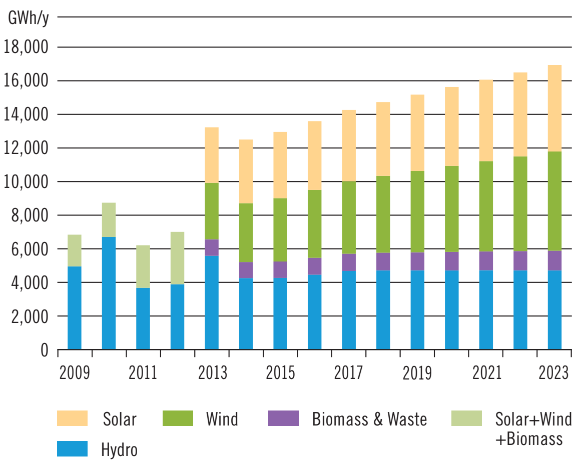


Figure 3.14: Forecast of power generation in Greece from Renewable Energy sources from 2009 to 2012

2023 is 9,093 GWh which is more than 240%. If we compare this increase with the difference between the historical and forecasted power generation figures for Greece (Figure 3.13) it results that the renewables can provide the additional power generation demand for the next 10 years.

3.5.2 HUNGARY RENEWABLES

The Figure 3.15 shows the split among the sources used for power generation in Hungary during the recent years.

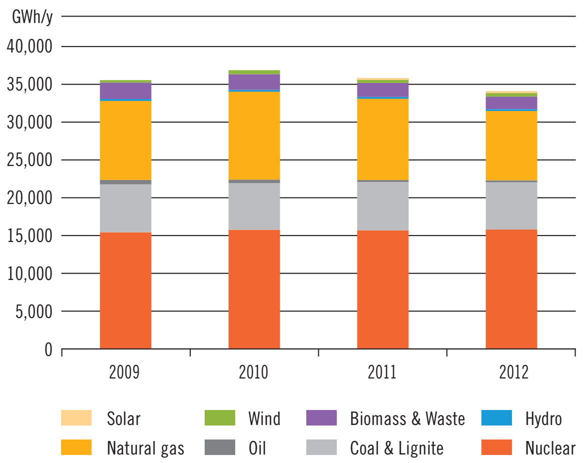


Figure 3.15: Power generation of Hungary by source (historical)

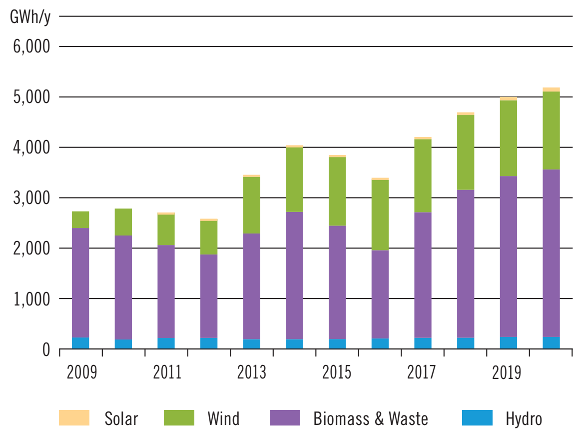


Figure 3.16: Forecast of power generation in Hungary from Renewable Energy sources from 2009 to 2020
Source: Hungary's Renewable Energy Utilization Action Plan

Figure 3.16 presents the forecasted evolution in the use of renewable sources for power generation in Hungary.

The difference between the historical value in 2012 and the forecast value in 2020 is 2,604 GWh which is more than 100 %. If we compare this growth with historical power generation of Hungary by source (Figure 3.15) it results that, till 2020, the renewables may replace up to 7.6 % of the total power generation in 2012.

Image courtesy of FGSZ

3.5.3 ITALY POWER PRODUCTION (INCLUDING RENEWABLES)

Figure 3.17 shows the evolution of electricity production and of the shares of the various energy sources used for power generation, in Italy, for the period 2009–2012.

Renewable sources in Italy experience a steady growth, during the last years, reaching in 2012 almost a third of the total power production. Hydroelectric production covers about half of RES share, followed by solar energy which accounts for around 6 % out of the total production.

Anyway, fossil fuels have and are expected to keep a key position in the Italian electricity balance, accounting for two-thirds of the electricity production. In particular, gas is by far the first among fossil fuel, covering in 2012 more than 40 % of the total production, followed by coal (represented in the graph under "Solids") with near 20 % and oil in progressive decrease.

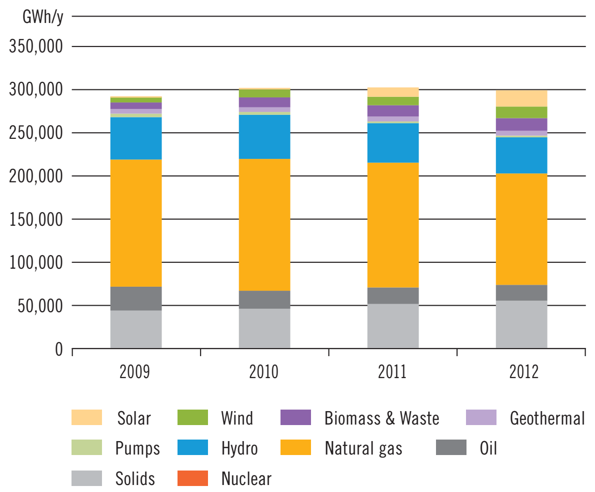


Figure 3.17: Power generation in Italy by source (historical)

3.5.4 SLOVENIA RENEWABLES

In Slovenia the renewables have a high share in power generation, about 23.5 %, and among the renewables hydro has the higher share, as shown in Figure 3.18 Slovenia has already fulfilled the EU 2020 requirements.

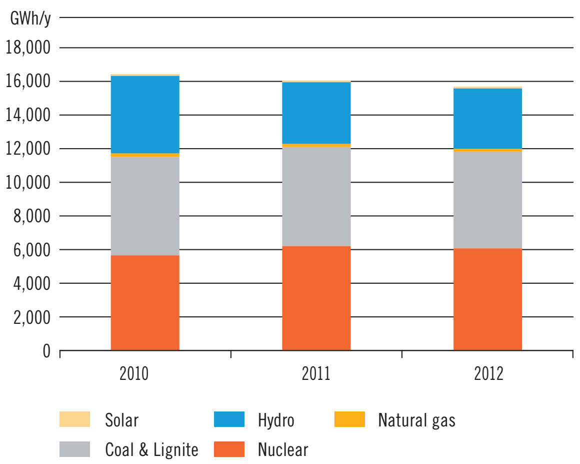


Figure 3.18: Power generation of Slovenia by source (historical)

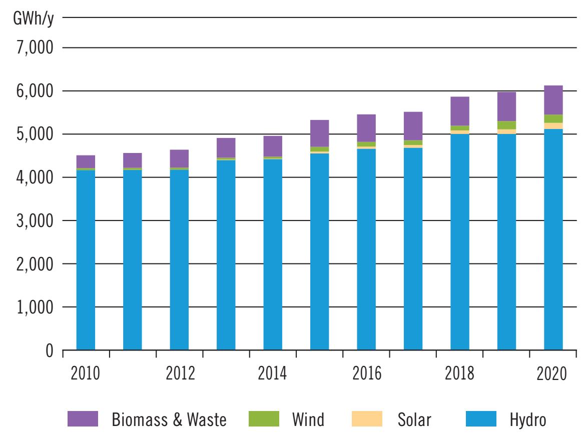


Figure 3.19: Forecast of power generation in Slovenia from Renewable Energy sources from 2010 to 2020 (GWh/y) Source: Action plan for renewable energy sources in Slovenia from 2010–2020

Figure 3.19 presents the forecasted evolution in the use of renewable sources for power generation in Slovenia.

The increase of the, already predominant, hydropower is expected to exceed the increase of all other renewable sources, among which biomass is to be the more important.

3.5.5 SLOVAKIA RENEWABLES

Figure 3.20 shows the evolution of renewable technologies in Slovakia between 2010 and 2025. Among the renewables the biomass and waste has currently the first place and its importance is expected to increase by 2025. The forecast growth from 2010 to 2025 is 20,056 GWh, or more than 145 %.

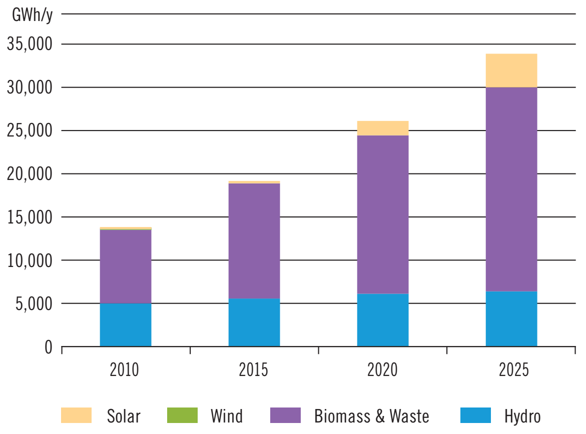


Figure 3.20: Forecast of power generation in Slovakia from Renewable Energy sources from 2010 to 2025 (GWh/y)

4 Supply

National Production | Imports | Prices

image courtesy of Snam Rete Gas

4.1. National Production

Gas from national production still plays an important role in some countries of the SC Region, especially in Romania where coverage of demand by national production is expected to be 71 % in 2014 and 50 % in 2023, Croatia (58 % in 2014 and 19 % in 2023), Bulgaria (24 % in 2014 and 34 % in 2023), Austria (17 % in 2014 and 10 % in 2023), Italy (10 % in 2014 and 8 % in 2023) and Hungary (15 % in 2014 and 4 % in 2023). By 2023, Romania will still be the major producer in the Region, among the countries already having a national production, with 39 % of the Region's production (with the exception of that of Cyprus discussed below), closely followed by Italy with 37 %. In 2012 the share of gas for national production has covered 19 % of the overall Southern Corridor demand as shown in Figure 4.1. Figure 4.2 shows the participation of each country in the national production of the Region in 2012.

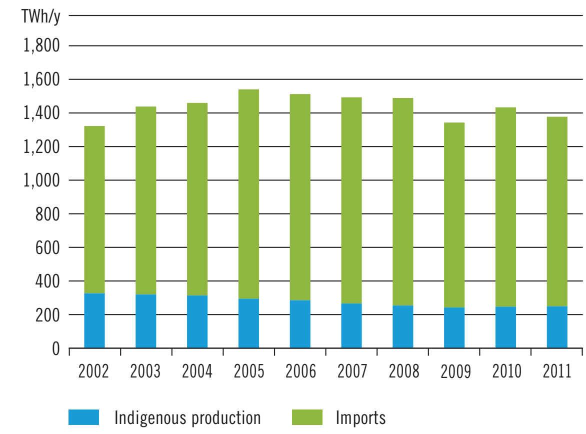


Figure 4.1: Part of gas imports in total consumption

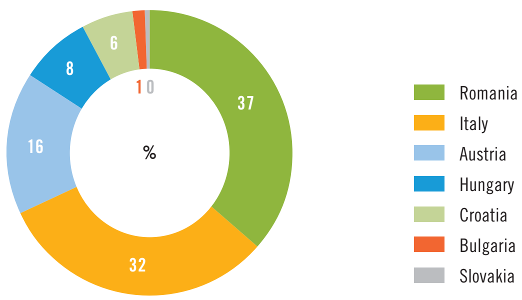
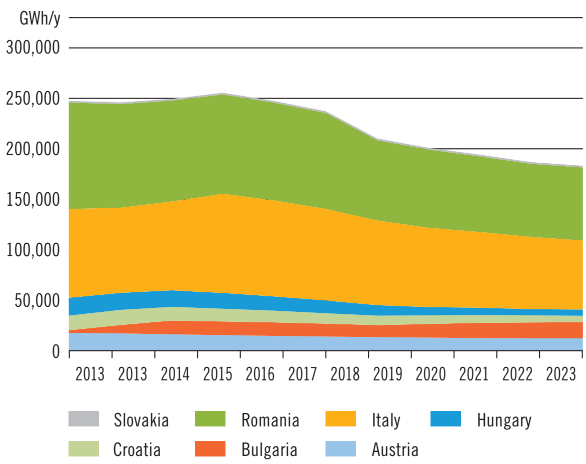


Figure 4.2: Share of national production by country in 2012

By 2023 this share is expected to decrease to approximately 12 %. However this trend will be reversed if and when the recently discovered off-shore gas fields in Cyprus will enter production phase. Unlike the national production of the other countries, the production of Cyprus will greatly exceed its consumption even taking into account the commissioning of gas fired power plants, presently planned to enter in operation by 2016 , and any other use that will be developed, given that no gas is presently used on the island. Figure 4.3 shows the impact on the gas production from Cyprus on the SC Region national production, from 2019 onwards. This impact will make the SC Region national production jump from a 18 % share of the EU national production, to almost 29 %.



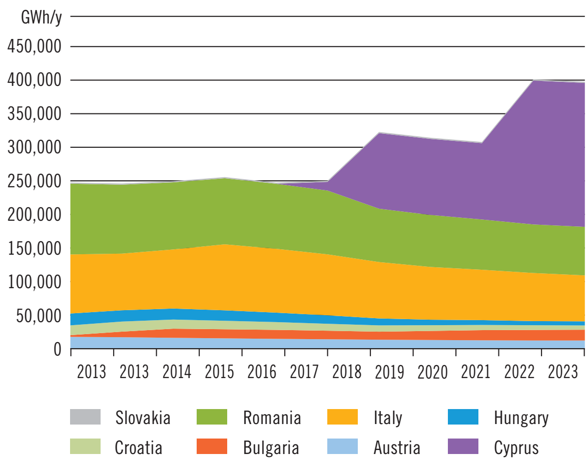


Figure 4.3: National production forecast with and without the production of Cyprus

It has however to be noted that the estimation of the effective, and not only arithmetic, share of national production on the Region's demand depends on the final destination of the Cypriot gas.

In fact, this gas will need to be exported but it is not yet known to which destination. Moreover, the quantities discovered so far do not seem sufficient to make feasible any export scheme other than a pipeline to Turkey, a low probability option unless a spectacular progress is made in the relations between the two countries. Therefore Cyprus should team with other countries of the Eastern Mediterranean, like Israel and possibly Lebanon, so that a critical mass is reached that will make a gas export project economically sustainable. The SC Region countries are one among other destinations. Many options are being discussed. The number of potential partners and the tensions inherent to this Region make, at this stage, any prediction on the successful option highly uncertain. In the present GRIP the non-FID project of a pipeline linking the Eastern Mediterranean gas fields to Greece, proposed by 3rd parties (TRA-N-054 & 189), has been included.

4.2 Imports

The easternmost countries of the Region are greatly dependent on imports from Russia, as shown by the modelling results (see paragraph 7.3.3). LNG is an important source for Italy and Greece. Figure 4.4, showing the relative importance of the infrastructure in place and the one planned, indicates that a further increase is possible (several LNG projects in Italy – all of them however non-FID – and the ongoing project of the 2nd extension of the Revythoussa terminal in Greece together with the construction of a 3rd storage tank). The rate of use of LNG will also depend on its price evolution. High demand from the far-east and prospects for LNG exports by the USA, are factors working in opposite directions (see also paragraph 4.3 below).

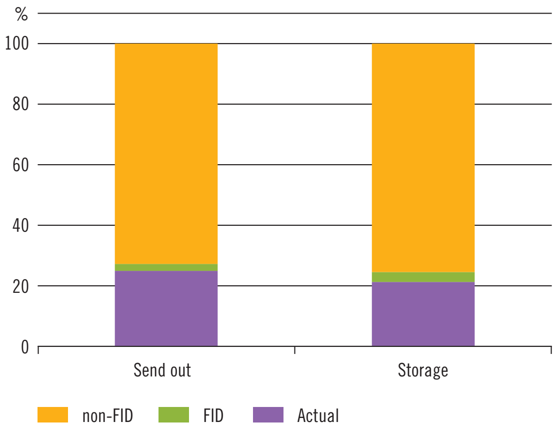


Figure 4.4: Relative capacity of existing, FID and non-FID LNG terminals in the Region

Figure 4.5 shows that gas supply to the Region as a whole is rather well diversified. However the aggregation at the Regional level conceals the fact that four countries (Bulgaria, Croatia, Hungary and Slovakia) depend on Russian gas for more than 80 % of their supply.

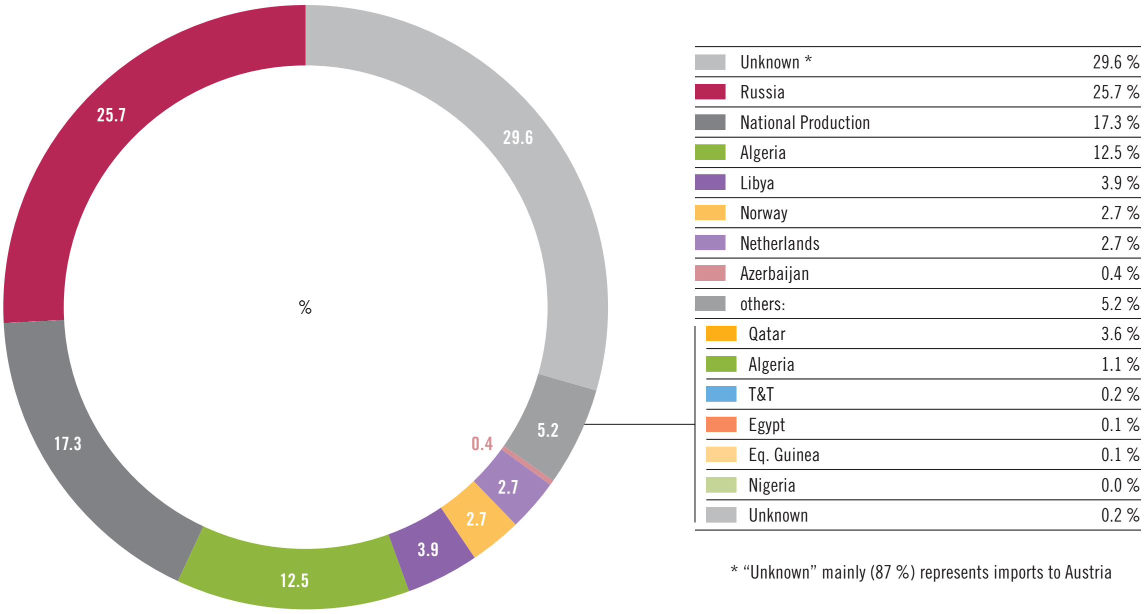


Figure 4.5: Diversification of supply in the Southern Corridor Region in 2012

During the three last years, the gas demand in the SC Region has stopped increasing and marked a slight decrease despite the fact that some of the markets are still immature and therefore have a potential for increase. This was the combined effect of:

- the economic crisis in Europe,
- the reduction in the power generation sector, due to the switch from gas to coal, to the decrease in electricity demand and to the progression of renewables in the power generation sector.

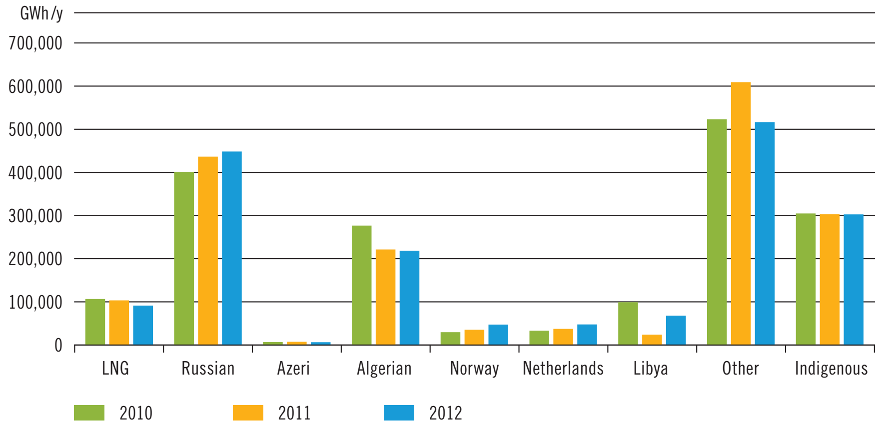


Figure 4.6: Evolution of gas supply by source

The split among the various sources of supply did not change substantially, as show the Figures 4.6 and 4.7. There was an increase of the Russian gas, a decrease of the Algerian (pipeline) gas, a slight increase of the Norwegian and Dutch gas and a decrease of LNG. The reasons for the decrease of LNG are described in chapter 4.3. Its reduction trend has been confirmed and even made more important in 2013 as shown in Figure 4.8.

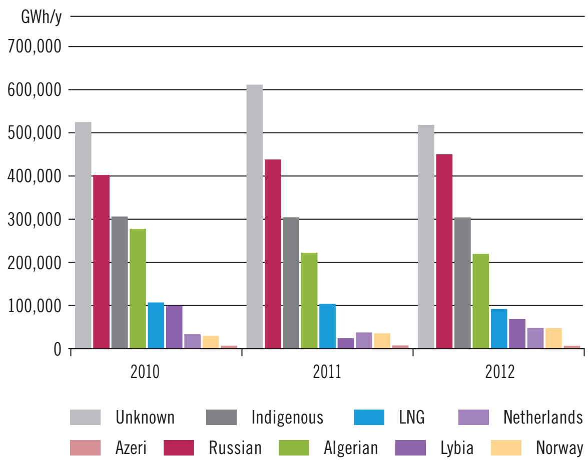


Figure 4.7: Evolution of gas supply by source
"Unknown" means imports from sources that cannot be identified. These include a part of the imports to Italy and Slovenia and the sum of the imports to Austria

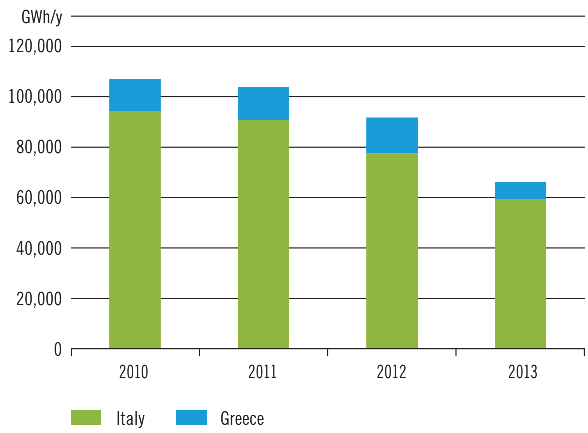


Figure 4.8: Evolution of LNG imports in SC Region

4.3 Prices

The import prices in the Region are in general higher than those of the liquid markets in Central and Western Europe.

Figure 4.9 shows that the Russian gas price to Eastern European countries are consistently higher than the prices applied in Germany, Belgium or than the day-ahead price at the UK NBP hub. (The drop in the price to Bulgaria recorded in the beginning of 2013 is due to an agreement for the reduction of the Russian gas price to Bulgaria which however did not impact the prices to the other countries[1)]). On the other hand the lack of liquidity results to a greater stability of the wholesale prices and the lack of important spikes like the one seen on the NBP due to the unexpectedly cold weather in March 2013.

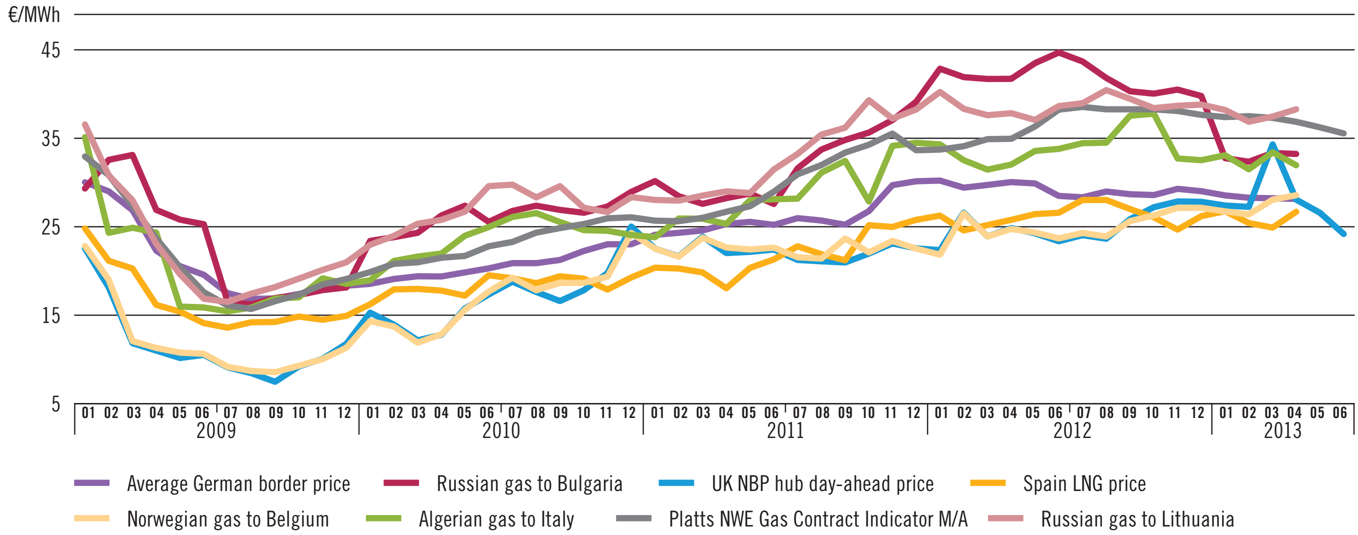


Figure 4.9: Comparison of EU wholesale gas price estimations
Source: EU Quarterly Report on European Gas Markets, 2Q 2013
http://ec.europa.eu/energy/observatory/gas/gas_en.htm

The above price pattern is related to the poor opportunities that the easternmost countries of the Region have for the diversification of their supplies. This increases the importance that the opening of the Southern Gas Corridor has for the Region.

1) A price reduction agreement was also signed between Gazprom and DEPA (Greece) in March 2014.

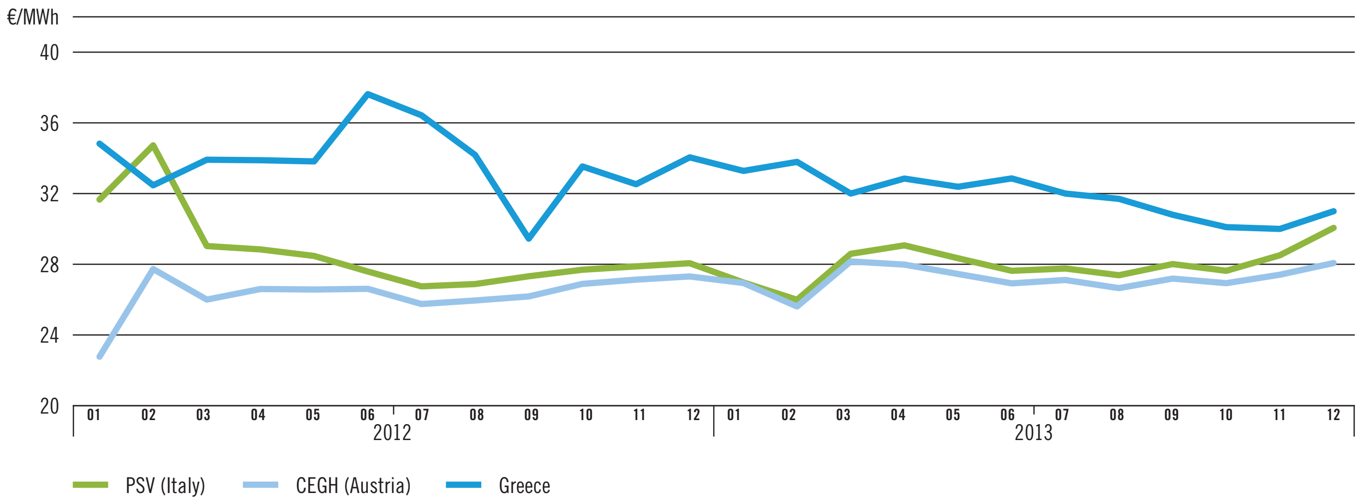


Figure 4.10: Comparison of gas prices in the SC Region

Figure 4.10 shows another side of the gas prices issue, namely the difference between the more liquid markets of the western parts of the Region (Austria and Italy), where hubs are operating, and less liquid markets like the one of Greece which however, thanks to the existence of an LNG terminal, offers more supply options than, for instance, the ones of Croatia or Bulgaria.

The graph reveals:

- A trend of progressive price-alignment between the Italian and the Austrian hubs, during the last two calendar years (2012 – 2013) which reflects the trend of increasing price correlation ongoing among all EU major gas hubs.
- A difference between the above hub prices and the prices of a less liquid market like the one of Greece where the gas price is mainly set by the long term import contracts in place, with prices linked to oil or oil product prices, and may be further influenced by the price of occasional LNG or pipeline gas imports at spot prices. Most of the downward movements of the average Greek import prices correspond to such, one-off, imports. Additional factors contributing to this lack of alignment with the hub prices are also:
  a. The lack of physical (not congested) interconnections. We may assume that a bi-directional link between Italy and Greece might eventually extend the alignment dynamics already experienced elsewhere.
  b. The difference in climatic conditions (example: absence of cold snap in February 2012 in Greece) which, together with the lack of interconnections, isolate Hellenic price from upward pressure in days of peak demand in neighbouring countries.

Gas prices have been influenced during the few recent years by two major factors:

- The growing energy demand in Asia, supported by the nuclear accident of 11 March 2011 in Fukushima. This has driven up prices in East Asia and has sustained LNG prices in other parts of the world as well. According to Figure 4.11, spot LNG prices in November 2013 were estimated (in October 2013) to be in Japan 50 % higher than in Belgium and almost five times higher than in the east coast of the USA.
- The considerable increase of shale gas production in the USA as shown in Figure 4.12. This has pushed gas prices down in the USA.

The price reduction in the USA made natural gas the preferred fuel for power generation and released quantities of coal to be exported to the rest of the world, including the EU. The increase of gas production did not yet make the USA an exporter of LNG however it is expected that this will take place in the future.

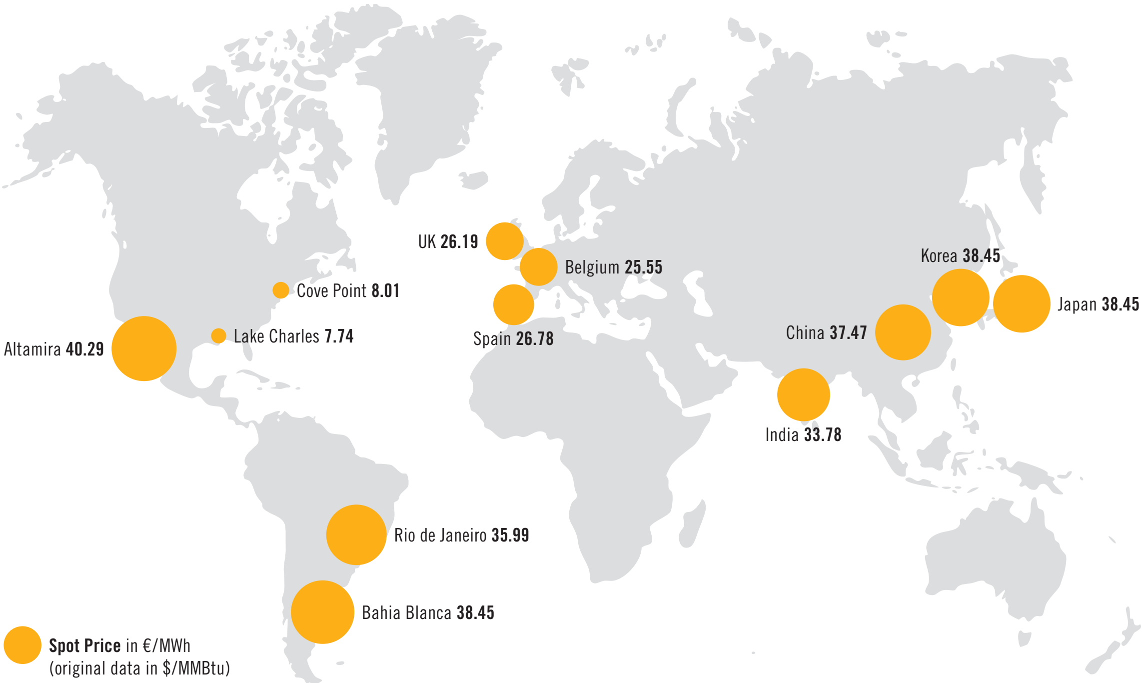


Figure 4.11: Estimated World LNG spot prices, November 2013 landed prices
Source: Federal Energy Regulatory Commission/USA:
http://www.ferc.gov/market-oversight/othr-mkts/lng/othr-lng-wld-pr-est.pdf

Therefore this has not yet had a sensible impact on gas prices but rather on demand since the availability of lower priced coal has had in Europe the inverse effect of that in the USA, that is, a switch from natural gas to coal for power generation. This is visible in Figures 4.13 and 4.14 that show the comparison of gas and coal prices in the EU and a reverse of the trend, established during the last years, for an important reduction in coal imports after almost a decade of relative stability. In fact these increased by approximately 10% from 2009 to 2012.

In addition to the above factors we have had, in the few recent years, a series of price renegotiations between GAZPROM and several of its European customers which resulted (either through direct agreement or through arbitration decision) to higher or lower reductions of the long-term contract prices. This contributed to the lower use of the LNG terminals, as shown in Figure 4.8 and as can also be seen in the next chapter 5 (paragraph 5.1.c), in the graphs showing the use of the LNG terminals capacity.

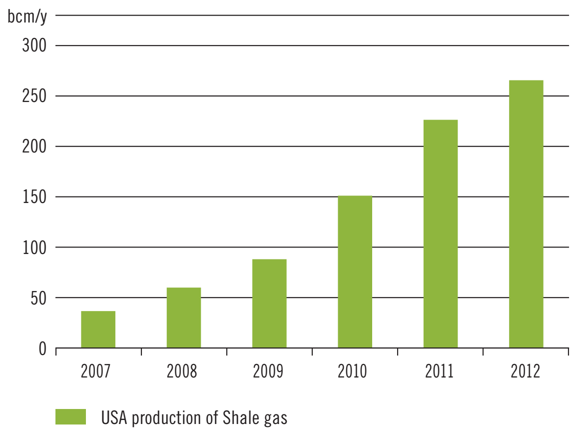


Figure 4.12: Production of shale gas in the USA
Source: USA Energy Information Administration

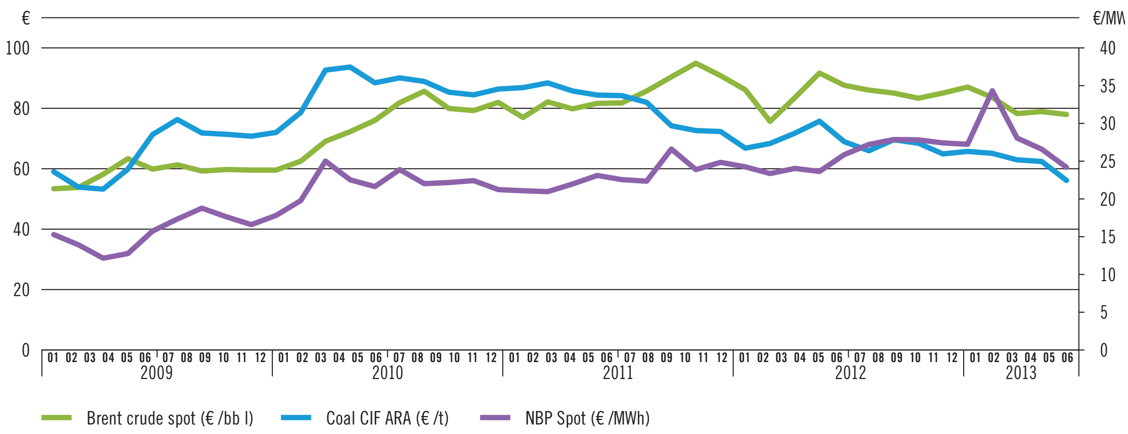


Figure 4.13: Spot prices of Oil, Coal and Gas in the EU
Source: EU Quarterly Report on European Gas Markets, 2Q 2013
http://ec.europa.eu/energy/observatory/gas/gas_en.htm

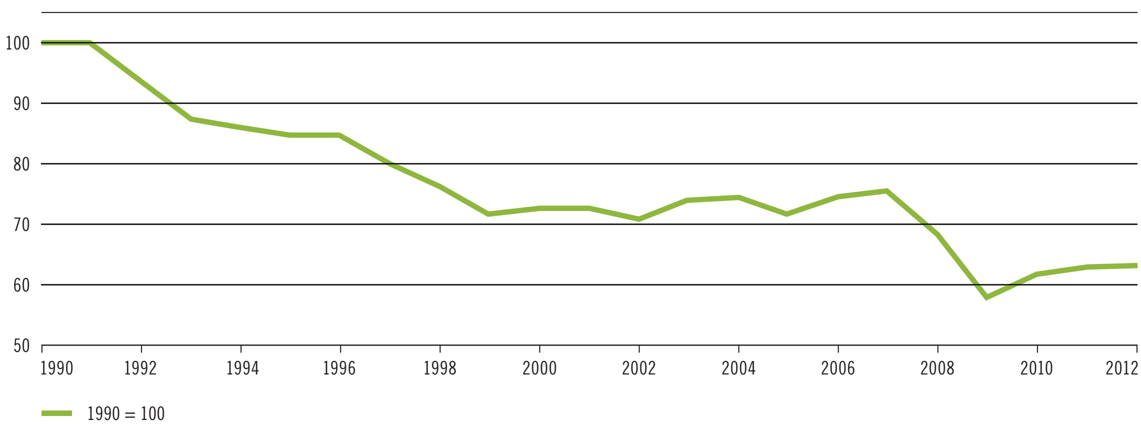


Figure 4.14: Evolution of coal imports to the EU-27 (1990 = 100)
Source: Eurostat, http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Coal_consumption_statistics

5 Assessments and Market Analysis

Interconnection Point capacities offered, booked and used
Conclusions on the existence of congestion of the Region's Interconnecting Points

image courtesy of Snam Rete Gas

5.1 Interconnection Point capacities offered (technical capacity), booked and used

In this chapter the capacities of all Region's IPs is presented in a graphical form making easier the comparison of the technical capacity of the IP, the part booked and the part actually used during the two-year period from October 2011 to September 2013, both on a daily basis and on an average per month one. In some cases the data published by TSOs on either side of the IPs are not identical. In such cases the lesser rule was applied.

The interconnection points, import points and LNG entry points are presented in this chapter in the same order as in the ENTSOG capacity map[1].

This section aims at providing an analysis of possible congestion at Regional IPs evaluating:

- Flows versus technical capacity (physical congestion considerations);
- Booked versus technical capacity (contractual congestion considerations)

Although several of the IPs offer reverse flow capacity, the graphs for both directions are only presented in the case of significant reverse flows.

1) http://www.entsog.eu/maps/transmission-capacity-map

A. CROSS-BORDER IPS WITHIN EU

Oberkappel (BOG > GRT gaz Deutschland and Open Grid Europe) Bidirectional

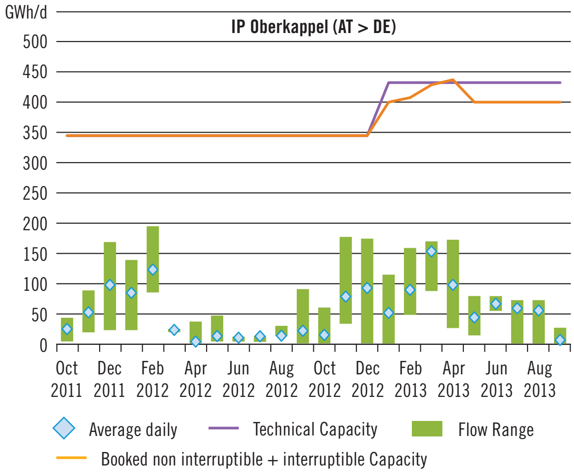


Figure 4.1.1: Oberkappel: Flows and booked capacity vs. technical capacity (monthly)

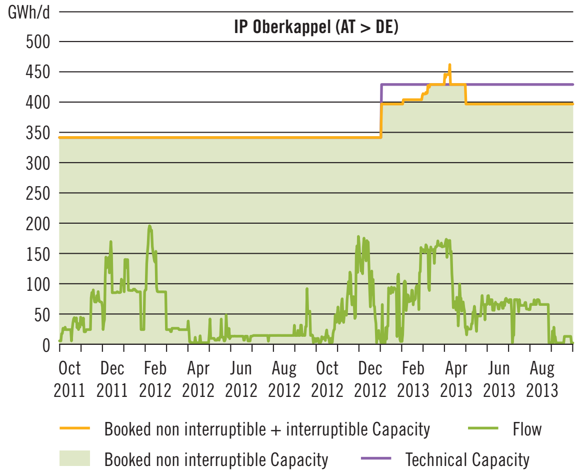


Figure 4.1.2: Oberkappel: Flows and booked capacity vs. technical capacity (daily)

Oberkappel (GRT gaz Deutschland and Open Grid Europe > BOG) Bidirectional

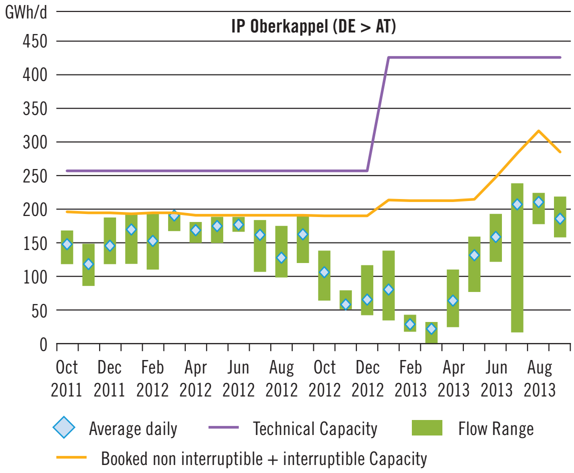


Figure 4.2.1: Oberkappel: Flows and booked capacity vs. technical capacity (monthly)

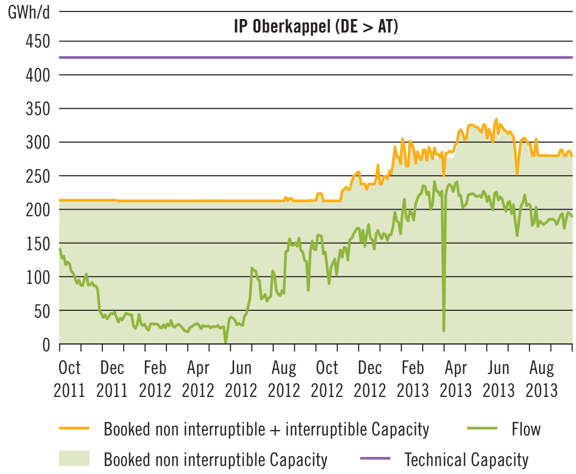


Figure 4.2.2: Oberkappel: Flows and booked capacity vs. technical capacity (daily)

Murfeld / Ceršak (Gas Connect Austria > Plinovodi) Unidirectional

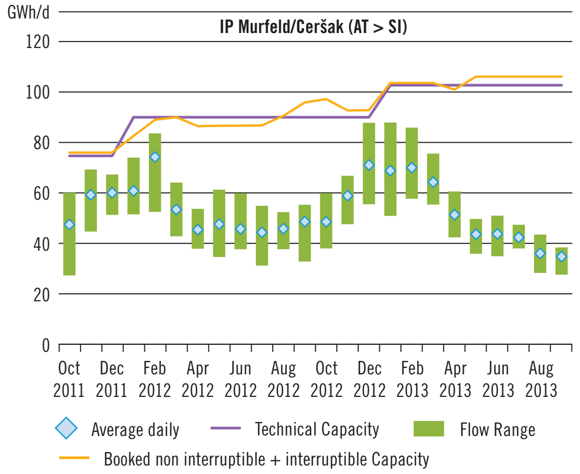


Figure 4.3.1: Murfeld / Ceršak: Flows and booked capacity vs. technical capacity (monthly)

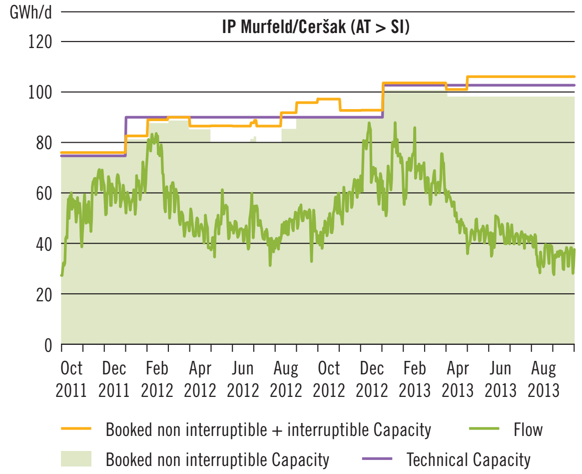


Figure 4.3.2: Murfeld / Ceršak: Flows and booked capacity vs. technical capacity (daily)

Arnoldstein / Tarvisio (TAG > Snam Rete Gas)[1] Bidirectional

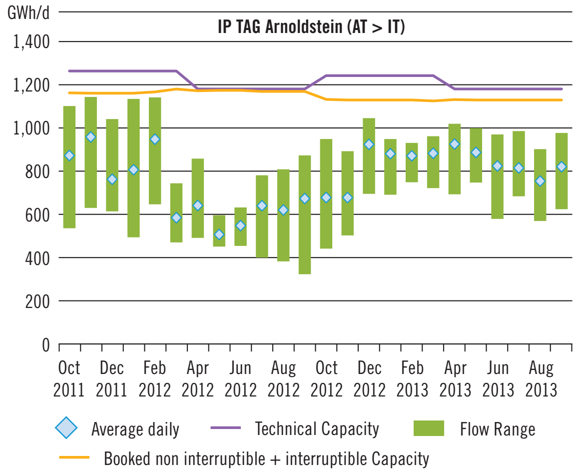


Figure 4.4.1: Arnoldstein / Tarvisio: Flows and booked capacity vs. technical capacity (monthly)

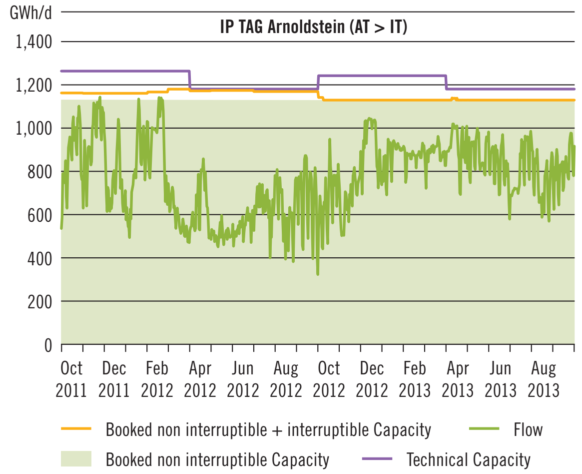


Figure 4.4.2: Arnoldstein / Tarvisio: Flows and booked capacity vs. technical capacity (daily)

The decrease of the booked capacity corresponds to the entry into force of the CMP provisions.

1) The seasonal increases of technical capacity shown at some interconnecting points are due to the higher consumption during those seasons which reduces the distance travelled by the gas entering that IP and by consequence reduces the loss of pressure thus increasing the available capacity.

Gorizia/Šempeter (Snam Rete Gas > Plinovodi) Unidirectional

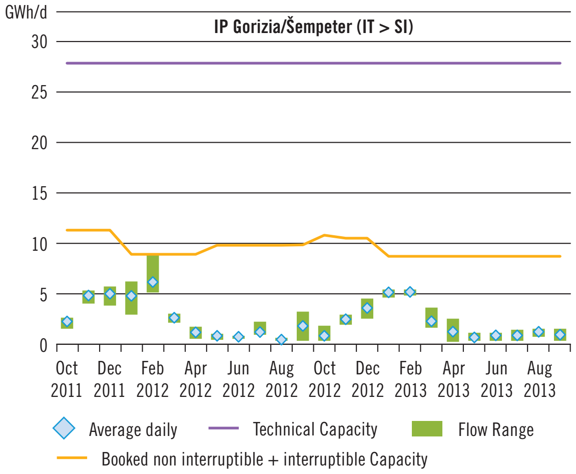


Figure 4.5.1: Gorizia/Šempeter: Flows and booked capacity vs. technical capacity (monthly)

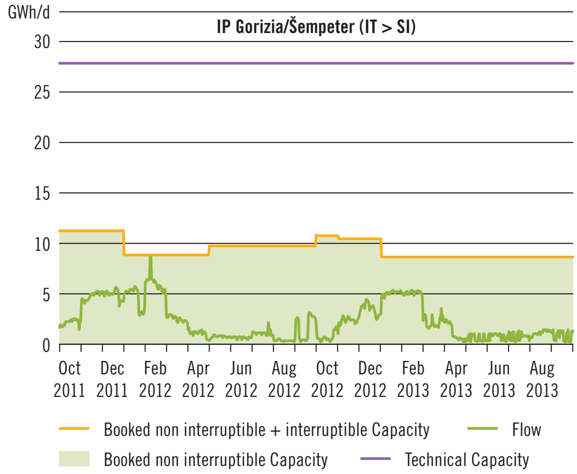


Figure 4.5.2: Gorizia/Šempeter: Flows and booked capacity vs. technical capacity (daily)

Rogatec (Plinovodi > Plinacro) Unidirectional

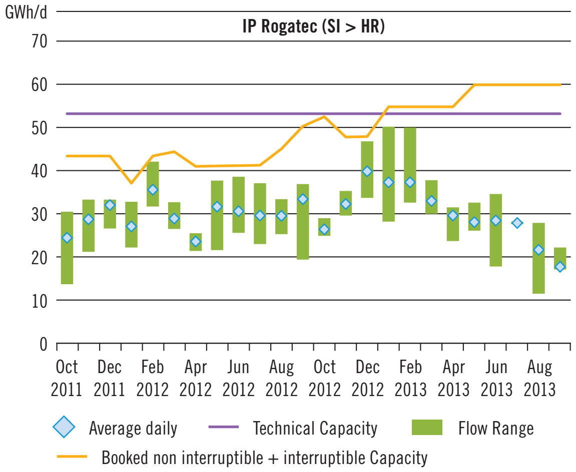


Figure 4.6.1: Rogatec: Flows and booked capacity vs. technical capacity (monthly)

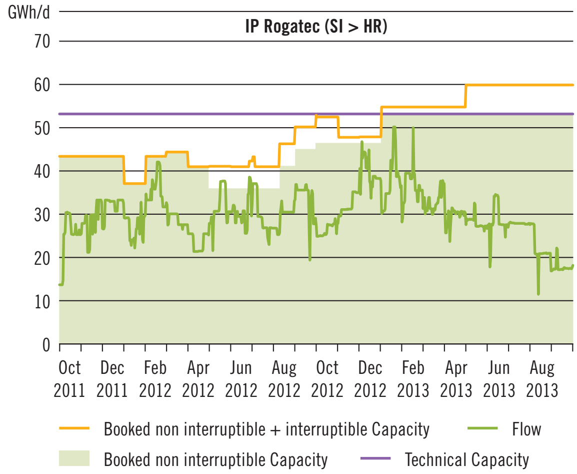


Figure 4.6.2: Rogatec: Flows and booked capacity vs. technical capacity (daily)

Lanžhot (eustream > NET4GAS) Bidirectional

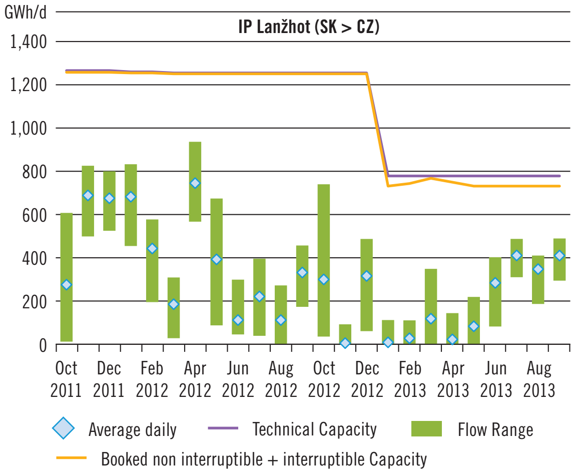


Figure 4.7.1: Lanžhot: Flows and booked capacity vs. technical capacity (monthly)

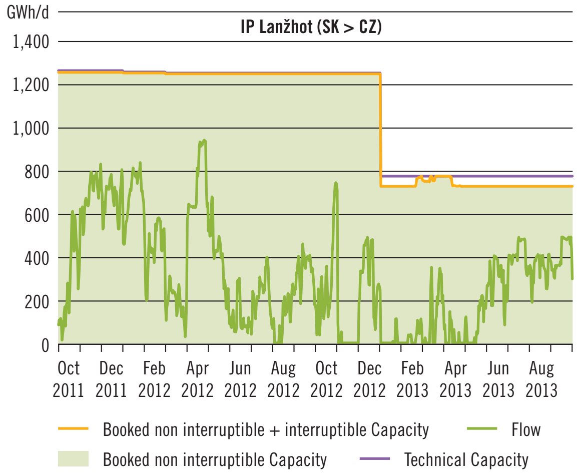


Figure 4.7.2: Lanžhot: Flows and booked capacity vs. technical capacity (daily)

The important reduction of the technical capacity was the consequence of a similar reduction made in the Import Point of Velké Kapušany (see below).

Baumgarten (eustream > BOG, Gas Connect Austria and TAG) Bidirectional

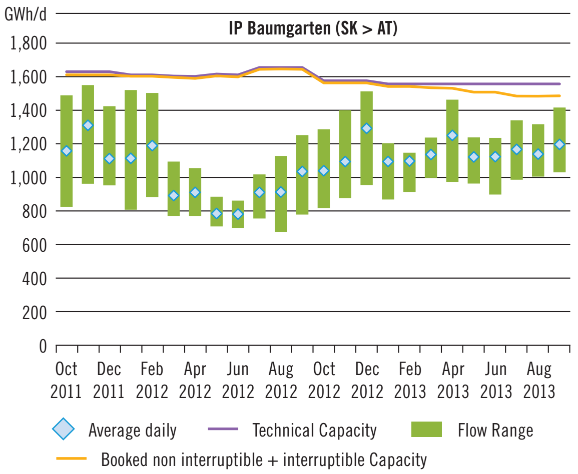


Figure 4.8.1: Baumgarten: Flows and booked capacity vs. technical capacity (monthly)

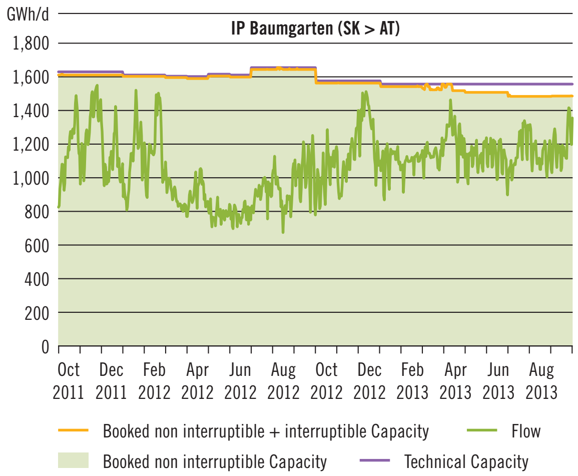


Figure 4.8.2: Baumgarten: Flows and booked capacity vs. technical capacity (daily)

Mosonmagyaróvár (Gas Connect Austria > FGSZ) Unidirectional

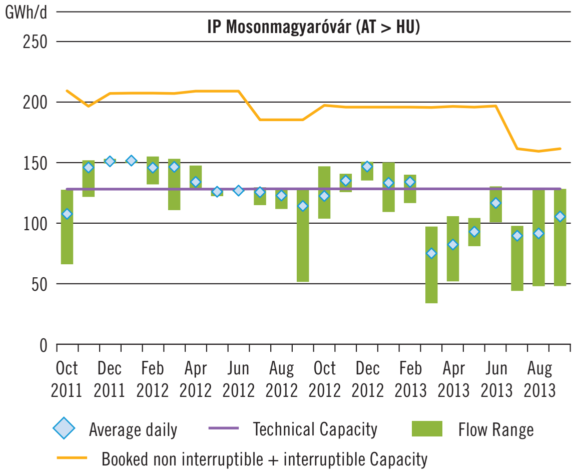


Figure 4.9.1: Mosonmagyaróvár: Flows and booked capacity vs. technical capacity (monthly)

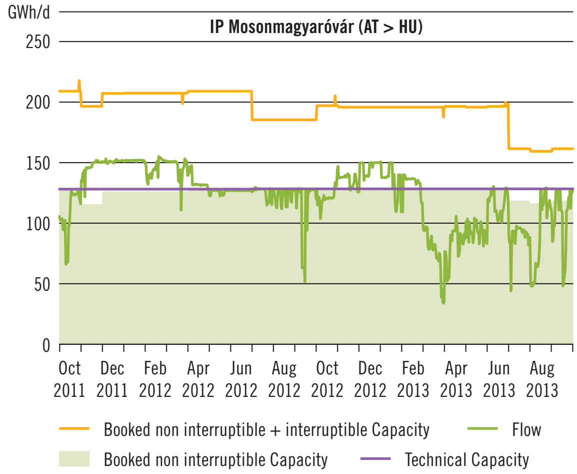


Figure 4.9.2: Mosonmagyaróvár: Flows and booked capacity vs. technical capacity (daily)

The two upward and downward spikes on the daily graph correspond to the days of switching between winter and summer time.

Kulata / Sidirokastro (Bulgartransgaz > DESFA) Bidirectional

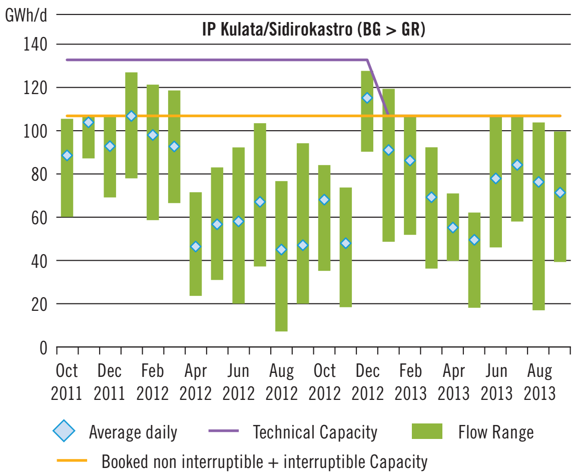


Figure 4.10.1: Kulata / Sidirokastro: Flows and booked capacity vs. technical capacity (monthly)

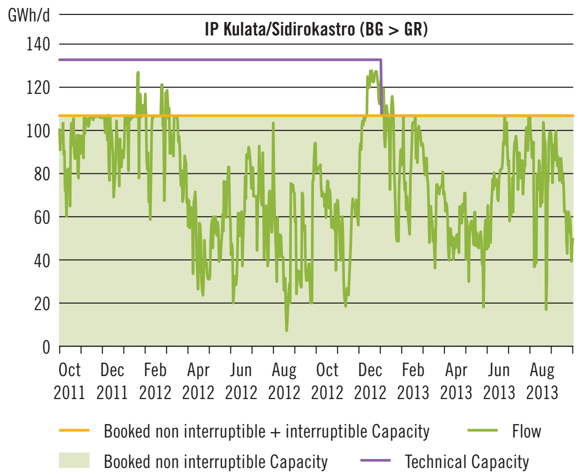


Figure 4.10.2: Kulata / Sidirokastro: Flows and booked capacity vs. technical capacity (daily)

Negru Voda 1 (Transgaz > Bulgartransgaz) Bidirectional

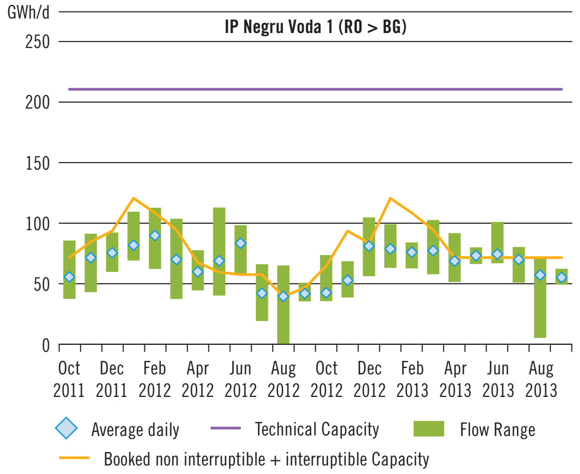


Figure 4.11.1: Negru Voda 1: Flows and booked capacity vs. technical capacity (monthly)

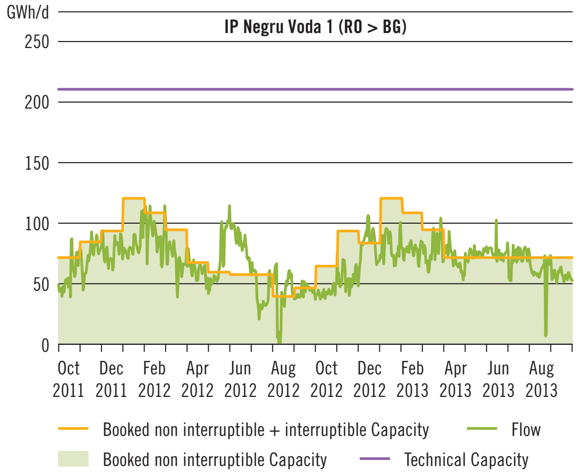


Figure 4.11.2: Negru Voda 1: Flows and booked capacity vs. technical capacity (daily)

Negru Voda 2 & 3 (Transgaz > Bulgartransgaz) Unidirectional

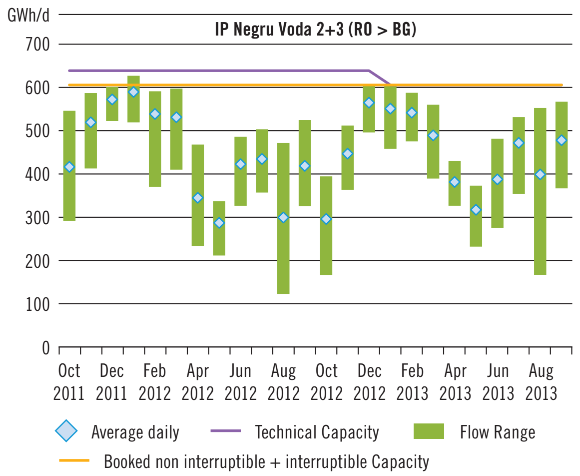


Figure 4.12.1: Negru Voda 2 & 3: Flows and booked capacity vs. technical capacity (monthly)

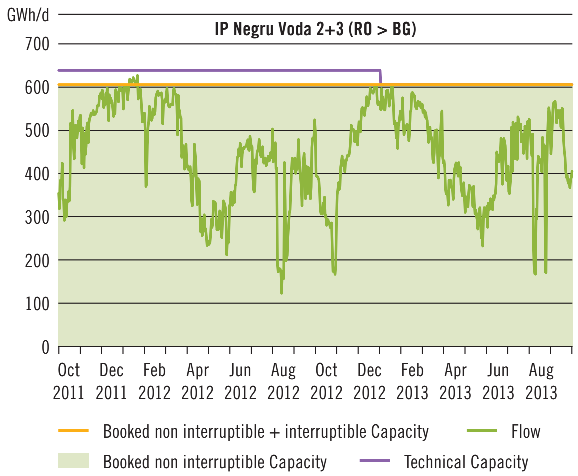


Figure 4.12.2: Negru Voda 2 & 3: Flows and booked capacity vs. technical capacity (daily)

Csanádpalota (FGSZ > Transgaz) Bidirectional

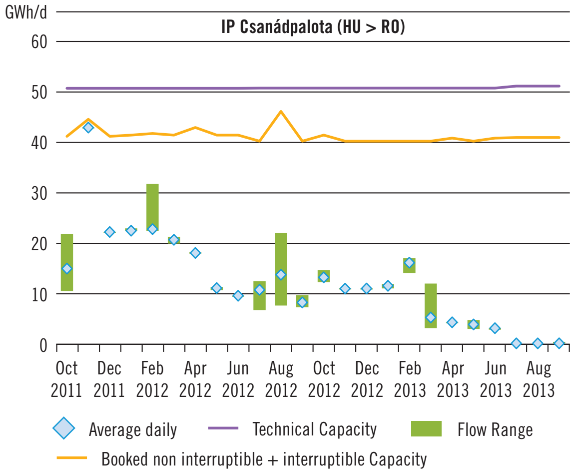


Figure 4.13.1: Csanádpalota: Flows and booked capacity vs. technical capacity (monthly)

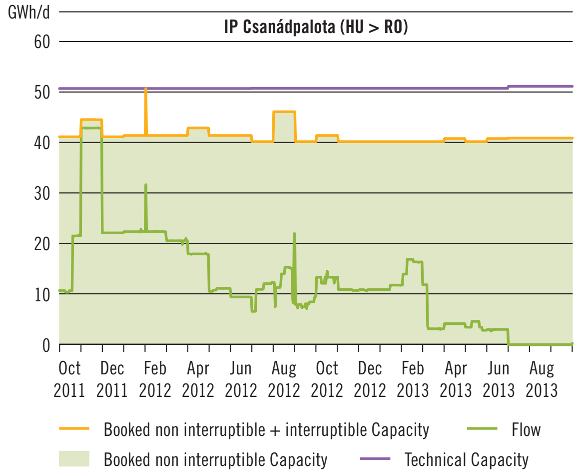


Figure 4.13.2: Csanádpalota: Flows and booked capacity vs. technical capacity (daily)

Dravaszerdahely (FGSZ > Plinacro) Unidirectional

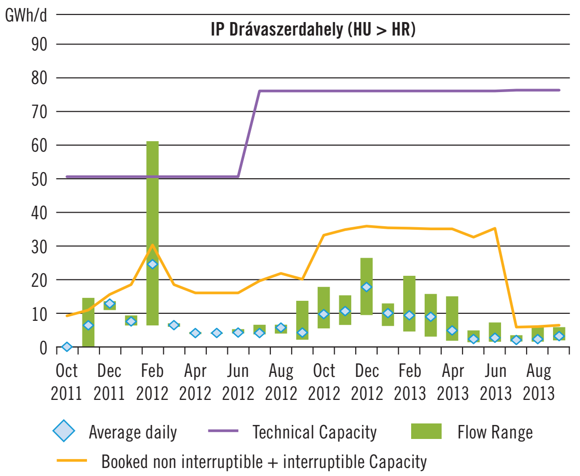


Figure 4.14.1: Dravaszerdahely: Flows and booked capacity vs. technical capacity (monthly)

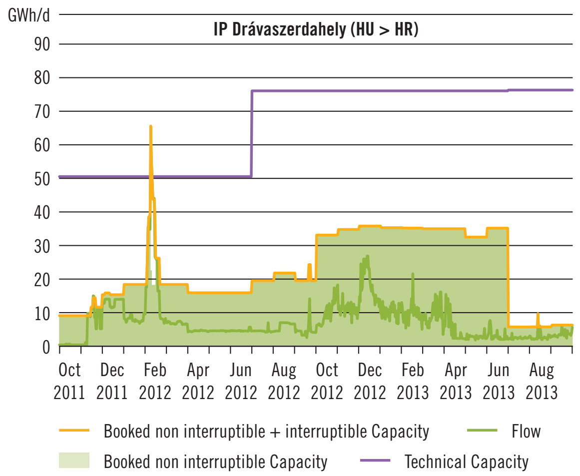


Figure 4.14.2: Dravaszerdahely: Flows and booked capacity vs. technical capacity (daily)

This IP has been designed as bi-directional but presently offers capacity only in the direction HU > HR at about 40 % of design capacity. Subject to a pressure management agreement between the two TSOs and an increased use of FGSZ CS the IP could operate at about 60 % of design capacity in both directions. The full bi-directional capacity will be made available after the installation of a CS on the Croatian side.

B. CROSS-BORDER IP WITH NON EU

B.1 IMPORT

Mazara del Vallo (TMPC > Snam Rete Gas)

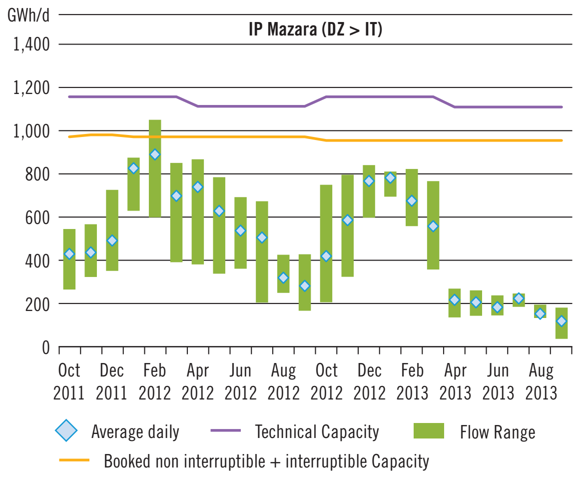


Figure 4.15.1: Mazara del Vallo: Flows and booked capacity vs. technical capacity (monthly)

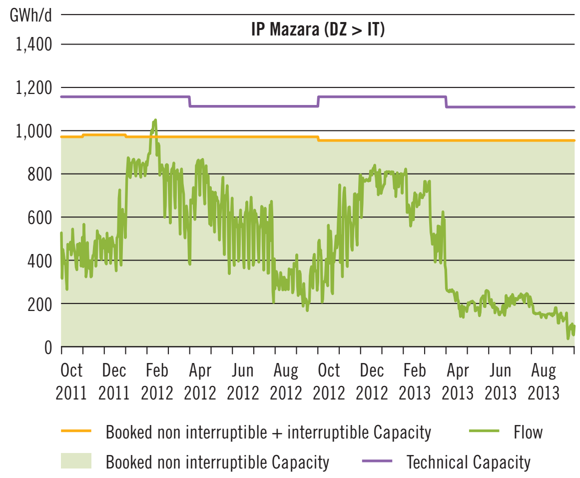


Figure 4.15.2: Mazara del Vallo: Flows and booked capacity vs. technical capacity (daily)

Gela (Green Stream > Snam Rete Gas)

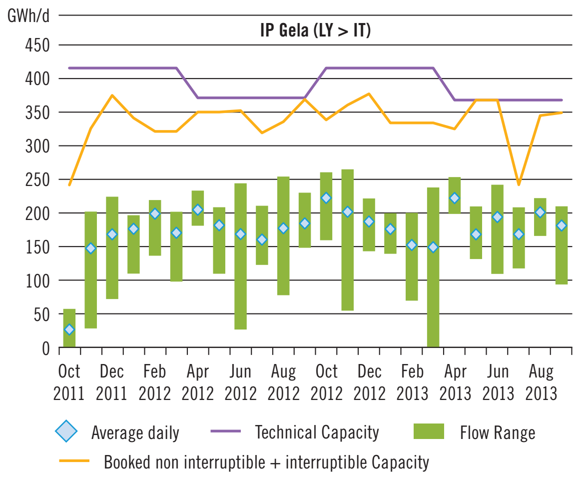


Figure 4.16.1: Gela: Flows and booked capacity vs. technical capacity (monthly)

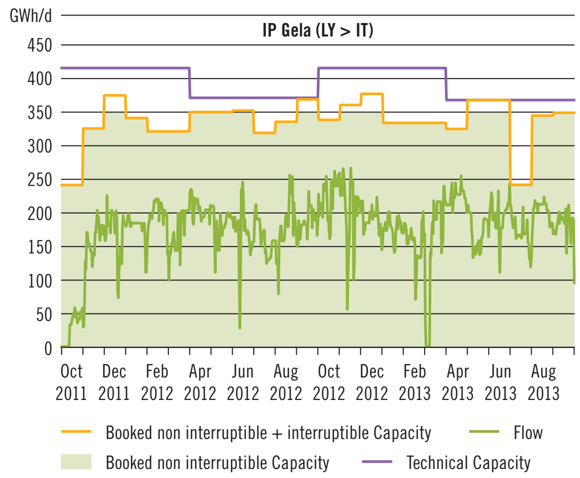


Figure 4.16.1: Gela: Flows and booked capacity vs. technical capacity (daily)

Uzhgorod / Velké Kapušany (Ukrtransgaz > eustream)

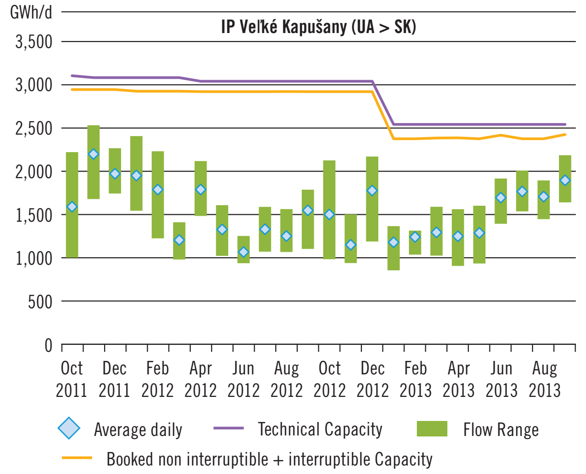


Figure 4.17.1: Uzhgorod / Velké Kapušany: Flows versus technical capacity (physical congestion considerations)

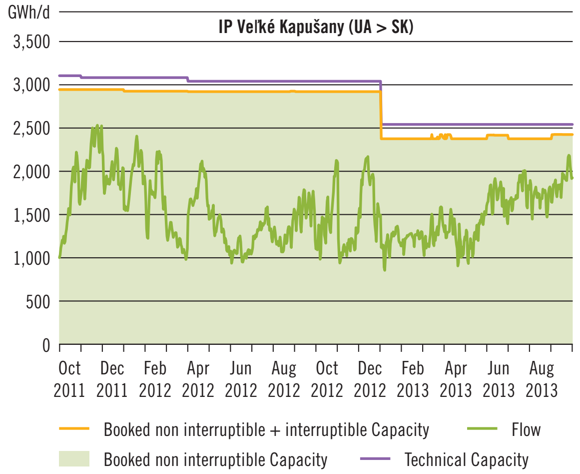


Figure 4.17.2: Uzhgorod / Velké Kapušany: Flows and booked capacity vs. technical capacity (daily)

The important reduction of the technical capacity was made in order to allow for a more efficient operation of the compressor station, given the reduced use of the IP by shippers.

Beregdaróc (Ukrtransgaz > FGSZ)

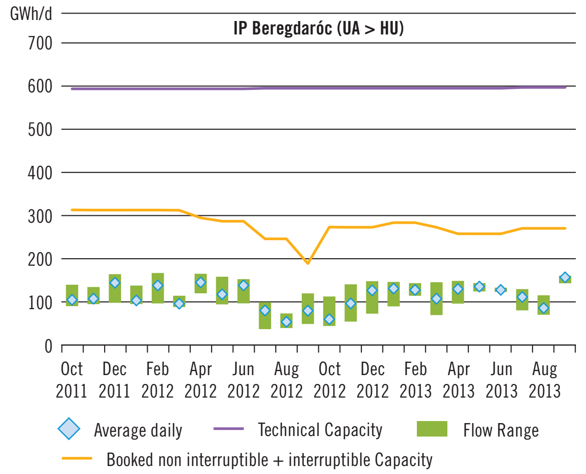


Figure 4.18.1: Beregdaróc: Flows and booked capacity vs. technical capacity (monthly)

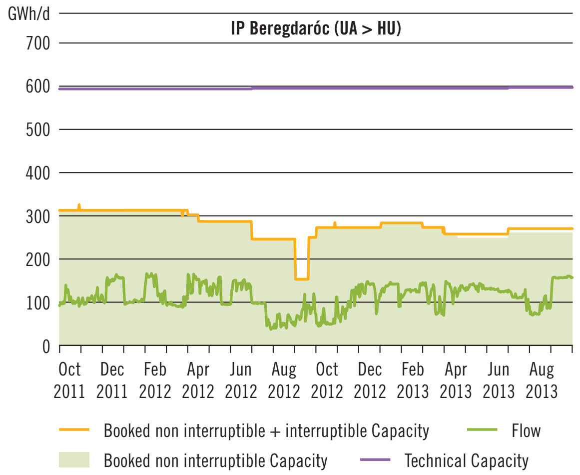


Figure 4.18.2: Beregdaróc: Flows and booked capacity vs. technical capacity (daily)

Tekovo / Mediesu Aurit (Ukrtransgaz > Transgaz)

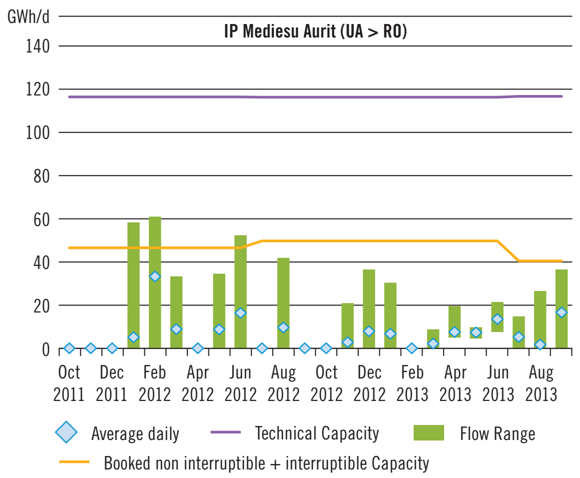


Figure 4.19.1: Tekovo / Mediesu Aurit: Flows and booked capacity vs. technical capacity (daily)

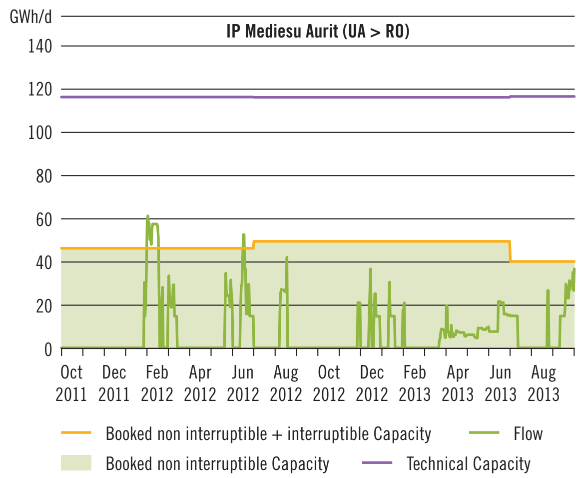


Figure 4.19.2: Tekovo / Mediesu Aurit: Flows and booked capacity vs. technical capacity (daily)

Orlovka / Isaccea (Ukrtransgaz > Transgaz)

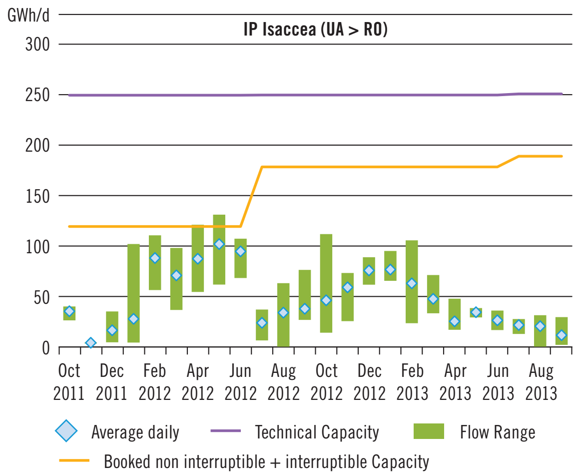


Figure 4.20.1: Orlovka / Isaccea: Flows and booked capacity vs. technical capacity (monthly)

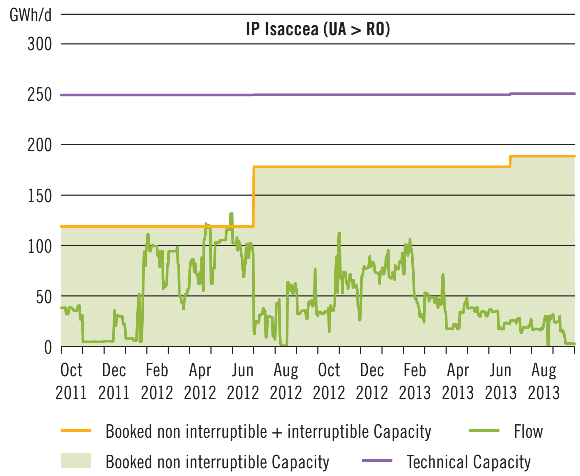


Figure 4.20.2: Orlovka / Isaccea: Flows and booked capacity vs. technical capacity (daily)

Kipi (BOTAŞ > DESFA)

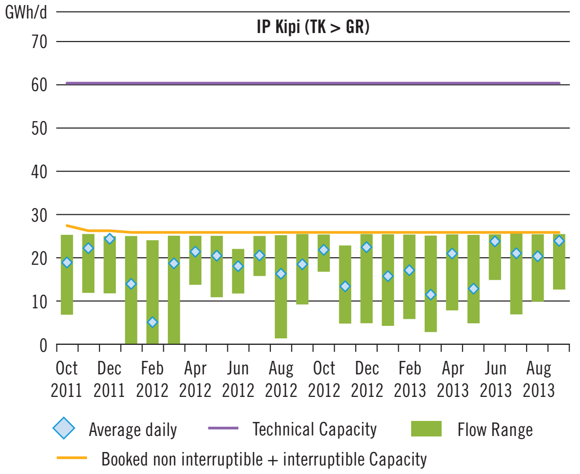


Figure 4.21.1: Kipi: Flows and booked capacity vs. technical capacity (monthly)

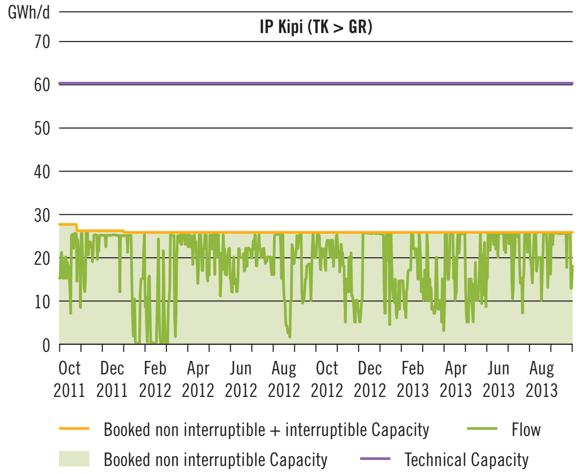


Figure 4.21.2: Kipi: Flows and booked capacity vs. technical capacity (daily)

Kiskundorozsma (FGSZ > Srbijagas) Unidirectional

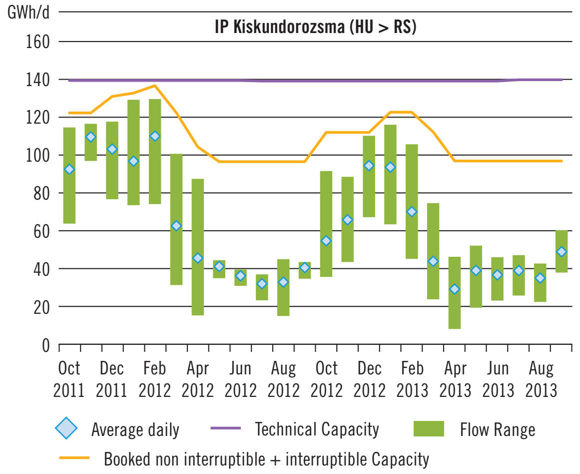


Figure 4.22.1: Kiskundorozsma: Flows and booked capacity vs. technical capacity (monthly)

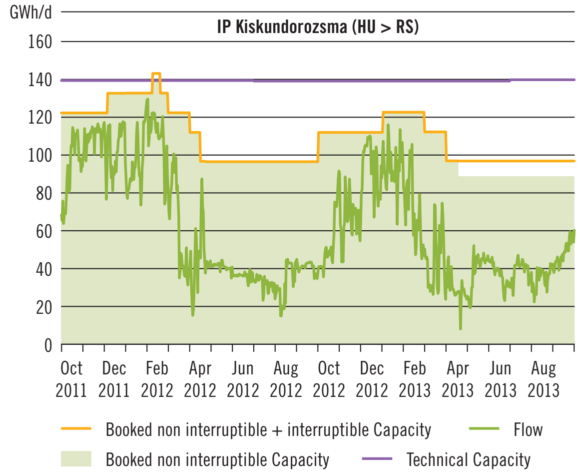


Figure 4.22.2: Kiskundorozsma: Flows and booked capacity vs. technical capacity (daily)

Malkoclar (Bulgartransgaz > BOTAŞ) Unidirectional

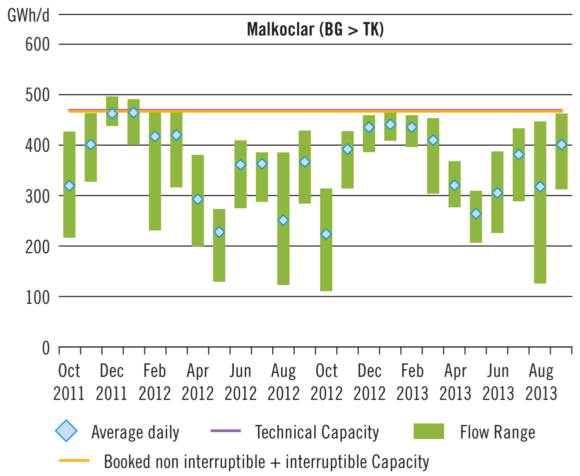


Figure 4.23.1: Malkoclar: Flows and booked capacity vs. technical capacity (monthly)

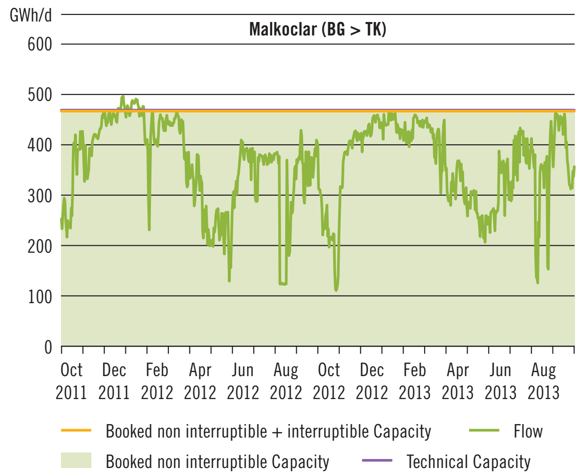


Figure 4.23.2: Malkoclar: Flows and booked capacity vs. technical capacity (daily)

Jidilovo (Bulgartransgaz > GA-MA) Unidirectional

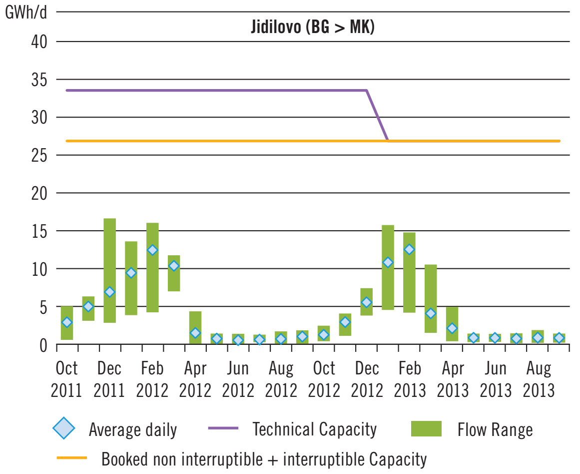


Figure 4.24.1: Jidilovo: Flows and booked capacity vs. technical capacity (monthly)

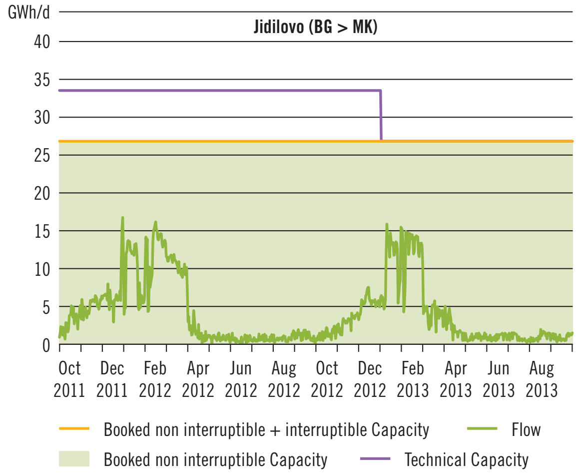


Figure 4.24.2: Jidilovo: Flows and booked capacity vs. technical capacity (daily)

Beregdaróc (FGSZ > Ukrtransgaz[1]) Bidirectional

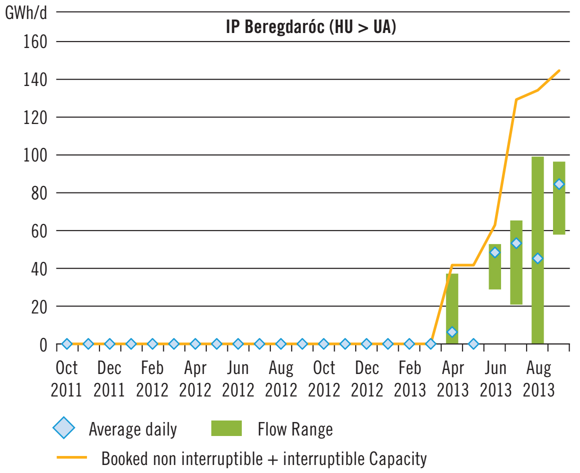


Figure 4.25.1: Beregdaróc: Flows and booked capacity vs. technical capacity (monthly)

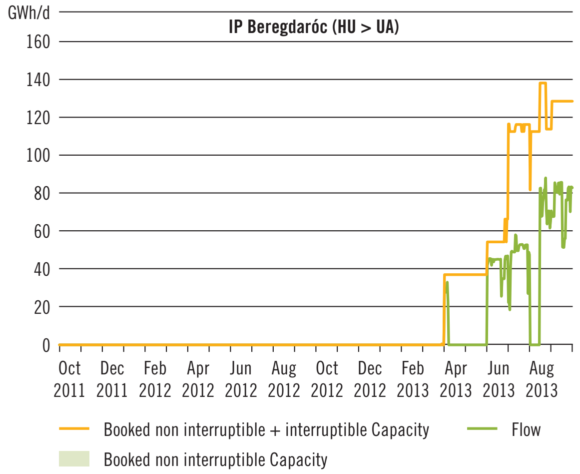


Figure 4.25.2: Beregdaróc: Flows and booked capacity vs. technical capacity (daily)

1) Only interruptible capacity is offered at the Beregdaróc IP in the direction from Hungary to Ukraine.

C. LNG ENTRY POINTS

Differently from the dynamics experienced at pipelines interconnection points, at LNG Entry Points gas flows are intrinsically more fluctuating, especially if the punctual, daily values are considered.

More stable indications can be drawn from the analysis of monthly dynamics, which are in general showing a decrease in the usage of the regasification terminals, confirming the trend across Europe determined by the current LNG market conditions.

Nevertheless, the role of LNG terminals both, on one hand, for security of supply and peak shaving needs and, on the other hand, for the exploitation of possible commercial opportunities cannot be denied or based on the study of a limited time window.

In this paragraph the technical capacity is meant to be the regasification capacity of the terminal which may be different from that of the downstream pipeline infrastructure.

Panigaglia (GNL Italia > Snam Rete Gas)

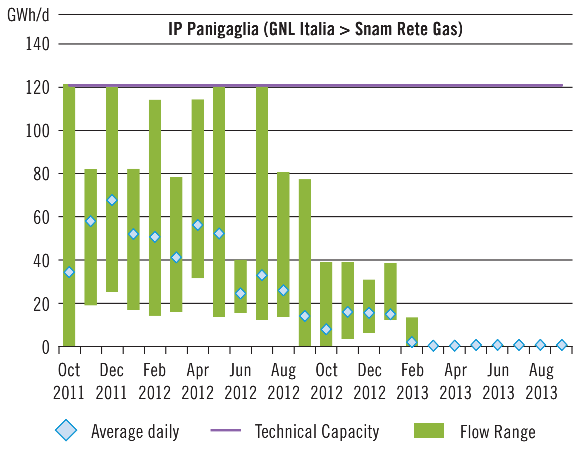


Figure 4.26.1: Panigaglia: Flows and booked capacity vs. technical capacity (monthly)

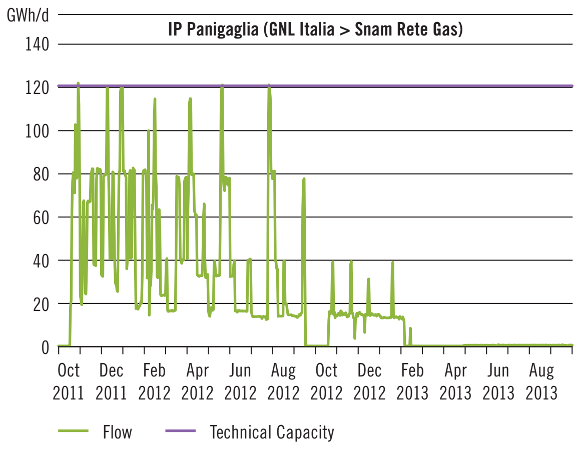


Figure 4.26.2: Panigaglia: Flows and booked capacity vs. technical capacity (daily)

Cavarzere (Terminale GNL Adriatico > Snam Rete Gas and Infrastrutture Trasporto Gas)

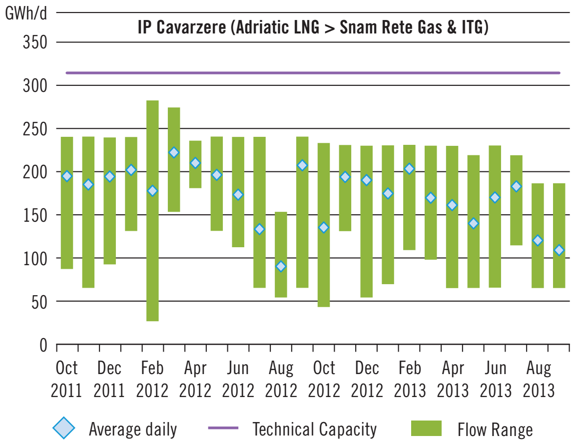


Figure 4.27.1: Cavarzere: Flows and booked capacity vs. technical capacity (monthly)

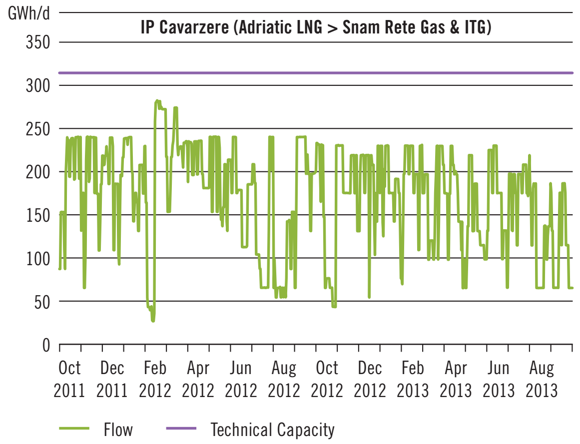


Figure 4.27.2: Cavarzere: Flows and booked capacity vs. technical capacity (daily)

- Booked capacity is not, in this case, a useful indicator for the capacity adequacy analysis, as in Italy the terminal operators reserve capacity in the transmission system on behalf of their users.
- The Offshore LNG Toscana (OLT) terminal was commissioned in the last quarter of 2013 therefore no historical data are available for the time window examined.

Revythoussa (DESFA > DESFA)

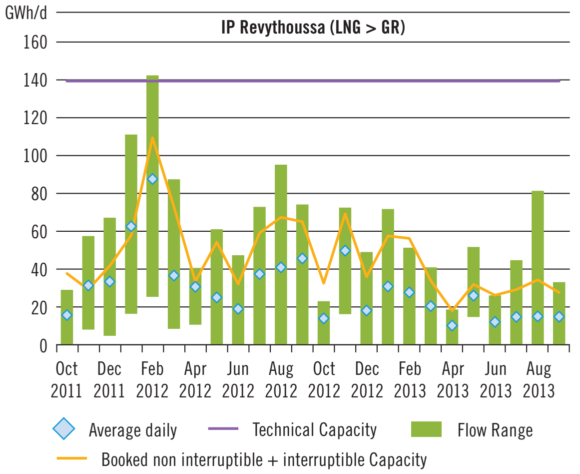


Figure 4.28.1: Revythoussa: Flows and booked capacity vs. technical capacity (monthly)

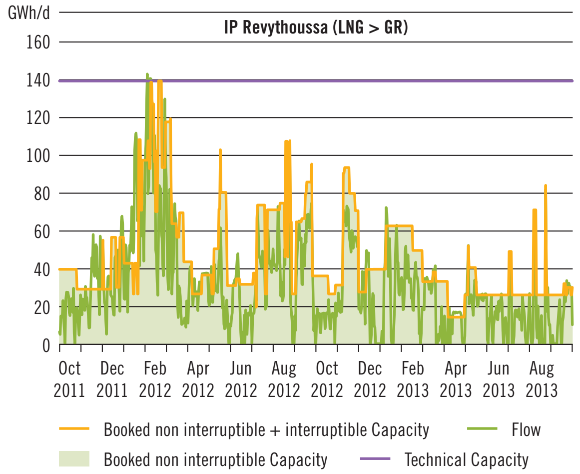


Figure 4.28.2: Revythoussa: Flows and booked capacity vs. technical capacity (daily)

5.2 Conclusions on the existence of congestion of the Region's Interconnecting Points

The graphs and data presented in the previous paragraph indicate that, regarding the sufficiency of technical capacity and the use made of it, the Region's IPs belong in different categories.

- Several IPs have a high percentage of spare capacity. In this category belong the supply Import Points from non EU members of Kipi (TK>GR) and Beregdaróc (UA>HU), as well as the IPs of Csanádpalota (HU>RO), of Gorizia/ Šempeter (IT>SI), of Negru Voda 1 (RO>BG) and of Jidilovo (BG>MK).
- Some IPs seem to be physically congested, presenting a high average ratio of "used over technical" capacity like the IP of Mosonmagyaróvár (AT>HU) with flows often higher than firm capacity over the period examined (Oct. 2011 to Sept. 2013) while the majority of the IPs presents intermediate average usage rates, showing however their maximum use close to or even exceeding the declared firm technical capacity in peak demand situations.
- In some IPs we notice that the technical capacity in winter is higher than the one in summer. This is due to the fact that in winter the gas flowing through the IP is consumed within a shorter distance from the IP and is therefore subject to lower pressure loss.
- Regarding the comparison between booking capacities and technical capacities, although we notice high average booking rates in the IPs of Oberkappel, (AT>DE), Murfeld/ Ceršak (AT>SI), Baumgarten (SK>AT), Arnoldstein / Tarvisio (AT>IT), Velké Kapušany (UA>SK), Lanžhot (SK>CZ), Negru Voda 2&3 (RO>BG), Jidilovo (BG>MK), Rogatec (SI>HR) and Kulata / Sidirokastro (BG>GR), an easy conclusion on contractual congestion in all these IPs should be avoided as the relevant graphs may correspond to very different situations like, indicatively:
  - In some cases shippers had proceeded, in the past, to long term booking saturating the technical capacity. Such situations have been mitigated with the progressive entry into force of CMP provisions and early implementation of CAM Network Code.
  - in some cases, as the actual flows were reduced, the TSOs proceeded to the sale of interruptible capacity to other shippers. This produces the image of a congestion situation while an important part of capacity may be available on a non-interruptible basis.
  - in other cases TSOs may have reduced the technical capacity, leaving however the margin imposed by the above Network Codes available, due to the lack of capacity booking by shippers.

6 The role of the Southern Corridor Region

Key transmission projects of the Region
Other large projects | Other projects of the Region

Image courtesy of Snam Rete Gas

The Role of the Souther Corridor Region in the development of the EU Gas Infrastructure and the quest for diversification of supply sources and routes

The capacity and integration of gas transmission networks into a common European network generally depends on the historical development of supply and sources. The development of new gas infrastructure supports the three pillars of the European energy policy: market integration, security of supply and sustainability. Ultimately, it enables and facilitates a liquid and competitive common gas market, through increased market participation and integration.

The rationale behind the key European gas transmission projects is increasing the flexibility and integration of energy markets by ensuring different connections, more alternatives of supply sources and at the same time increasing the cross-border capacities. Despite the estimation that over 60 % of natural gas, which is used in the EU, crosses at least one border, the flexibility of its transmission system still needs to be increased. The resulting increased flexibility of the European gas system will enable and enhance supply diversification thus improving the security of gas supply.

The integration level of different gas transmission networks is also affected by the characteristics of larger projects in which the EU member countries are included. Approximately half of these projects are intended to increase the existing capacities and the other half to develop new gas transmission infrastructure with new capacities.

Gas infrastructure can also have a significant role to play in improving sustainability in Europe, since natural gas is likely to play a key role in helping the EU meet its environmental targets as the cleanest available fossil fuel and the one better suited to complement the intermittency of most renewable energy sources used for power generation.

6.1 Key transmission projects of the Region

TAP (TRA-N[1]-051)

The Trans Adriatic Pipeline is a natural gas pipeline project, which is foreseen to transport natural gas from the giant Shah Deniz II field in Azerbaijan, to Greece, Albania and, across the Adriatic Sea, to Southern Italy. From there on, via the Italian transmission system, Azeri gas will reach Northern and Western Europe. This connection represents the shortest (and most direct) link from the Caspian Region to the European markets. One of the main aims of the TAP project is securing future energy supply, which supports a strategic goal of the European Union. The 1,200 mm pipeline, that will operate at 95 bar, is designed to allow reverse flow and to expand transportation capacity from 10 bcm, initially, to 20 bcm per year, depending on supply and demand. Other benefits of the TAP project are:

- providing a diversification opportunity for Europe,;
- interlinking several strategic European corridors (bridging Southern and North-South West Corridors and also, with the contribution of the lateral connections IAP and IGB, the North-South East Corridor),
- allowing the development of natural gas storage facilities in Albania and Greece to further ensure security of supply to European markets during possible operational interruptions,
- promoting economic development and creation of jobs along the pipeline route.

1) In December 2013 the project reached FID status

TANAP (TRA-N-221)

The Trans Anatolian Pipeline is the necessary link between the South Caucasus Pipeline (SCP) and TAP. This is an Azeri-Turkish project that will carry the Caspian Gas through Turkey and up to the Turkish/Greek border at Kipi. The possibility of a connection with the Interconnector Turkey – Bulgaria (ITB) is also being considered.

IAP (TRA-N-068)

The Ionian Adriatic Pipeline is foreseen to run from Albania (Fier), through Montenegro and Bosnia & Herzegovina, to Croatia (Ploče) with a diameter of 800 – 1,000 mm and a pressure of 75 bar with reverse flow capability (from North to South). In Fier, IAP would connect with the Trans Adriatic Pipeline, whose implementation was also one of the prerequisites for IAP's implementation. The objectives of the IAP project are to:

- ensure the possibility of gas supply from the Caspian and Central-Eastern sources to the Western Balkan markets, enabling easier gasification of Albania, creating the preconditions for gasification of Montenegro, and completing the gasification of South Croatia and a significant part of Bosnia & Herzegovina,
- diversify natural gas supply, provide access to Albanian and Croatian storage capacities,
- integrate the Region's gas market into the European gas market and
- promote economic development in the Western Balkans.

South Stream (TRA-N[1]-187)

The project begins with the offshore gas pipeline section, which will run under the Black Sea from the Russkaya compressor station, on the Russian coast, to the Bulgarian coast. The total length of the offshore section will be around 900 kilometres, the maximum depth over two kilometres and the design capacity 63 billion cubic meters (on the Bulgarian coast). Taking into account the size of the project and current demand projections, it should be considered that, to a large extent, this will offer a diversified route for the gas currently flowing to Central Europe through other routes. The onshore part is expected to run through Bulgaria, Serbia, Hungary and Slovenia to Italy and/or Austria. The aim of the South Stream project is to enhance the European energy security by diversifying the routes of gas supplies to the EU.

IGB (TRA-N-149) and ITB (TRA-N-140):

Gas Interconnectors Greece – Bulgaria and Turkey – Bulgaria are proposed gas pipelines, connecting the Bulgarian natural gas pipeline network with the Greek and the Turkish transmission systems respectively. The IGB project includes the construction of a trans-border reverse gas pipeline from the area of Komotini in Greece to the area of Stara Zagora in Bulgaria, with a length of approximately 168.5 km (Bulgarian section: 140 km, Greek section: 28.5 km), and a diameter of 700 mm. The ITB project includes the construction of a trans-border reverse gas pipeline from the Gas Receiving Station of Malkoçlar, in Turkey, to the Lozenets compressor station in Bulgaria, running in parallel to the existing gas pipeline. Both projects have similar planned capacities (3 up to 5 bcm/year for IGB and 3 bcm/year for ITB). The objective of both projects is mainly the diversification of sources of natural gas supply thus providing enhanced security of supply to the Bulgarian and other South and Central-Eastern European gas markets. IGB project will also enhance, through its reverse flow capability, the security of supply of Greece.

1) According to the project promoter FID has been taken for the part of the project to be built in Bulgaria and Serbia.

6.2 Other large projects

A Two projects also competing for the transportation of the Shah Deniz II gas

The following two projects were also competing for the transportation of the Shah Deniz II gas but were not selected by the Consortium having the rights to exploit the field. Although they are presently on hold they might resurface in the future, possibly with a different definition, depending on the developments of the gas upstream in the Region.

IGI-Poseidon (TRA-N-010)

The Interconnector Greece–Italy and Poseidon project consisted of a new offshore pipeline that would connect the westwards extension of the Greek transmission system with the Italian one. The main objective of the IGI-Poseidon project was to complete, in conjunction with DESFA's project Komotini-Thesprotia pipeline (TRA-N-014), the natural gas corridor through Turkey, Greece and Italy (Interconnection Turkey Greece Italy – ITGI), enabling Italy and the rest of Europe to import natural gas from the Caspian Sea and the Middle East. This way it would contribute to the security and diversification of European energy supply. The design capacity of the IGI-Poseidon project was over 8 billion cubic meters per year. The project sponsors intend to keep the project alive, looking forward to undertaking the transportation of natural gas, from the Eastern Mediterranean offshore fields, to Europe via Greece. This could take place in case this gas would transit Turkey up to the Turkish/Greek border or it would arrive to Greece through an offshore pipeline and then cross Western Greece up to the landfall position of the Poseidon offshore pipeline. As the second scenario has been proposed by the sponsors[1)] (DEPA and the Government of Cyprus) this has been simulated in chapter 7[2)].

According to the results of this simulation, Poseidon pipeline could allocate, in the design case (i.e. the case with the maximum daily demand) almost 60 % of its capacity to the transportation of gas from Greece to Italy, delivering about 130 GWh/day.

Nabucco (TRA-N-077 & 078)

Nabucco was a project proposing a new natural gas pipeline corridor from Turkey to Austria, running through Bulgaria, Romania and Hungary. The strategic aim of the project was to provide supply of natural gas from the Caspian Region, Central Asia and the Middle East. Another aim of the Nabucco pipeline was to diversify the natural gas suppliers and delivery routes for Europe, thus reducing European dependence on Russian energy. On 14 November 2013 the General Assembly of the project sponsor, Nabucco Gas Pipeline International GmbH, decided to suspend its operation and have it enter a liquidation procedure.

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1) projects TRA-N-054 and TRA-N-189

2) Please see chapter 7.1 on the limitations of the simulation model.

b Proposed alternatives to the transportation of the Caspian gas

The following two projects proposed alternatives to the transportation of the Caspian gas through Turkey however the decision of SOCAR and BOTAŞ to form the TANAP Joint Venture has greatly reduced their chances of implementation within the time frame of the present Investment Plan. They might revive again in case of very important additional gas discoveries in the Caspian or if a transcaspian pipeline would carry Turkmen gas to the Azeri shore and/or if for geopolitical reasons a diversification from the Turkish route will be considered appropriate.

White stream (TRA-N-053)

This is a PCI project that consists of the implementation of an offshore pipeline in the Black sea from Georgia to Romania. In addition to being technically challenging (as the pipeline should cross the Black see in its longer direction) and relying on the permission by states with contrary interests (Russia or Turkey), the project did not show any activity in the last two years.

AGRI project (TRA-N-132)

The Azerbaijan-Georgia-Romania Interconnector is partly a PCI (on Romanian territory only) project that would be the LNG version of the White Stream. In order to overcome the technical challenges of laying an offshore pipeline in the Black sea from East to West, i.e. at the longer possible distance as well as any right-of-way issues, AGRI would liquefy the Caspian gas in Georgia and would deliver it to an LNG terminal in Constanța on the Romanian shore. This project would however not benefit from the flexibility that a liquefaction plant confers to gas producers since it would most probably be limited to the Black sea market, as it is highly unlikely that LNG carriers would ever be allowed (for safety considerations) to cross the Bosphorus.

Image courtesy of Eustream

6.3 Other projects of the Region

6.3.1 Projects allowing bidirectional flows between Poland, Czech Republic, Slovakia and Hungary linking the LNG terminals in Poland and Croatia

The new LNG terminal of Krk in Croatia and the bidirectional interconnections running through Croatia, Hungary and Slovakia will be part of the North-South Interconnection, linking the Adriatic sea LNG terminals to the ones of the Baltic sea, that will ensure security of supply, with natural gas, to the above countries. Projects contributing to this purpose are the main gas transit pipeline in Croatia (running from Zlobin, through Bosiljevo, Sisak and Kozarac to Slobodnica) as well as the new interconnections, connecting Hungary to Slovakia and Slovakia to Poland. The new LNG terminal also represents a diversification of sources, which ensures further security of supply in case of possible disruptions of existing (and other) sources.

6.3.2 Projects allowing gas to flow from Croatian LNG terminal to neighbouring countries

The Croatian LNG terminal will provide an additional source of natural gas for the Croatian market as well as the neighbouring markets, including Bosnia & Herzegovina, Serbia, Slovenia, Italy, Hungary and Austria. The new LNG terminal also represents a diversification of sources, which ensures further security of supply in case of possible disruptions. Projects contributing to this effect are the new interconnections:

- between Croatia and Bosnia & Herzegovina (Slobodnica-Bosanski Brod – Zenica, Lička Jesenica – Rakovica – Tržac – Bosanska Krupa, with branches to Bihać and Velika Kladuša),
- between Croatia and Serbia (Slobodnica – Sotin – Bačko Novo Selo),
- between Croatia and Slovenia (Bosiljevo – Karlovac – Lučko – Zabok – Rogatec, LNG evacuation pipeline Omišalj – Zlobin – Rupa and M8 Kalce – Jelšane)
- between Slovenia and Italy (M3/1 Gorizia/Šempeter – Vodice)
- between Croatia and Italy (International Pipeline Omišalj – Casal Borsetti).

6.3.3 Projects allowing gas flows from Greece through Bulgaria, Romania and further to Hungary as well as Ukraine, including reverse flow capability from south to north and integration of transit and transmission systems

The extension of the existing Revythoussa LNG terminal in Greece and the two new FSRUs (Aegean and Alexandroupolis) in Northern Greece, will provide additional sources of natural gas for the Greek market and will also represent a distribution point for natural gas in the direction from south to north, running through Bulgaria, Serbia and Romania to Hungary and Ukraine. To this effect will contribute the new interconnections between Greece and Bulgaria (IGB), between Bulgaria and Romania, Bulgaria and Serbia as well as the reverse flow capacity to be implemented at the interconnecting points at the Greek/Bulgarian[1)] (Kulata/Sidirokastro), Bulgarian/Romanian (Negru Voda) and Romanian/Ukrainian (Isaccea) borders the east-west axis between Romania and Hungary and, finally, the modernisation and rehabilitation of the gas transmission infrastructure on the territory of Bulgaria. The objective is to achieve diversification of sources and ensure the security of natural gas supply to the relevant corridor/area.

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1) This project reached FID status in 2013 when construction works also were completed.

6.3.4 Projects allowing gas from the Southern Gas Corridor and/or LNG terminals reaching Italy to flow towards the north to Austria, Germany and Czech Republic (as well as towards the NSI West corridor)

New gas infrastructure planned in the direction from south to north represents a diversification of sources by ensuring the possibility of gas supply from the Southern Gas corridor, from the Caspian and Central-Eastern sources and also from LNG terminals, reaching Italy and continuing/providing access further to Austria, Germany and Czech Republic, thus representing a new supply route as well as providing security of supply for these countries. Projects contributing to this effect are:

- projects allowing bi-directional flows (i. e. the project Support to the North West market and bi-directional cross-border flows planned by Snam Rete Gas, the bi-directional Interconnector between Austria and Czech Republic, reconstruction of MRS Šempeter in Slovenia, etc.),
- projects enabling new interconnections and allowing the increase of transport capacity at new or existing entry points (Development for new imports from the South (Adriatica Line), Import developments from North-East and Additional Southern Developments in Italy, Ionian Adriatic Pipeline from Albania to Croatia, M8 Kalce–Jelšane in Slovenia, M3/1 Gorizia/Šempeter-Vodice in Slovenia, etc.),
- several planned LNG terminals in Italy (i. e. LNG off-shore regasification terminal of Falconara Marittima in Ancona, Zaule LNG terminal in Trieste, LNG Porto Empedocle in Sicily, Offshore LNG Toscana – already in operation – and LNG Medgas terminal in Southern Italy).


Image courtesy of Snam Rete Gas

6.3.5 Projects allowing development of underground gas storage capacity in South-Eastern Europe

The main objective of these projects is to provide the possibility for seasonal balancing of supply and demand in South-Eastern Europe, through the development of underground gas storages in Bulgaria (UGS Chiren Expansion and the construction of a new gas storage facility), Greece (UGS at South Kavala) and Romania (expansion of the Depomureş storage facility). New storage capacity in the southern part of the Balkans will be better valued in conjunction with the TAP project.

6.3.6 Project allowing gas to flow in the East-West direction in the Romania – Hungary – Austria Transmission Corridor

New gas infrastructure will enable additional capacity and security of supply in the east-west corridor, running through Romania, Hungary, Austria and Slovenia. To this effect will contribute the newly planned pipelines and a compressor station in Hungary (i. e. pipeline Városföld – Ercsi – Győr, pipeline Ercsi-Szazhalombatta and CS Városföld), the implementation of reverse flow capacity on the existing interconnection between Hungary and Romania (CS Csanádpalota) as well as a new reverse flow interconnection between Hungary and Slovenia (Slovenian – Hungarian interconnector on Hungarian territory and R15/1 Lendava-Kidričevo on Slovenian territory).

6.3.7 Projects allowing development of underground gas storage capacity in Italy

Planned gas pipeline projects that will establish a new supply route from east to west, along the Southern Corridor, will increase their impact on Security of Supply and multiply their positive effects on the Region and overall Europe if coupled with the increased flexibility provided by several planned underground gas storage facilities in Italy (Bordolano and System Enhancements by Stogit, San Potito e Cotignola, Palazzo Moroni, and Nuovi Sviluppi by Edison Stoccaggio, Grottole-Ferrandina by Gas Storage, UGS Cornegliano by IGS), most of them in the northern part of the country.

7 Network Assessments

Introduction | Scenarios | Simulation results

Image courtesy of DESFA

7.1 Introduction

This chapter presents the capabilities and the potential need for improvements of the gas transmission in the Region, in three different points in time and under various conditions referring to:

- The implementation of new projects
- The level of demand
- The existence of supply restriction factors

This investigation is done with the use of the ENTSOG model. This is a linear programming model which minimises the cost for meeting the demand in all countries (or balancing zones), represented as a single node[1].

Each node is connected to neighbouring nodes with arcs having a limited capacity equal to the sum of the capacities of existing interconnectors. LNG and UGS capacities, import points (from non-EU sources) and new projects are represented by additional arcs.

The ENTSOG model calculations are based on

- Entry and Exit Capacities of IPs between two countries respectively balancing zones as calculated by the relevant TSOs
- Working gas volume respectively injection / withdrawal capacities of UGS
- Send-out Capacities of LNG Regasification facilities
- National production capacities

This model was used to:

- Analyse the balance between demand and supply
- Estimate the resilience of the transmission network
- Estimate the dependence of various countries on individual sources, specifically Russian gas and LNG.

This is achieved through the examination of various scenarios modelled by modifying the capacity assigned to different arcs. A more detailed description of the ENTSOG Network Modelling tool can be found in the ENTSOG TYNDP 2013 – 2022[2].

It is important to keep in mind that this model only proposes **one of many possible combinations** that cover the demand of various markets (one per country) while respecting the constraints regarding:

- the capacity of interconnections and entry points (from third countries) and
- the availability of supply sources

The model does not forecast the actual flows neither can the solution proposed be considered more probable than other solutions. The actual flows will depend from decisions made by the shippers who take into account gas prices, use of system tariffs and other commercial conditions of the transportation contracts. We have seen, in chapter 4, that prices are influenced by several parameters both technical

1) There are a few countries in the EU where the internal transmission system applies constraints in the gas transmission within the country. In such cases a country may be represented by more nodes. No such case exists in the Southern Corridor Region.

2) ENTSOG TYNDP 2013 – 2022, Main Report pp. 26-30

and commercial. For this reason the utility of the model is mainly proved in the stress cases where it is crucial to determine whether there is a possibility of overcoming a supply disruption or supply minimisation, under high demand conditions, or this might be impossible, in one or more areas, because of lack of adequate transportation capacity.

7.2 Scenarios

In order to perform the above analysis a certain number of cases were defined.

For the **Supply & Demand Analysis**, the following demand cases have been defined:

- Design Case (DC). In this case the daily demand in every country is equal to the daily demand used for the design of infrastructures according to the national provisions. This is the highest possible demand case.
- Average day: In this case the demand in every country is equal to the average daily demand of the full year or to the average daily demand of the winter period only (AW)
- One or 14 day Uniform Risk (UR) in Southern Corridor Region, with winter average conditions in the rest of the EU. This is further split in two cases. In the first, the Uniform Risk conditions are experienced by the Central–Eastern countries, in the second by the Mediterranean zone (CEE UR/AW, Mediterranean UR / AW). The Uniform risk conditions are those expected to be statistically encountered once in every 20 years. Their difference with the Design case conditions consists in that in a few countries the demand used for the design of infrastructures corresponds to more severe conditions (e.g. the ones expected to be encountered once in every 50 years). The decision to simulate different EU areas under different climatic conditions has as underlying assumption a certain level of simultaneity driven by geographic location.

  The EU's countries have been split in the two climatic zones as follows:

  Mediterranean: CY, GR, IT, ES & PT

  Central-Eastern: PL, CZ, SK, AT, HU, SI, HR, RS, BH, RO, BG, MK
- 14 day Uniform Risk in whole of the EU (UR)

The goal of the analysis is an assessment of whether the infrastructure is capable to serve the demand.

For the **Network Resilience Analysis**, the impact of different disruption scenarios on the gas supply has been investigated. For this purpose, and taking into account Regional specificities, a disruption of the Ukrainian (UA) route and a minimization of the use of LNG, were simulated.

As a third step, the **Supply Source Dependencies** of each SC country are analysed. This is crucial, not only in terms of security of supply, but also in terms of a functioning competition within the market, to gain information on this issue as a basis for further development of the gas transmission system within Europe towards an increased overall efficiency and maintaining energy prices within a reasonable range.

The above cases have been simulated with various infrastructure scenarios. In addition to the distinction made in the TYNDP, between FID and non-FID projects, the present GRIP has adopted a finer classification of projects creating smaller groups, within the non-FID one, in order to allow for a more detailed examination of the impact of several large key projects and of the PCI project for the Region. Thus the following project groups were created:

- **FID**
- **FID + TAP**
- **FID + TAP + IGB**
- **FID + TAP + IGB + IAP**
- **FID + PCI**
- **FID + non-FID**

All the cases considered are shown in the following table 7.1:

SUPPLY SOURCES			
SITUATIONS	**PIPE IMPORTS**	**LNG**	**UGS**
1-DAY DESIGN-CASE OR 1-DAY UNIFORM RISK	The maximum reached on one day during the last 3 years	Import component is equal to the Average Winter Supply. The remaining send-out is used as last resort	Last resort supply
14-DAY UNIFORM RISK	The highest average of 14 consecutive days during the last 3 years	Import component is equal to the Average Winter Supply. Additional send-out based on the maximum use of stored LNG	
1-DAY AVERAGE	Average shares by source of the different supply import sources in the European yearly balance of last 3 years, applied to the required imports. When the supply coming from one source is limited by the intermediate potential supply scenario, the corresponding missing volume is divided between the remaining sources proportionally to their ability to increase their level i.e. how far they are from reaching their own intermediate supply potential scenario.		Not used
1-DAY AVERAGE SUMMER	Based on the 1-day average – decreased by source to represent the seasonal swing. The seasonal swing in gas supply has been estimated as the average seasonal swing of the last 3 years for each source.		The total injected volume for Europe has been defined as 80% of the WGV (based on the average use of the last 3 years), and divided by balancing zone proportionally to the injection capacity.
1-DAY AVERAGE WINTER	Based on the 1-day average – decreased by source to represent the seasonal swing. The seasonal swing in gas supply has been estimated as the average seasonal swing of the last 3 years for each source.		Average withdrawal equals average injection (country by country) of the average summer.
1-DAY – MIXED CASES	Minimum: Supply by source and route as resulting of the 1-day Average. Maximum: As the 1-day Design Case		Min: value in average winter Max: withdraw availability (linked to stock level)
2-WEEK – MIXED CASES	Minimum: Supply by source and route as resulting of the 1-day Average. Maximum: As the 1-day Design Case		Min: value in average winter Max: withdraw availability (linked to stock level)

Table 7.1: Cases considered for the assessment of the Region's Transmission Infrastructure

In the maps that follow the remaining flexibility level is indicated by the following colours:

< 1 % 1 – 5 % 5 – 20 % > 20 %

7.3 Simulation results

7.3.1 INFRASTRUCTURE RESILIENCE UNDER DESIGN-CASE CONDITIONS (REFERENCE CASE)

The supply situation in the Region under Design Case conditions is almost satisfactory. In the 2014, FID-case, only Bulgaria (16.55 %) has a remaining flexibility lower than 20 %. In the 2018, FID-case, only Hungary (13.59 %) and Cyprus (4.16 %) have a remaining flexibility lower than 20 %, which is increased in the 2018 FID+PCI case, for Hungary, but remains low for Cyprus even in the 2018 non-FID case. In the 2023 FID+PCI case or the non-FID case the remaining flexibility is above 20 % all over the Region, but under 2023 FID case Hungary (7.95 %), Slovenia (17.62 %) and Greece (19.19 %) have a remaining flexibility under 20 %.

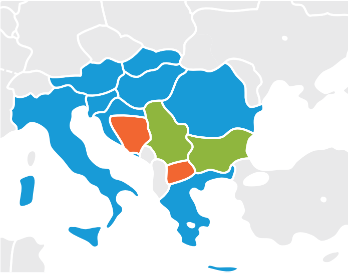
It should be noted that the results concerning Cyprus are highly uncertain as this country does not currently have a natural gas sector. The reduced resilience, in 2018, is due to the Cyprus plan to have gas fired power generation, supplied by imported gas, before starting national production.

Considering the 2023 FID+TAP case, only Hungary (7.95 %) and Slovenia (17.62 %) have a remaining flexibility under 20 %.

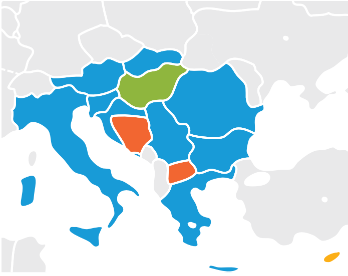
Comparing the 2023 FID+TAP case with the 2023 FID+TAP+IGB and 2023 FID+TAP+IGB+IAP cases the main difference is that the remaining flexibility for Slovenia with the addition of IAP is increased above 20 %, but TAP, IGB and IAP projects do not have any direct impact on Hungary, where the remaining flexibility remains practically constant. These results clearly indicate the relevance of the large key-projects to improve the energy landscape in the Region.

Finally, FYROM presents a low resilience in all cases simulated. This is due to the fact that it is supplied through a single pipeline from Bulgaria and there is not, in this GRIP, any project adding import capacity. On the contrary resilience is greatly improved in Bosnia & Herzegovina in the 2023 non-FID cases due to the commissioning of the connection with Croatia.

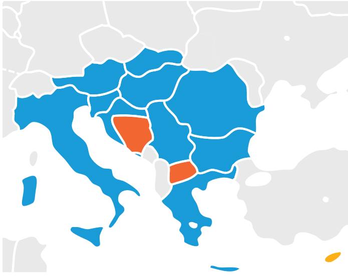
It is worth noting that Austria and Slovakia do not face any resiliency problem in any of the scenarios examined due to their better interconnections which gives them access to alternative sources of gas.



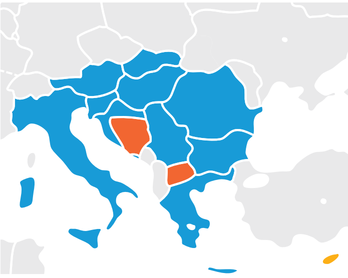
2014 FID



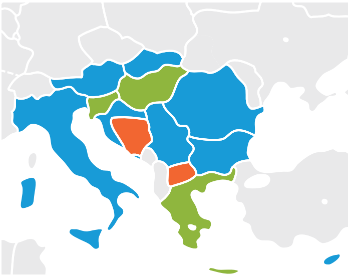
2018 FID
Improvement in Bulgaria and Serbia is due to the operation of South Stream, which is a FID project in these two countries.



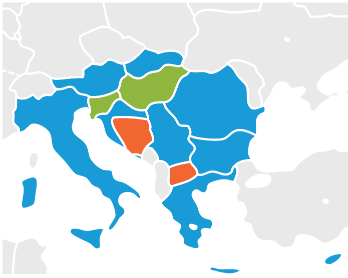
2018 FID + PCI



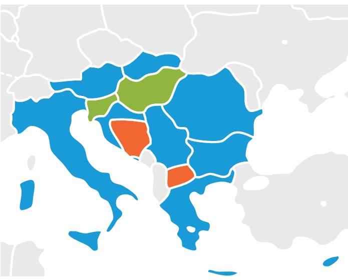
2018 non-FID



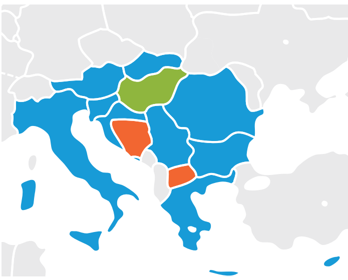
2023 FID



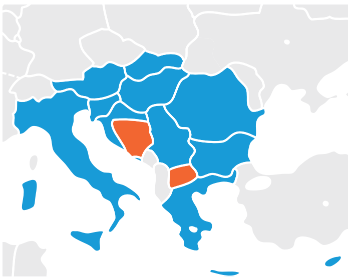
2023 FID + TAP
Greece benefits from the implementation of TAP.



2023 FID + TAP + IGB



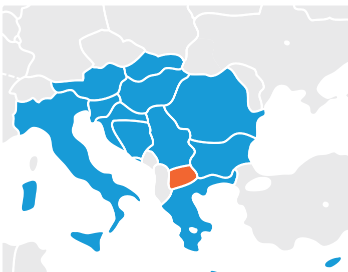
2023 FID + TAP + IGB + IAP
Slovenia benefits from the implementation of IAP.



2023 FID + PCI
Hungary benefits from the reduction of exit flows to neighbouring countries.

Remaining flexibility

- < 1 %
- 1 – 5 %
- 5 – 20 %
- > 20 %



2023 non-FID
Bosnia & Herzegovina benefits from the implementation of the connection with Croatia.

Figure 7.1: Remaining flexibility in Southern Corridor Countries (+ Bosnia & Herzegovina, FYROM and Serbia) under Design-Case situation (Reference Case)

7.3.2 UKRAINE DISRUPTION

7.3.2.1 CEE Region Uniform Risk demand, other Average Winter Demand

This scenario has been analysed considering the special relevance for the Regional context of such an occurrence.

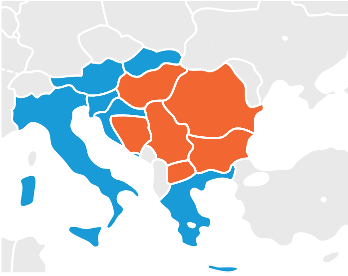
The supply situation in the Region under Ukraine disruption and assuming Uniform Risk demand for the CEE Region is not sufficient. In the 2014 FID case, Bulgaria, Hungary, and Romania face shortages, as the demand of these countries exceeds the supply. In the 2018 FID case only Hungary and Romania face shortages, since Bulgaria benefits from the implementation of the South Stream. Serbia also benefits from this project. On the other hand the resilience is reduced in Croatia, due to the decrease of national production that cannot be compensated through the supply from Hungary. The situation is improved, for Croatia, with the implementation of the PCI projects as these involve the LNG terminal in Krk Island.

In the 2018 non-FID case, the shortage of Hungary disappears, although the resilience remains very low. Romania still has a small shortage because there is no dedicated capacity from South Stream towards Romania.

Considering the 2023 FID, non-FID and FID+PCI cases it is visible that the supply situation is sufficient in case of realization of the PCI projects.

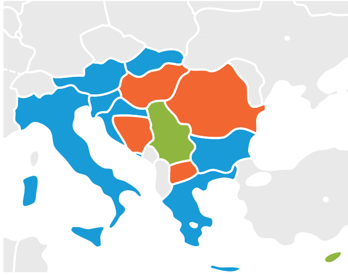
The TAP, IGB and IAP projects have no impact on Hungary, and Romania as they do not change the corresponding remaining flexibilities.

Image courtesy of Plinovodi

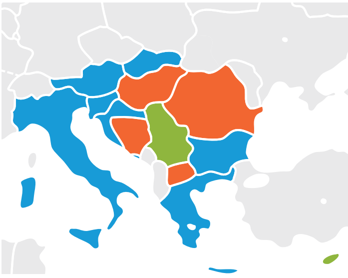


2014 FID

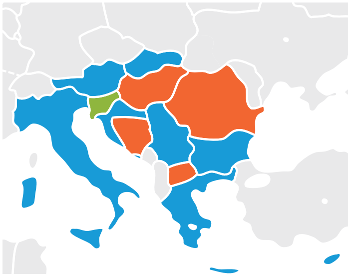
2018 FID
Bulgaria and Serbia benefit from the implementation of South Stream while Croatia faces a decrease in national production.



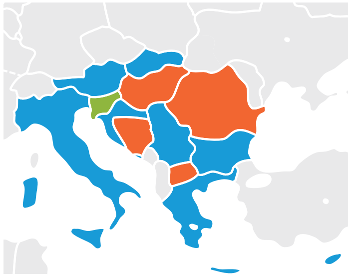
2018 FID + PCI
Croatia benefits from the commissioning of the LNG terminal in Krk Island.



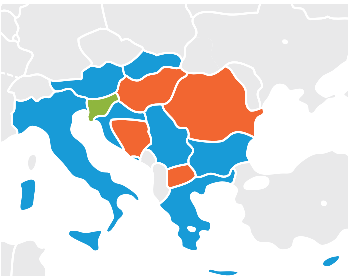
2018 non-FID



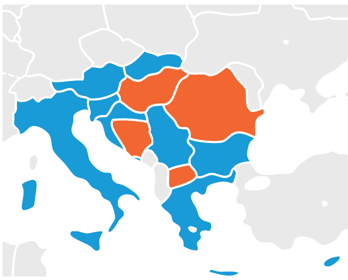
2023 FID
Slovenia faces an increase in demand from power production units.



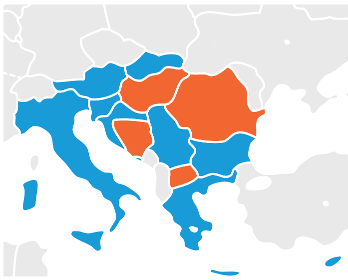
2023 FID + TAP



2023 FID + TAP + IGB



2023 FID + TAP + IGB + IAP
Slovenia benefits from the implementation of IAP.

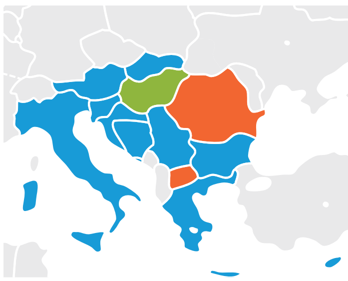


2023 FID + PCI

Remaining flexibility

- < 1 %
- 1 – 5 %
- 5 – 20 %
- > 20 %

Figure 7.2: Remaining flexibility in Southern Corridor Countries (+ Bosnia & Herzegovina, FYROM and Serbia) under Ukraine disruption, CEE-Region Uniform Risk Demand, other Average Winter Demand



2023 non-FID
Hungary benefits from the implementation of South Stream together with various non-FID projects in the Region which reduce the exit flows to neighbouring countries.

7.3.2.2 Mediterranean Region Uniform Risk demand, other Average Winter Demand

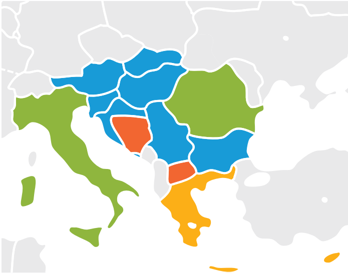
In this case, as it could have been expected, the remaining flexibility, in 2014 FID case, under Ukraine disruption, is reduced more in Italy and Greece. In comparison with the previous case, flexibility is not affected in Hungary and is less affected in Romania.

In the 2018 FID case the implementation of South Stream improves the situation in Bulgaria and Serbia and, to a lesser extent, in Greece where the situation is redressed in the 2018 FID+PCI case.

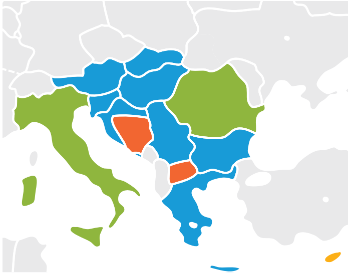
In 2023 the situation worsens for Hungary and is redressed after the implementation of IAP which reduces the needs of neighbour Croatia. Finally in the 2023 non-FID case no problem remains for the Region's EU countries.

Image courtesy of Snam Rete Gas

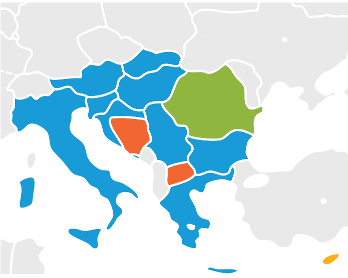
2014 FID



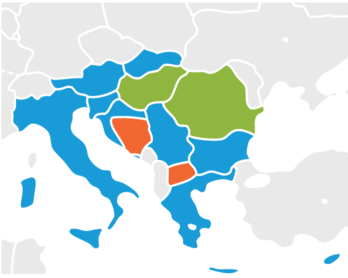
2018 FID
Improvement in Bulgaria and Serbia due to South Stream, and in Greece due to the commissioning of the Revythoussa LNG terminal extension.



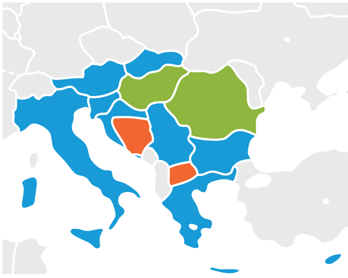
2018 FID + PCI
Further improvement in Greece due to the implementation of two PCI LNG projects.



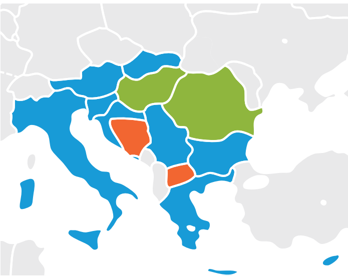
2018 non-FID
Improvement in Italy due to several non-PCI and non-FID LNG and UGS projects.



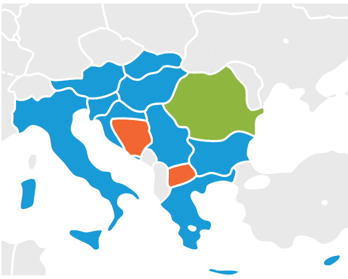
2023 FID
The situation in Hungary is aggravated by the increase in demand and the reduction in national production.



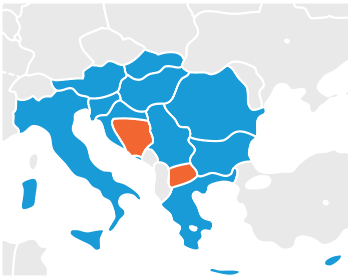
2023 FID + TAP



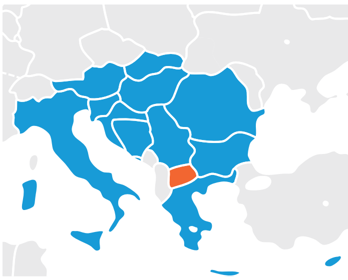
2023 FID + TAP + IGB



2023 FID + TAP + IGB + IAP
Hungary's flexibility is improved as IAP increases the supply to Croatia, reducing the flow from Hungary to Croatia.



2023 FID + PCI
The improvement in Romania is due to the implementation of the Austria-Hungary-Romania transmission corridor.



2023 non-FID
The situation in Bosnia & Herzegovina is improved due to the implementation of interconnections with Croatia.

Remaining flexibility

- < 1 %
- 1 – 5 %
- 5 – 20 %
- > 20 %

Figure 7.3: Remaining flexibility in Southern Corridor Countries (+ Bosnia & Herzegovina, FYROM and Serbia) under Ukraine disruption, Mediterranean Region Uniform Risk Demand, other Average Winter Demand

7.3.2.3 CEE Region 2 weeks Uniform Risk, other Average Winter Demand

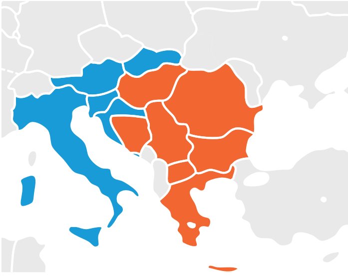
This scenario describes the Average Daily Demand under Ukrainian disruption, on a sustained 2-week cold event in the CEE Region, while the other Regions of EU experience an average winter demand. The demand in this situation is lower than in the one-day Design Case or Uniform Risk situations. On the other hand, because of a 2 weeks period of sustained high demand, there is less gas in stock hence the withdrawal capacities of the storages are also lower than in 1 day scenarios. This has a knock-on effect reaching even Greece, in the 2014 FID case.

The operation of South Stream improves the situation in Bulgaria and Serbia in the 2018 FID case.

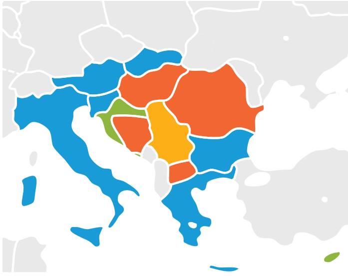
In the 2018 FID+PCI case Croatia, Bulgaria and Greece benefit from the Krk Island LNG terminal, the FSRUs in Northern Greece and the Chiren storage expansion in Bulgaria.

In 2023 the effect of the reduction of the UGS deliverability becomes visible in the Western Balkans and Hungary. This is gradually relieved in the Western Balkans with the operation of IAP, in the Eastern Balkans with the remaining PCI projects and in Hungary with the non-FID projects, among which South Stream.

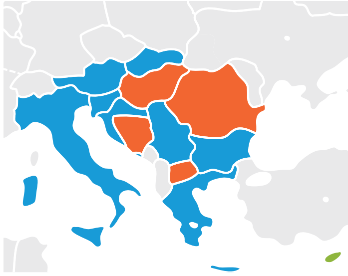

Image courtesy of FGSZ



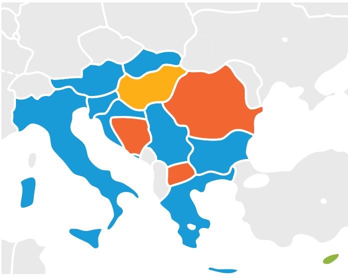
2014 FID



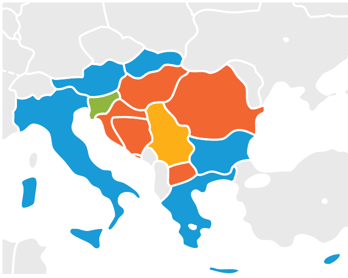
2018 FID
Due to the decreasing of national production in HR its remaining flexibility is lower than in 2014 FID case. The South Stream improves the situation in BG and RS and the Revythoussa LNG terminal extension does the same in GR.



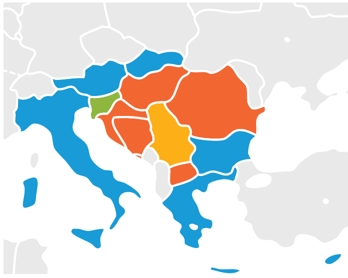
2018 FID + PCI
Croatia benefits from the commissioning of the LNG terminal in Krk Island.



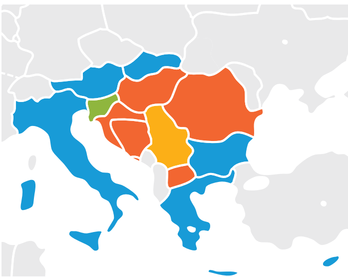
2018 non-FID
The South Stream pipeline improves the remaining flexibility in Hungary to a lesser extent than in the 1-day case because of the reduced deliverability of the UGSs.



2023 FID
The reason of the difference between the CEE UR and CEE 2W scenarios, assuming the 2023 FID case, is mostly the lower withdrawal capacity of the storages.

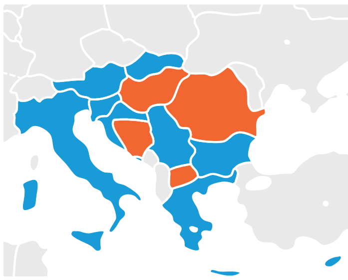


2023 FID + TAP
The TAP project does not compensate the decreased withdrawal capacity of the storages.



2023 FID + TAP + IGB

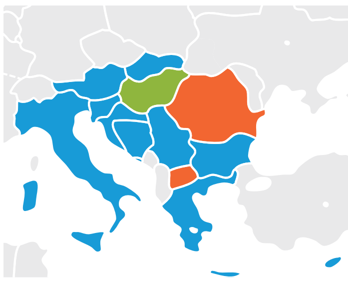
2023 FID + TAP + IGB + IAP
The IAP project has a positive impact on Croatia and Slovenia.



2023 FID + PCI
In the 2023 FID+PCI case only Hungary has a remaining flexibility below 1 % since the South Stream project is a non-FID project in this country.

Remaining flexibility

- < 1 %
- 1 – 5 %
- 5 – 20 %
- > 20 %



2023 non-FID
The situation in HU is improved due to the South Stream project. BH benefits from the interconnections with Croatia.

Figure 7.4: Remaining flexibility in Southern Corridor Countries (+ Bosnia & Herzegovina, FYROM and Serbia) under Ukraine disruption, CEE 2 weeks Peak Demand, other Average Winter Demand

7.3.2.4 Mediterranean Region 2 weeks Uniform Risk, other Average Winter Demand

This scenario describes the Average Daily Demand on a sustained 2-week cold event in the Mediterranean Region, while the other Regions of EU experience an Average Winter demand. The demand in this situation is lower than in the one-day Design Case or Uniform Risk situations. On the other hand, because of a 2 weeks period of sustained high demand, on the last day of this period, there is less gas in stock hence the withdrawal capacities of the storages are also lower than in the corresponding 1 day scenarios. For this reason, the northern countries of the Region, that depend more on storages, have in some cases a lower remaining flexibility.

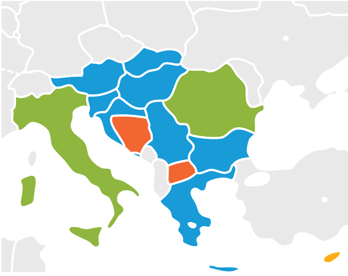
The reduction in flexibility is, as expected, lower in Romania and higher in Italy, in comparison with the scenario of paragraph 7.3.2.3. The situation improves:

- in Italy, in 2018, with several non-FID and non-PCI LNG and UGS projects
- in Greece, in 2018, with the commissioning of the FID extension of the Revythoussa LNG terminal.

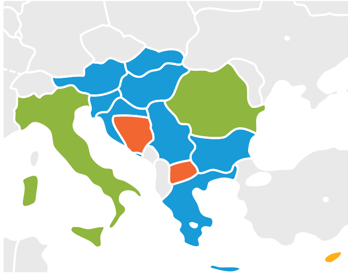
In Hungary and Slovenia the remaining flexibility is reduced in 2023 as a result of the increasing demand, the decreasing national production (in Hungary) and the reduced deliverability of the UGS. It is increased again, first with the implementation of the IGB, which reduces the need for gas supply to Serbia and Romania through Hungary, then with the implementation of IAP which increases the supply to Slovenia and finally with the remaining PCI projects which include the Romania-Hungary-Austria transmission corridor.

Image courtesy of Snam Rete Gas

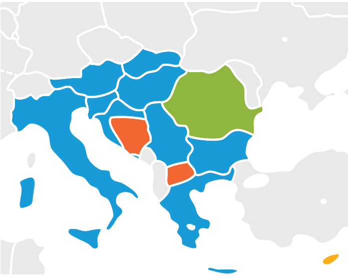
2014 FID



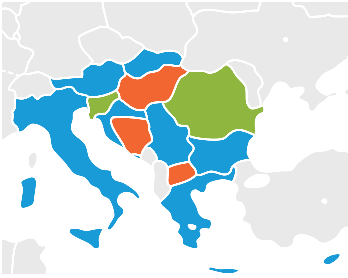
2018 FID
The FID South Stream project in Bulgaria and Serbia, and the Revythoussa LNG terminal extension in Greece improve the remaining flexibility of these countries.



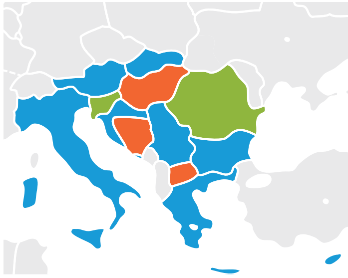
2018 FID + PCI



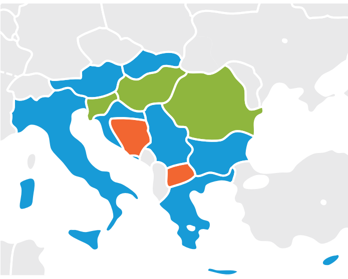
2018 non-FID
Improvement in Italy due to several non-PCI and non-FID LNG and UGS projects.



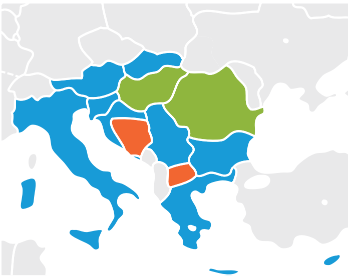
2023 FID
Due to the fact that Hungary is a transit country for Croatia, Romania and Serbia, the remaining flexibility of Hungary falls below 1 %.



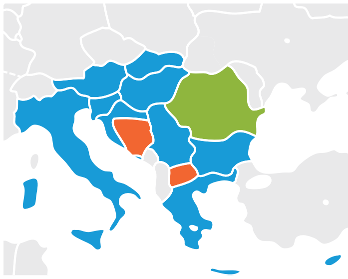
2023 FID + TAP



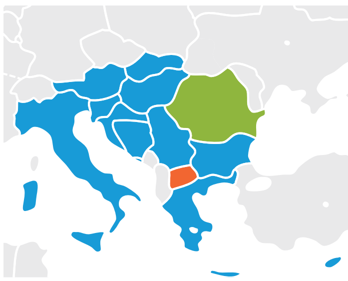
2023 FID + TAP + IGB
The IGB improves the remaining flexibility of Hungary because the supply of Serbia and Romania from Bulgaria is increased thus decreasing their supply through Hungary.



2023 FID + TAP + IGB + IAP
The IAP improves the remaining flexibility of Slovenia.



2023 FID + PCI
Hungary benefits from the implementation of the Romania-Hungary-Austria transmission corridor. Bosnia & Herzegovina benefits from the interconnections with Croatia.



2023 non-FID
Bosnia & Herzegovina benefits from the interconnections with Croatia.

Remaining flexibility

- $< 1\,\%$
- $1 - 5\,\%$
- $5 - 20\,\%$
- $> 20\,\%$

Figure 7.5: Remaining flexibility in Southern Corridor Countries (+ Bosnia & Herzegovina, FYROM and Serbia) under Ukraine disruption, Mediterranean Region 2 weeks Peak Demand, other Average Winter Demand

7.3.3 IDENTIFICATION OF ZONES WITH STRONG RELIANCE ON A SINGLE SUPPLY SOURCE

This part of the assessment aims at identifying the Zones strongly relying on a single supply source. This dependence is measured as the minimum share of a given supply source required to balance the annual demand and exit flows of a Zone. This assessment is based on full supply minimization modelling, seeking for cases where a Zone will require a supply share of more than 20 % from the minimized source.

The full minimization of any source is based on the assignment of an increased cost in the simulation model, while the costs of the other sources are not modified. This means that the source in question will be used only in case the countries cannot cover their demand from other sources.

In the maps that follow the colour code below is used to denote the minimum share in total supply:

LNG	RU	
(grey)	(grey)	< 20 %
(light blue)	(light red)	20 – 40 %
(medium blue)	(medium red)	40 – 60 %
(dark blue)	(dark red)	> 60 %

The symbol ⬠ indicates the existence of (one or more) LNG terminals.

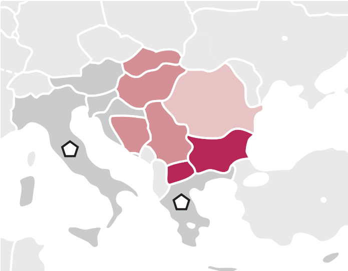
Two sets of maps are presented:

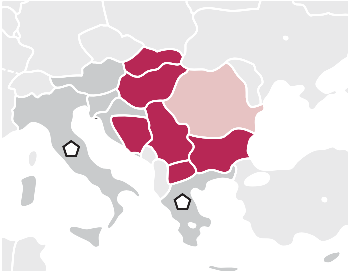
The first one shows the reliance from either LNG or Russian gas during one day under average conditions. As shown below, no country has a reliance from LNG higher than 20 % while many countries, with the exception of those who have access to LNG (Italy and Greece), Austria, Slovakia and Croatia rely on Russian gas for more than 20 % and up to 60 % of their supply.

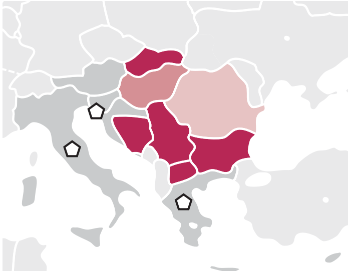
The second one shows the reliance on LNG, in the more stressed case of two weeks peak demand. This case was selected in order to explore the limits of the low reliance from LNG as these were not revealed in the previous case.

7.3.3.1 Full minimization of Russian gas or LNG (occurrence: average day)

The Russian gas is crucial for the supply of Slovakia, Hungary, Romania, Serbia and Bulgaria.



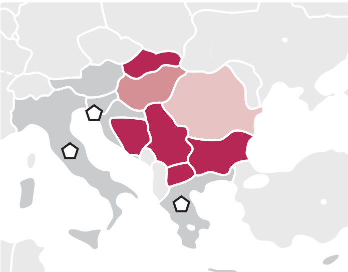


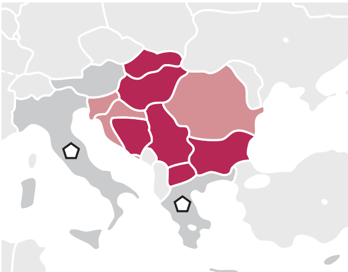


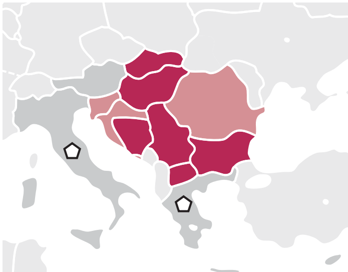
2014 FID
Romania has a lower dependence due to its significant national production.

2018 FID
The South Stream increases the dependence of Serbia and Bosnia & Herzegovina. The dependence of Hungary increases because of the increasing demand and decreasing national production while the one of Slovakia increases due to the operation of the HU-SK interconnection.

2018 FID + PCI
The dependence of Hungary is slightly reduced from 62 % to 58 % due to a higher use of capacity from Austria.



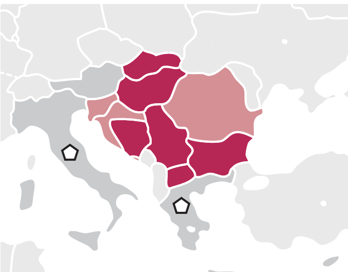


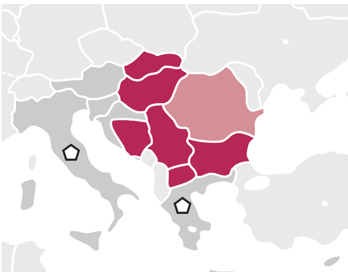


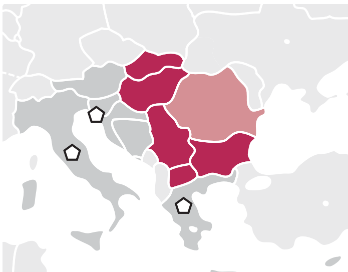
2018 non-FID

2023 FID

2023 FID + TAP
The reduction in national production (Croatia) and the increase of consumption (Slovenia) increase the dependence of these two countries from Russian gas.







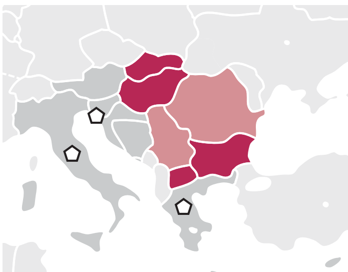
2023 FID + TAP + IGB
IGB reduces the dependence of Bulgaria from 85 % to 69 %.

2023 FID + TAP + IGB + IAP
IAP reduces the dependence of Croatia and Slovenia.

2023 FID + PCI
Bosnia & Herzegovina reduces the dependence from Russian gas due to Croatia's LNG terminal in Krk Island.

Minimum share in total supply

- < 20 %
- 20 – 40 %
- 40 – 60 %
- > 60 %
- Existence of (one or more) LNG-Terminals

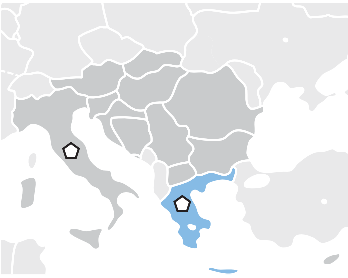


2023 non-FID
The dependence of Serbia is reduced due to the commissioning of the Slobodnica (HR) – Bačko Novo Selo (RS) interconnection.

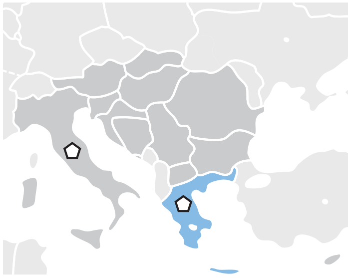
Figure 7.6: Zones with strong reliance on a single supply source in Southern Corridor Countries (+ Bosnia & Herzegovina, FYROM and Serbia), full minimization of Russian gas or LNG (occurrence: average day)

7.3.3.2 Minimization of LNG (occurrence: 2 week peak demand all over Europe)

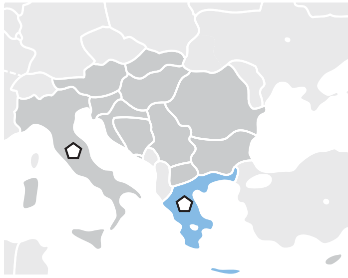
It is visible that there is no dependence on LNG in the Region with the exception of Greece. The countries of the Region can, if needed, fulfil their demand from other supply sources. In these cases the main supply sources for Croatia are Russia and its national production, for Italy are Algeria and Libya. Greece reduces its dependence from LNG first thanks to the commissioning of TAP (from 53 % to 42 %) and then, when the East-Med pipeline is taken into account (in the 2023 FID+PCI case), to less than 20 %.



2023 FID + TAP



2023 FID + TAP + IGB



2023 FID + TAP + IGB + IAP

2023 FID + PCI
Due to the gas from eastern Mediterranean, the dependence of Greece on LNG is reduced to less than 20 %.

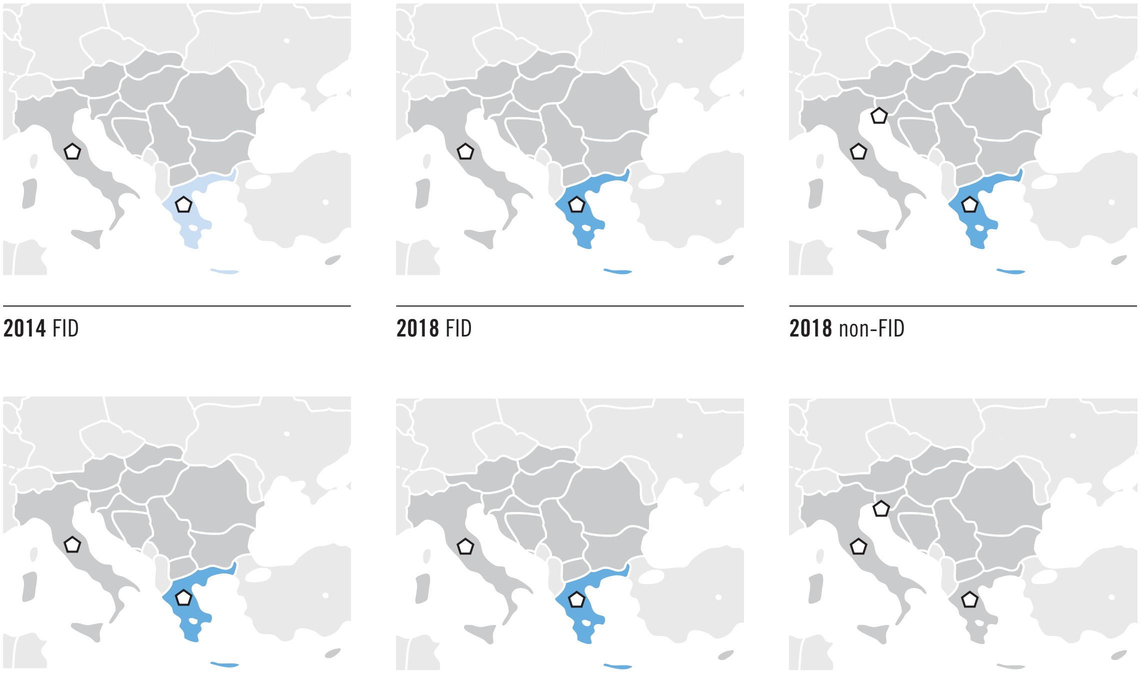
Minimum share in total supply

- < 20 %
- 20 – 40 %
- 40 – 60 %
- > 60 %
- Existence of (one or more) LNG-Terminals

Figure 7.7: Zones with strong reliance on a single supply source in Southern Corridor Countries (+ Bosnia & Herzegovina, FYROM and Serbia), minimization of LNG (occurrence: 2 week peak demand all over Europe)

7.3.3.3 Minimization of LNG (occurrence: 2 week peak demand in the Mediterranean, average winter demand in the other countries)

As can be seen from the maps this scenario is similar to the previous one. The only country presenting a significant dependence from LNG is Greece until 2023 (FID+PCI case) when this is reduced thanks to the East-Med project bringing gas from the Eastern Mediterranean gas fields.



2014 FID

2018 FID

2018 non-FID

2023 FID

2023 FID + TAP + IGB + IAP

2023 FID + PCI
Due to the gas from eastern Mediterranean, the dependence of Greece on LNG is reduced to less than 20 %.

Minimum share in total supply

- < 20 %
- 20 – 40 %
- 40 – 60 %
- > 60 %
- Existence of (one or more) LNG-Terminals

Figure 7.8: Zones with strong reliance on a single supply source in Southern Corridor Countries (+ Bosnia & Herzegovina, FYROM and Serbia), minimization of LNG (occurrence: 2 week peak demand in the Mediterranean, average winter demand in the other countries)

8 Conclusions

Image courtesy of Infrastrutture Trasporto Gas

The present publication of the "Southern Corridor Gas Regional Investment Plan" is the second edition of a report aimed at gathering and processing information from TSOs of countries which surround or are more directly influenced by the gas transportation route defined as "Southern Corridor". Compared to the first edition, we tried to offer to the reader a more complete picture of the Region supplemented with various enhancements, mainly resulting in the production of two completely new sections: "Assessment and Market analysis" chapter, including the examination of congestion at Regional IPs, and "Network Assessments" chapter, where we show modelling results of a variety of scenarios.

Results reflect all the specific attributes of the area which the readers of this document have to take into account, in particular:

- This Region hosts new transmission projects with larger capacities than planned infrastructure in the other Regions. Therefore new potential volumes will have high influence on security of supply and diversification of routes and/or sources in the States of the area and all over Europe.
- Many of the members of the Southern Corridor Region are transit countries, while infrastructure in other Regions has more a balanced role, being mostly destined to handle internal consumption.
- This Region gathers countries with great variety of their national production. From one side, we have systems where production is from 0% to 10% of their peak consumption and may only marginally contribute to cover gas demand even in normal circumstances, let alone during crisis situation. On the other side, there are countries where production is a significant element in the supply mix, representing a substantial factor for the diversification of sources both for themselves and for their neighbours as well. Nevertheless the gas production volume in all producing countries of the Region follows a decreasing trend.
- Such mixed picture can be seen also at the demand side, which is affected by different population sizes of member states, by their geographical spread, from central parts of Eastern Europe, with high consumption in winter periods, to Southern Europe countries, with relatively high consumption levels also during summer and finally, by different market maturity.

Despite these differences all the countries, in the Region, and their TSOs, will be strongly affected by the construction of any of the big transmission projects and are prepared to adapt their investments to such possibilities.

Furthermore the present GRIP is providing a complete overview of the gas demand trends in the past 4 years and those expected in the next 10 years, analysing the current situation characterised by a weak annual consumption (reflected also in a decrease of successive forecasts). This dynamic is mainly due to the economic crisis effects and to the substitution of gas in power generation by other sources, such as coal and Renewable Energy Sources. At the same time the Region faces a general decrease of average load factor while the peak requirements remain important. Added to a higher intermittency of demand (RES-drive) the need for flexible infrastructure is destined even to increase its importance.

On the supply side Southern Corridor Region faces probably the biggest challenge across Europe. Projects planned in the Region are expected to enable a considerable change of the supply patterns with positive impacts also for the Europe as a whole. Such a change will be brought out by new sources of gas (Caspian and East-Mediterranean / Middle East) and new routes with TAP and South Stream among the bigger players.

When assessing demand and supply of the Southern Corridor Region, the GRIP gives us as clear message that they are balanced in the reference case scenario. On the other hand, the Region is vulnerable to disruption of the Ukrainian route, while the FID projects help to satisfy part of the expected demand but are not sufficient to fully mitigate the situation. Therefore, also the non-FID projects are needed to ensure a complete redress. This again proves that the Region has high dependence on Russian gas, although this is expected to be reduced for some of the countries with the help of FID and PCI projects.

As one of the main roles of TSOs is to reduce any possible bottlenecks at their IPs, the GRIP also analyses congestion dynamics both from a physical and from a contractual point of view. The findings are that no physical congestion appears in any IP (with the exception of Mosonmagyaróvár) while contractual congestion is a very limited phenomenon, expected to progressively improve with the implementation of projects and the new CMP and CAM rules.

The TSOs of the Region hope that stakeholders will consider that the present report is a valuable informative tool offering a comprehensive overview of the Southern Corridor Region's countries, projects, and gas market data.


Image courtesy of Snam Rete Gas

Legal Disclaimer

The Southern Corridor GRIP was prepared in a professional and workmanlike manner by the TSOs of the nine countries forming the Southern Corridor Region, on the basis of information collected and compiled by them and from stakeholders, and on the basis of the methodology developed by ENTSOG with the support of the stakeholders via public consultation for the preparation of the TYNDP 2013–2022. The Southern Corridor GRIP contains TSOs' own assumptions and analysis based upon this information.

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The reader in its capacity as professional individual or entity shall be responsible for seeking to verify the accurate and relevant information needed for its own assessment and decision and shall be responsible for use of the document or any part of it for any purpose other than that for which it is intended.

Definitions

Number formatting	Comma (,) is used as a 1,000 separator Point (.) is used as decimal separator
1-day Uniform Risk Demand Situation	A daily demand Situation forecasted under the same risk of a climatic occurrence close to 1-in-20 years
14-day Uniform Risk Demand Situation	A 14-day average daily demand Situation forecasted under the same risk of a climatic occurrence close to 1-in-20 years
Average Day Demand Situation	A daily average demand Situation calculated as 1/365th of an annual demand
Case	A combination of a demand and supply situation, infrastructure cluster and the respective time reference
Design-Case Demand Situation	A high daily demand situation used by TSOs in their National Development Plans to determine the resilience of their system and needs for investment
FID project	A project where the respective project promoter(s) has (have) taken the Final Investment Decision
Full Minimisation	A modelling approach aimed at minimising supply from each source separately, in order to identify Zone Supply Source Dependence, and replacing it with the corresponding volume from the remaining sources in such a way that the maximum minimisation of the analysed supply is achieved
Import	The supply of gas at the entry of the European network as defined by this GRIP or gas delivered at the entry of a Zone
Interconnection Point	A point of interconnection between two different infrastructures; an Interconnection Point may or may not be operated by different infrastructure operators
National Production	The indigenous production related to each country covered in the GRIP; a Zone allocation has been carried out where relevant
Network Resilience	A notion related to the capability of a network to ensure supply demand balance in High Daily Demand Situations, including also under Supply Stress
Non-FID project	A project where the Final Investment Decision has not yet been taken by the respective project promoter(s)
Plan	Means the referenced GRIP, including all Annexes; Plan and Report are used interchangeably
Reference Case	The Case that extends the historical (last three years) trend of supply over the 10-year period covered by the GRIP; where new import pipe/LNG terminal projects are planned to come on stream the supply is adjusted in proportion to the last applicable supply situation
Remaining Flexibility	A notion related to the assessment of Network Resilience; it refers to the ability of a Zone to offer additional room for supply arbitrage; the value of the Remaining Flexibility is benchmarked against defined limits to identify potential capacity gaps
Scenario	A set of assumptions related to a future development which is the basis for generating concrete value sets covering demand or supply
Situation	A combination of conditions and circumstances relating to a particular occurrence of demand or supply, or both; such conditions and circumstances may relate to e.g. time duration, climatic conditions, or infrastructure availability.

Supply Dependence A notion related to Supply Diversification in terms of dependence of a Zone on a particular external supply source; it is measured through an indicator which is set at 20 % and 60 % share of an external supply source in covering the total annual demand forecast of a Zone.

Supply Stress A supply situation which is marked by an exceptional supply pattern due to a supply disruption.

Technical capacity The maximum firm capacity that the Transmission System Operator can offer to the network users, taking account of system integrity and the operational requirements of the transmission network (Art. 2(1)(18), REG-715)

Transmission The transport of natural gas through a network, which mainly contains high-pressure pipelines, other than an upstream pipeline network and other than the part of high-pressure pipelines primarily used in the context of local distribution of natural gas, with a view to its delivery to customers, but not including supply (Art. 2(1)(1), REG-715)

Transmission system Any transmission network operated by one Transmission System Operator (based on Article 2(13), DIR-73)

Transmission System Operator A natural or legal person who carries out the function of transmission and is responsible for operating, ensuring the maintenance of, and, if necessary, developing the transmission system in a given area and, where applicable, its interconnections with other systems, and for ensuring the long-term ability of the system to meet reasonable demands for the transport of gas (Article 2(4), DIR-73)

Zone An Entry/Exit Transmission system or sub-system, including all National Production, Underground Gas Storage and LNG terminal Interconnection Points connected to such system or sub-system, which has been defined on the basis of either the commercial (capacity) framework applicable in such system or sub-system or the physical limits of the respective Transmission system

Abbreviations

AD	Average Day
AGRI	Azerbaijan-Georgia-Romania Interconnector
AW	Average Winter
bcm	Billion Cubic Meter
BOTAŞ	BOTAŞ Petroleum Pipeline Corporation (Turkey)
CAM	Capacity Allocation Mechanisms
CCGT	Combined Cycle Gas Turbine
CEE	Central Eastern Europe
CEGH	Central European Gas Hub
CMP	Congestion Management Procedures
CNG	Compressed Natural Gas
CO2	Carbon Dioxide
CS	Compressor Station
DC	Design Case
DN	Nominal Diameter
DSO	Distribution System Operator
EC	European Commission
ENTSOG	European Network of Transmission System Operator for Gas
ETS	Emission Trading Scheme
EU	European Union
FID	Final Investment Decision
GMS	Gas Metering Station
GRIP	Gas Regional Investment Plan
GRS	Gas Receiving Station
GWh/y	Giga Watt hour/ year
IAP	Ionian Adriatic Pipeline
IGB	Interconnector Greece Bulgaria
IP	Interconnection Point
ISO	Independent System Operator
ITB	Interconnector Turkey Bulgaria
ITO	Independent Transmission Operator
km	Kilometer
LNG	Liquified Natural Gas
mcm	Million cubic meter
mm	Millimeter
MRS	Metering & Regulating Station
MS	Member State (EU)
MW	Mega Watt
NBP	National Balancing Point (UK)
NRA	National Regulating Authority
NSI	North South Interconnections
OU	Ownership Unbundling
PCI	Project of Common Interest
RCI	Residential-Commercial-Industrial
RES	Renewable Energy Sources
SC	Southern Corridor
SCP	South Caucasus Pipeline
SOCAR	State Oil Company of Azerbaijan Republic
TANAP	Trans Anatolian Pipeline
TAP	Trans Adriatic Pipeline
TSO	Transmission System Operator
TYNDP	Ten Year Network Development Plan
UGS	Underground Storage
UR	Uniform Risk
USA	United States of America
WGV	Working Gas Volume

Country Codes (ISO 3166-1)

Albania	AL	**Morocco**	MA
Algeria	DZ	**Montenegro**	ME
Austria	AT	**Netherlands, The**	NL
Azerbaijan	AZ	**Norway**	NO
Belarus	BY	**Poland**	PL
Belgium	BE	**Portugal**	PT
Bosnia & Herzegovina	BH	**Romania**	RO
Bulgaria	BG	**Russia**	RU
Croatia	HR	**Serbia**	RS
Czech Republic	CZ	**Slovakia**	SK
Cyprus	CY	**Slovenia**	SI
Denmark	DK	**Spain**	ES
Estonia	EE	**Sweden**	SE
FYROM	MK	**Switzerland**	CH
Greece	GR	**Tunisia**	TK
Hungary	HU	**Turkey**	TK
Ireland	IE	**Ukraine**	UA
Italy	IT	**United Nations interim administration Mission In Kosovo**	UNMIK
Latvia	LV	**United Kingdom**	UK
Libya	LY		
Lithuania	LT		
Malta	MT		

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