GAS REGIONAL INVESTMENT PLAN SOUTHERN CORRIDOR

BASED ON ENTSOG's TYNDP 2020

BULGARTRANSGAZ
desfa
eustream SLOVAK GAS TSO
FGSZ
GAS CONNECT AUSTRIA
plinacro
Plinovodi Connected through energy
snam
Trans Adriatic Pipeline
TAG Trans Austria Gasleitung
TRANSGAZ MAGISTRALA ENERGIEI

SOUTHERN CORRIDOR

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FOREWORD

It is our pleasure to welcome you to the fifth edition of the Southern Corridor Regional Investment Plan (SC GRIP).

Southern Corridor Region and its gas infrastructures will represent for the next decades a bridge between further EU natural gas market integration and flexibility needs, being at the same time an enabler for the uptake of low-carbon and decarbonised gases required by the energy transition.

The gas infrastructure in SC Region is further developing, connecting new needs of customers with additional energy sources, thus stimulating the market activity and contributing to the creation of liquid and competitive gas markets. These developments provide substantial contribution to the achievement of the main European energy policy objectives, both in terms of market integration, security of supply, competition enhancement as well as under the sustainability dimension.

Indeed, this fifth edition of the SC GRIP marks a step forward by highlighting the efforts and the initiatives that TSOs are establishing to tackle not only markets and energy systems security of supply needs but also the decarbonisations goals as defined in the recent European climate policies developments.

Natural gas represent a fundamental energy carrier in the process of transition toward a net-zero energy system: it will allow for quick decarbonisation wins, enabling an immediate substitution effect leading to the reduction of GHG emissions in a Region which is still reliant on more carbon intensive fuels such as coal, lignite and oil, while intermittent renewable energy sources are still in a developing phase, although increasing fast. Therefore, this energy carriers represents an opportunity for immediate and significant emissions reduction, providing at the same time stability and flexibility to the energy systems.

Furthermore, gas infrastructures are expected to be enablers of energy transition allowing for the uptake and scaling-up of new low-carbon and decarbonised gases, from natural gas itself with CCS to biomethane and hydrogen, as well as their potential blends. These represent efficient solutions for the decarbonisation of the energy system, since they allow the exploitation of the opportunities that existing gas infrastructures and relevant market arrangements can already offer in this new context.

The SC GRIP is the result of close cooperation between 11 TSOs and 9 countries under the coordination of SNAM and DESFA. The TSOs of the Southern Corridor Region would welcome any comments or feedback that could assist in improving this report.

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EXECUTIVE SUMMARY

The present 5th edition of the Southern Corridor Gas Regional Investment Plan (SC GRIP) aims to provide a regional detailed overview of the investment projects in gas infrastructure (transmission, underground storage and LNG)[1] and of the historical and future gas demand, outlining also the role of gas infrastructure for energy transition.

This Corridor represents a key supply route for secure and competitive European gas market, and covers gas systems from 9 countries: Austria, Bulgaria, Croatia, Hungary, Greece, Italy, Romania, Slovakia, and Slovenia.

The report offers an in depth-analysis of the infrastructure projects and analysis proposed by the involved TSOs (Bulgartransgaz, DESFA, Eustream, FGSZ, Gas Connect Austria, Plinacro, Plinovodi, Snam Rete Gas, Trans Adriatic Pipeline, Trans Austria Gasleitung, Transgaz) and other promoters in the SC Region as resulting from the EU-wide TYNDP 2020 developed by the European Network of Transmission Operators for Gas (ENTSOG) and national development plans.

The total number of ongoing projects in the Region is 103 out of which 70 were already presented in the last GRIP editions, and 33 are more recent initiatives.

As in the previous edition the Region is characterised by the presence of few large projects, mostly interlinked, aiming at the transportation of Caspian, Russian and Eastern Mediterranean gas to Europe. In addition, other projects aim to support gas penetration in countries where natural gas was only recently introduced in the energy mix, exploiting the potential of gas infrastructures.

For the first time new type of projects has been introduced, the Energy Transition Related (ETR) projects, which are initiatives that aim to support the decarbonisation process and the achievement of European climate targets (e. g. biomethane, hydrogen, sector-coupling, etc.).

The analysis of the historical trends in SC Region suggests that in the last five years the gas consumption has increased by 116 TWh, determining a stable share of 25 % of the EU28 total gas consumption. Moreover, the projections reveal that an increase in gas consumption is expected up to 2025, driven mainly by the increasing demand for power generation as gas will progressively substitute more pollutant fuels such as coal, lignite and oil. Such consumption level is forecasted to be maintained approximately up to 2030. Afterwards, a downward trend is expected due to the decrease of conventional gas consumption mainly in residential and tertiary sectors, determined by the achievement of energy efficiency and decarbonisation targets. This decrease is broadly counterbalanced by the development of sustainable gases (hydrogen, bio and synthetic gases) as unavoidable energy carriers for the adequacy and storability of the European energy system, highlighting the crucial role that gas infrastructure will continue to have in the next decades to provide the required flexibility to integrate the electricity system.

Finally, coherently with the recent developments in European climate policies, TSOs are developing new initiatives that confirm the role of gas infrastructure as an enabler of energy transition, allowing for the uptake of new low-carbon and decarbonised gases such as biomethane and hydrogen, that will be fundamental to achieve the decarbonisation targets.

Disclaimer:
All the information, data and findings included in this report are the results of a process led by the involved TSOs of the Southern Corridor Region along 2021 and therefore does not consider the recent developments regarding the Russian-Ukrainian conflict nor investigates its potential consequences.

1 Project with Regional relevance

1 INTRODUCTION

The biannual publication of a Regional investment plan is a legal obligation for European TSOs, which is enshrined in EU Directive 2009/73 Article 7 and further detailed by Regulation (EC) 715/2009 Article 12 and required in order to promote regional cooperation by providing an overview of the current and future interconnections, operations, infrastructure developments and demand trends.

This GRIP covers gas infrastructure projects and analysis from 9 countries[2]: Austria, Bulgaria, Croatia, Hungary, Greece, Italy, Romania, Slovakia, and Slovenia.

This edition builds on the ENTSOG TYNDP 2020, published in November 2020 and in its final version in July 2021 (including a Feedback section with ENTSOG's response to the ACER Opinion) and on the previous Southern Corridor (SC) GRIP editions, providing stakeholders with a comprehensive overview of the gas networks, the evolution of the infrastructure projects developments that are either planned or under construction, and the evolution of demand trends within the Region.

This report is organised as follows: Chapter 2 lists the infrastructure projects promoted by the TSOs and offer a brief description of the main Incremental capacity procedures in the Region. Chapter 3 provides an extensive analysis of the historical and future gas demand. Chapter 4 details the main projects outlining the role of the SC Region in the development of EU gas infrastructure. Finally, Chapter 5 describes the relevance of gas network for the decarbonisation process and to achieve EU climate goals, including a country-specific overview of the main initiatives developed by the TSOs on energy transition.

Note: This 5th edition of the SC GRIP has been approved by ten TSOs of the Region, namely Gas Connect Austria, Trans Austria Gasleitung, Bulgartransgaz, Plinacro, DESFA, FGSZ, Snam Rete Gas, Transgaz, Plinovodi and Trans Adriatic Pipeline.

Picture courtesy of Plinovodi

2 Work on this edition of the SC GRIP was coordinated by Snam and DESFA

2 LIST OF PROJECTS

The following chapter includes the list of all projects in the Southern Corridor Region, sponsored by either the Region's TSOs or by 3rd parties, as resulting from TYNDP 2020 and with a comparison to TYNDP 2018. Furthermore, as this edition is published after the TYNDP 2020 the TSOs had the chance to update the information related to the commissioning of their projects. Finally, in the last part of the chapter the main results for the incremental capacity procedures in the Region are presented.

2.1 COMPARATIVE LIST OF PROJECTS IN THE PREVIOUS AND CURRENT GRIP

The following chapter offers an overview of all projects in the Southern Corridor Region by country, presented in a table that includes the main data about each project. This information is based on the data from TYNDP 2020, which was reviewed by participating TSOs.

The list also includes a column, comparing the status and inclusion of each project in the previous and current SC GRIP. As shown in the following tables out of a total of 131 projects:

- 70 were already present in the previous GRIP,
- 11 were already present in the previous GRIP but have since then been successfully commissioned,
- 33 are new projects,
- 17 were present in the previous GRIP but have been withdrawn from this edition.

LIST OF PROJECTS (TABLES)

Austria

Country/ Promoter	TYNDP Code	Project Name	Project Type	PCI 4th list status and code	Inclusion in GRIP SC documents	
					2019	2021
Gas Connect Austria GmbH	TRA-N-361	GCA 2015/08: Entry/Exit Murfeld*	Pipeline including CS	Yes; 6.26.1.4	√	√
Gas Connect Austria GmbH	TRA-A-021	Bidirectional Austrian-Czech Interconnector (BACI)*	Pipeline including CS	No	√	√
Gas Connect Austria GmbH	TRA-N-423	GCA Mosonmagyaróvár*	Pipeline including CS	No	√	√
Gas Connect Austria GmbH	ETR-N-896	P2G4A*	Energy Transition Related Project	No	×	√
Trans Austria Gasleitung GmbH	TRA-F-954	TAG Reverse Flow*	Pipeline including CS	No	√	√
Gas Connect Austria GmbH	N/A	Czech-Austrian Interconnector (CZATi)**	Pipeline including CS	No	×	√
Gas Connect Austria GmbH	N/A	GCA 2015/04: Entry Mosonmagyaróvár – Minimum***	Pipeline including CS	No	×	√

* see Austrian Coordinated Network Development plan 2020

** see Austrian Coordinated Network Development plan 2020;a new project which reacts on a non-binding capacity demand received by companies GAS CONNECT AUSTRIA and NET4GAS in 2019 during the market demand assessment process for incremental capacity realized based on the Commission Regulation (EU) 2017/459. Not included in the TYNDP2020

*** see Austrian Coordinated Network Development plan 2020;A new project which reacts on a non-binding capacity demand received by companies GAS CONNECT AUSTRIA and FGSZ in 2019 during the market demand assessment process for incremental capacity realized based on the Commission Regulation (EU) 2017/459. Not included in the TYNDP2020.

Bulgaria

Country/ Promoter	TYNDP Code	Project Name	Project Type	PCI 4th list status and code	Inclusion in GRIP SC documents	
					2019	2021
Bulgartransgaz EAD	TRA-F-298	Modernization and rehabilitation of the Bulgarian GTS	Pipeline including CS	Yes; 6.8.2	√	√
Bulgartransgaz EAD	TRA-A-654	Eastring – Bulgaria	Pipeline including CS	No	√	√
Bulgartransgaz EAD	UGS-A-138	UGS Chiren Expansion	Storage Facility	Yes; 6.20.2	√	√
Bulgartransgaz EAD	TRA-F-592	Necessary expansion of the Bulgarian gas transmission system	Pipeline including CS	No	√	√
Bulgartransgaz EAD	TRA-N-137	Interconnection Bulgaria–Serbia	Pipeline including CS	Yes; 6.8.3	√	√
ICGB a.d.	TRA-F-378	Interconnector Greece–Bulgaria (IGB Project)	Pipeline including CS	Yes; 6.8.1	√	√
Bulgartransgaz EAD	TRA-N-593	Varna-Oryahovo gas pipeline*	Pipeline including CS	No	√	×
Bulgartransgaz EAD	TRA-N-594	Construction of a Looping CS Provadia – Rupcha village*	Pipeline including CS	No	√	×
Bulgartransgaz EAD	TRA-N-1197	Expansion of the gas infrastructure between BG-TR and BG-RS borders*	Pipeline including CS	No	√	×
Bulgartransgaz EAD	TRA-N-140	Interconnection Turkey...Bulgaria*	Pipeline including CS	No	√	×

* not included in TYNDP2020

Croatia

Country/ Promoter	TYNDP Code	Project Name	Project Type	PCI 4th list status and code	Inclusion in GRIP SC documents	
					2019	2021
Plinacro Ltd	TRA-F-334	Compressor station 1 at the Croatian gas transmission system	Pipeline including CS	Yes, 6.5.5	√	*
Plinacro Ltd	TRA-N-086	Interconnection Croatia/Slovenia (Lučko–Zabok–Jezerišće–Sotla)	Pipeline including CS	Yes; 6.26.1.1	√	√
Plinacro Ltd	TRA-F-90	LNG evacuation pipeline Omišalj–Zlobin (Croatia)	Pipeline including CS	Yes; 6.5.1	√	*
Plinacro Ltd	TRA-N-066	Interconnection Croatia–Bosnia and Herzegovina (Slobodnica-Bosanski Brod)	Pipeline including CS	No	√	√
Plinacro Ltd	TRA-N-075	LNG evacuation pipeline Zlobin–Bosiljevo–Sisak–Kozarac	Pipeline including CS	No	√	√
Plinacro Ltd	TRA-A-302	Interconnection Croatia–Bosnia and Herzegovina (South)	Pipeline including CS	No	√	√
Plinacro Ltd	TRA-A-068	Ionian Adriatic Pipeline	Pipeline including CS	No	√	√
Plinacro Ltd	TRA-N-1057	Compressor stations 2 and 3 at the Croatian gas tranmission system	Pipeline including CS	Yes; 6.26.1.3	√	√
Plinacro Ltd	TRA-A-070	Interconnection Croatia/Serbia (Slobodnica–Sotin–Bačko Novo Selo)	Pipeline including CS	No	√	√
Plinacro Ltd	TRA-N-1058	LNG Evacuation Pipeline Kozarac-Slobodnica	Pipeline including CS	No	√	√
Plinacro Ltd	TRA-N-303	Interconnection Croatia–Bosnia and Herzegovina (west)	Pipeline including CS	No	√	√
Plinacro Ltd	TRA-N-336	Interconnection Croatia/Slovenia (Umag-Koper)	Pipeline including CS	No	√	√
Plinacro Ltd	ETR-N-898	CNG filling station system development (CroBlueCorr project)	Energy Transition Related Project	No	×	√
LNG Hrvatska d.o.o.	LNG-F-082	LNG terminal Krk 1st phase	LNG Terminal	Yes; 6.5.1	√	*
LNG Hrvatska d.o.o.	LNG-N-815	LNG terminal Krk 2nd phase	LNG Terminal	No	×	√
Podzemno skladiste plina Ltd	UGS-N-347	Gas storage facility Grubisno Polje	Storage Facility	No	×	√

* commissioned

Greece

Country/ Promoter	TYNDP Code	Project Name	Project Type	PCI 4th list status and code	Inclusion in GRIP SC documents	
					2019	2021
DESFA S.A.	TRA-F-941	Metering and Regulating station at Nea Messimvria	Pipeline including CS	Yes; 7.1.3	√	*
DESFA S.A.	TRA-N-128	Compressor Station Kipi	Pipeline including CS	Yes; 6.8.1	√	√
DESFA.S.A.	TRA-A-967	Nea-Messimvria to Evzoni/Gevgelija pipeline (IGNM)	Pipeline including CS	No	√	√
DESFA S.A	TRA-N-1090	Metering and Regulating Station at Alexandroupoli	Pipeline including CS	Yes; 6.9.1	√	√
DESFA S.A.	TRA-N-971	Compressor station at Nea Messimvria	Pipeline including CS	Yes; 7.1.3	√	√
DESFA.S.A.	TRA-N-1091	Metering and Regulating station at Megalopoli	Pipeline including CS	Yes; 7.1.3	√	√
DESFA S.A.	TRA-N-014	Komotini-Thesprotia pipeline	Pipeline including CS	No	√	× **
DESFA S.A.	TRA-N-1092	Metering and Regulating Station at UGS South Kavala	Pipeline including CS	Yes; 6.20.3	√	√
DESFA.S.A.	TRA-N-1129	Compressor Station Kipi Increment	Pipeline including CS	No	√	× ***
DESFA S.A.	TRA-F-1276	Compressor station at Nea Messimvria (3rd unit)	Pipeline including CS	No	√	√
DESFA S.A.	TRA-N-1278	Compressor station at Ambelia	Pipeline including CS	No	√	√
Trans Adriatic Pipeline AG	TRA-F-051	Trans Adriatic Pipeline	Pipeline including CS	Yes; 7.1.3	√	* ****
Gastrade S.A.	LNG-N-062	LNG terminal in northern Greece / Alexandroupolis – LNG Section	LNG Terminal	Yes; 6.9.1	√	√
Gastrade S.A.	TRA-N-063	LNG terminal in northern Greece / Alexandroupolis – Pipeline Section	Pipeline including CS	Yes; 6.9.1	√	√
Natural Gas Submarine Interconnector Greece-Italy Poseidon S.A	TRA-A-010	Poseidon Pipeline	Pipeline including CS	Yes; 7.3.3	√	√
Natural Gas Submarine Interconnector Greece-Italy Poseidon S.A	TRA-A-330	EastMed Pipeline	Pipeline including CS	Yes; 7.3.1	√	√
Hellenic Republic Asset Development Fund	UGS-N-385	South Kavala Underground Gas Storage facility	Storage Facility	Yes; 6.20.3	√	√
Trans Adriatic Pipeline AG	TRA-N-810	TAP Expansion	Pipeline including CS	No	×	√

* commissioned

** The project was not included in DESFAs latest NDP 2021–2030, due to lack of market interest and sufficient progress over the past years

*** The project is compementary to TRA-N-014, was not included for the same reasons

**** Commissioned and operational from 15 November 2020

Hungary

Country/ Promoter	TYNDP Code	Project Name	Project Type	PCI 4th list status and code	Inclusion in GRIP SC documents	
					2019	2021
FGSZ Ltd.	TRA-F-286	Romanian-Hungarian reverse flow Hungarian section 1st stage	Pipeline including CS	No	√	*
FGSZ Ltd.	TRA-N-325	Slovenian-Hungarian interconnector	Pipeline including CS	Yes; 6.23	√	√
FGSZ Ltd.	TRA-A-656	Eastring–Hungary	Pipeline including CS	No	√	√
FGSZ Ltd.	TRA-A-123	Városföld CS**	Pipeline including CS	Yes; 6.24.4.3	√	×
FGSZ Ltd.	TRA-A-377	Romanian-Hungarian reverse flow Hungarian section 2nd stage	Pipeline including CS	Yes; 6.24.4.6	√	√
FGSZ Ltd.	TRA-N-524	Enhancement of Transmission Capacity of Slovak–Hungarian interconnector	Pipeline including CS	Yes; 6.2.13	√	√
Magyar Gáz Tranzit Zrt.	TRA-N-831	Vecsés–Városföld gas transit pipeline***	Pipeline including CS	No	√	×
Magyar Gáz Tranzit Zrt.	TRA-N-636	Development of Transmission Capacity at Slovak–Hungarian interconnector***	Pipeline including CS	No	√	×

* commissioned

** Deleted, substituted by modification of Városföld node

*** Not included in TYNDP2020

Italy

Country/ Promoter	TYNDP Code	Project Name	Project Type	PCI 4th list status and code	Inclusion in GRIP SC documents	
					2019	2021
Snam Rete Gas S.p.A.	TRA-N-007	Development for new import from the South (Adriatica Line)	Pipeline including CS	Yes; 7.3.4	√	√
Snam Rete Gas S.p.A.	TRA-N-354	Interconnection with Slovenia	Pipeline including CS	No	√	√
Snam Rete Gas S.p.A.	TRA-N-008	Import developments from North-East	Pipeline including CS	No	√	√
Snam Rete Gas S.p.A.	TRA-N-009	Additional Southern developments	Pipeline including CS	No	√	√
Snam Rete Gas S.p.A.	TRA-N-1063	Export to Malta	Pipeline including CS	Yes; 5.19	×	√
Snam4 environment	ETR-F-523	Biomethane plants development	Energy Transition Related Project	No	×	√
Snam Rete Gas S.p.A.	ETR-N-617	Project to facilitate biomethane production plants inteconnection	Energy Transition Related Project	No	×	√
Snam4mobility	ETR-F-516	CNG and L-CNG stations	Energy Transition Related Project	No	×	√
Snam Rete Gas S.p.A.	ETR-F-599	Sector coupling: hybrid compressor station	Energy Transition Related Project	No	×	√
Snam4mobility	ETR-N-528	Microliquefaction plants	Energy Transition Related Project	No	×	√
Snam	ETR-N-591	Power to gas plant in the south of Italy	Energy Transition Related Project	No	×	√
Snam	ETR-N-595	Transport of hydrogen into natural gas network for industrial customers	Energy Transition Related Project	No	×	√

Country/ Promoter	TYNDP Code	Project Name	Project Type	PCI 4th list status and code	Inclusion in GRIP SC documents	
					2019	2021
Snam	ETR-N-958	Green Crane – Italy	Energy Transition Related Project	No	×	√
ENURA S.p.A.	TRA-N-1194	Sardinia Methanisation	Pipeline including CS	No	√	√
Snam S.p.A.	LNG-N-304	Italy–Sardinia Virtual Pipeline	LNG Terminal	No	×	√
Snam Rete Gas S.p.A.	TRA-F-1193	TAP interconnection	Pipeline including CS	Yes; 7.1.3	√	*
Snam Rete Gas S.p.A.	TRA-N-1195	Matagiola–Massafra pipeline	Pipeline including CS	Yes; 7.3.4	√	√
Snam Rete Gas S.p.A.	TRA-N-1227	Gorizia plant upgrade	Pipeline including CS	Yes; 6.23	√	√
Snam Rete Gas S.p.A.	TRA-N-1265	Biomethane productions interconnection	Pipeline including CS	No	√	√
Snam Rete Gas S.p.A.	TRA-F-1241	Interconnection with production in Gela	Pipeline including CS	No	√	√
Snam Rete Gas S.p.A.	TRA-F-1228	Interconnection with UGS Cornegliano in Laudense**	Pipeline including CS	No	√	*
STOGIT S.p.A.	UGS-F-1045	Bordolano Second phase**	Storage Facility	No	√	*
STOGIT	UGS-F-260	System Enhancements – Stogit – on-shore gas fields	Storage Facility	No	√	√
Galsi S.p.A.	TRA-A-012	GALSI Pipeline Project	Pipeline including CS	No	√	√
SGI S.p.A.	TRA-F-409	Larino–Chieti	Pipeline including CS	No	×	√
SGI S.p.A.	TRA-F-424	San Marco–Recanati	Pipeline including CS	No	×	√
S.G.I. SpA	ETR-N-305	PEGASUS	Energy Transition Related Project	No	×	√
S.G.I. SpA	TRA-N-439	Stazione di Spinta "San Marco"	Pipeline including CS	No	×	√
Edison Stoccaggio S.p.A	UGS-N-235	Nuovi Sviluppi Edison Stoccaggio**	Storage Facility	No	√	×
Edison Stoccaggio S.p.A	UGS-N-237	Palazzo Moroni**	Storage Facility	No	√	×
Nuove Energie S.r.l.	LNG-N-198	Porto Empedocle LNG**	LNG Terminal	No	√	×
Società Gasdotti Italia	TRA-N-974	Larino–Recanati Adriatic coast backbone**	Pipeline including CS	No	√	×
Società Gasdotti Italia	TRA-N-975	Sardinia Gas Transportation Network**	Pipeline including CS	No	√	×

* commissioned

** Not included in TYNDP2020

Romania

Country/ Promoter	TYNDP Code	Project Name	Project Type	PCI 4th list status and code	Inclusion in GRIP SC documents	
					2019	2021
SNTGN Transgaz SA	TRA-F-357	NTS developments in North-East Romania	Pipeline including CS	No	√	√
SNTGN Transgaz SA	TRA-F-139	Interconnection of the NTS with the DTS and reverse flow at Isaccea	Pipeline including CS	No	√	*
SNTGN Transgaz SA	TRA-F-964	New NTS developments for taking over gas from the Black Sea shore	Pipeline including CS	No	√	√
SNTGN Transgaz S.A.	TRA-F-358	Development on the Romanian territory of the NTS (BG–RO-HU-AT Corridor) phase I	Pipeline including CS	Yes; 6.24.1.2	√	*
SNTGN Transgaz S.A.	TRA-A-1322	Development on the Romanian territory of the NTS (BG–RO-HU-AT Corridor) phase II	Pipeline including CS	Yes; 6.24.4.4	√	√
SNTGN Transgaz S.A.	TRA-A-362	Development on the Romanian territory of the Southern Transmission Corridor	Pipeline including CS	Yes; 6.24.4.5	√	√
SNTGN Transgaz S.A.	TRA-A-655	Eastring – Romania	Pipeline including CS	No	√	√
SNTGN Transgaz S.A.	TRA-N-959	Further enlargement of the BG—RO—HU—AT transmission corridor (BRUA) phase 3	Pipeline including CS	No	√	√
SNTGN Transgaz S.A.	TRA-A-1268	Romania-Serbia Interconnection	Pipeline including CS	No	√	√
SNTGN Transgaz S.A.	TRA-F-1277	Upgrading GMS Isaccea 1 and GMS Negru Voda 1	Pipeline including CS	No	√	√
SNTGN Transgaz S.A.	TRA-N-596	Interconnection between the RO and the UA gas transmission systems	Pipeline including CS	No	×	√
SNTGN Transgaz S.A.	TRA-N-598	NTS developments in North-West Romania	Pipeline including CS	No	×	√
SNGN Romgaz S.A. – Filiala de Inmagazinare Gaze Naturale Depogaz Ploiesti SRL	UGS-F-311	Bilciuresti daily withdrawal capacity increase	Storage Facility	No	×	√
SNGN Romgaz S.A. – Filiala de Inmagazinare Gaze Naturale Depogaz Ploiesti SRL	UGS-N-398	Ghercesti underground gas storage in Romania	Storage Facility	No	×	√
SNGN Romgaz S.A. – Filiala de Inmagazinare Gaze Naturale Depogaz Ploiesti SRL	UGS-N-399	Falticeni UGS	Storage Facility	No	×	√
SNGN Romgaz S.A. – Filiala de Inmagazinare Gaze Naturale Depogaz Ploiesti SRL	UGS-N-371	Sarmasel undeground gas storage in Romania	Storage Facility	Yes; 6.20.6	√	√
Engie Romania S.A.	UGS-A-233	Depomures	Storage Facility	Yes; 6.20.4	√	√
AGRI LNG Project Company SRL (RO)	LNG-N-376	Azerbaijan, Georgia, Romania Interconnector – AGRI	Pipeline including CS	No	√	×
Societatea Națională de Gaze Naturale Romgaz S.A.	UGS-N-366	New undergound gas storage in Romania	Storage Facility	No	√	×

* commissioned

Slovakia

Country/ Promoter	TYNDP Code	Project Name	Project Type	PCI 4th list status and code	Inclusion in GRIP SC documents	
					2019	2021
eustream, a.s.	TRA-N-017	System Enhancements – Eustream	Pipeline including CS	No	√	×
eustream,a.s.	TRA-F-190	Poland – Slovakia interconnection	Pipeline including CS	Yes; 6.2.1	√	√
eustream,a.s.	TRA-F-902	Capacity increase at IP Lanžhot entry	Pipeline including CS	No	√	√
eustream,a.s.	TRA-A-628	Eastring – Slovakia	Pipeline including CS	No	√	√
eustream, a.s.	TRA-N-1235	Firm transmission capacity increase at the IP Veľké Zlievce	Pipeline including CS	Yes; 6.2.13	√	√
eustream, a.s.	ETR-N-913	Modification of NP23 MW turboset to a hydrogen-ready low-emissions at CS04	Energy Transition Related Project	No	×	√
eustream, a.s.	ETR-N-916	Measures for achieving hydrogen blending readiness of the transmission syst	Energy Transition Related Project	No	×	√
eustream, a.s.	ETR-N-920	Measures for the reduction of methane emissions	Energy Transition Related Project	No	×	√
NAFTA a.s.	UGS-A-356	Underground Gas Storage Velke Kapusany	Storage Facility	No	√	√
NAFTA a.s.	ETR-A-312	P2G Velke Kapusany	Energy Transition Related Project	No	×	√
NAFTA a.s.	ETR-N-315	G2F – Gas to Future	Energy Transition Related Project	No	×	√

Slovenia

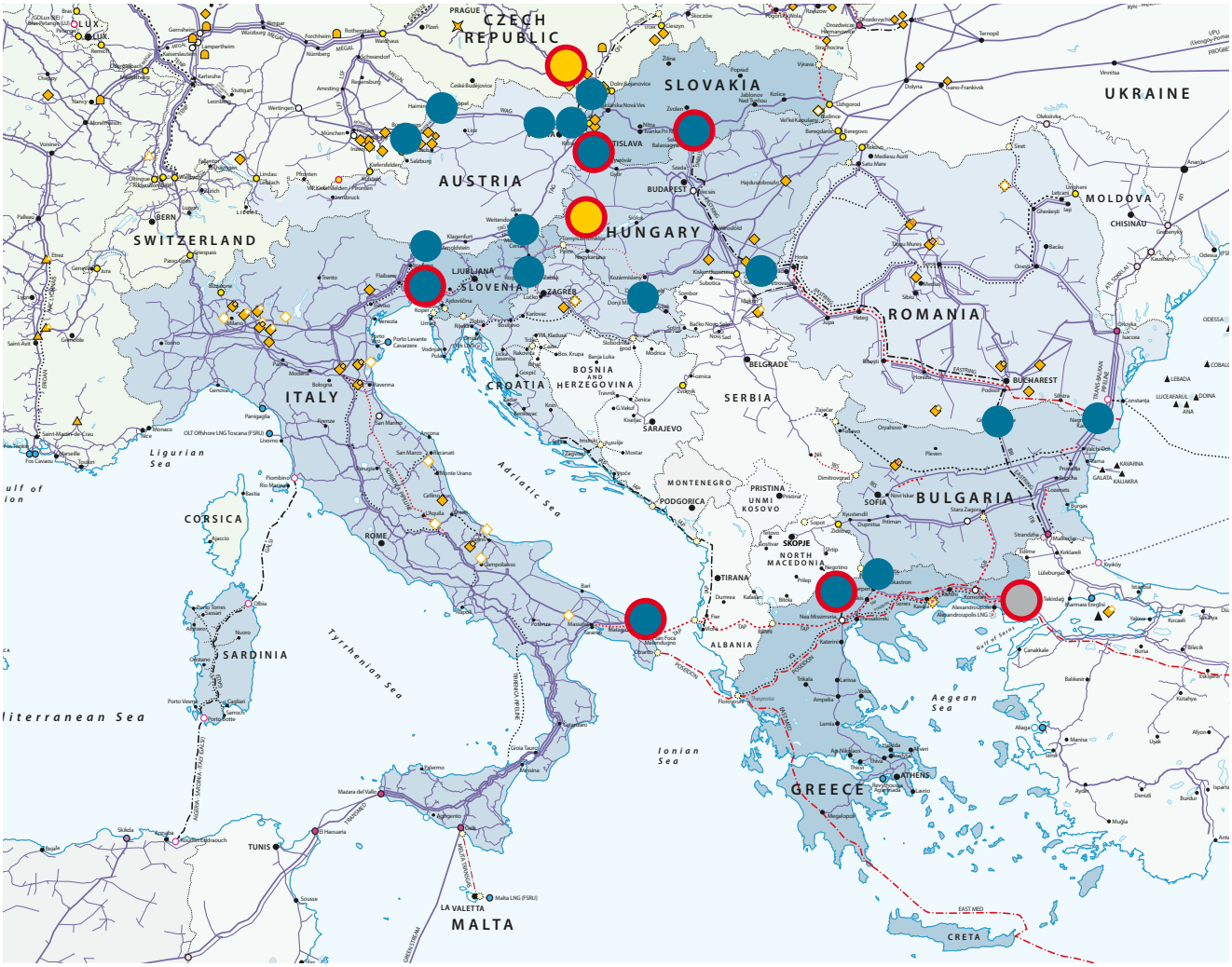
Country/ Promoter	TYNDP Code	Project Name	Project Type	PCI 4th list status and code	Inclusion in GRIP SC documents	
					2019	2021
Plinovodi d.o.o.	TRA-N-390	Upgrade of Rogatec interconnection (M1A/1 Interconnection Rogatec)	Pipeline including CS	Yes; 6.26.1.6	√	√
Plinovodi d.o.o.	TRA-N-094	CS Kidričevo, 2nd phase of upgrade	Pipeline including CS	Yes; 6.26.1.2	√	√
Plinovodi d.o.o.	TRA-N-108	M3 pipeline reconstruction from CS Ajdovščina to Šempeter/Gorizia	Pipeline including CS	Yes; 6.23	√	√
Plinovodi d.o.o.	TRA-N-112	R15/1 Pince–Lendava–Kidričevo	Pipeline including CS	Yes; 6.23	√	√
Plinovodi d.o.o.	TRA-N-389	Upgrade of Murfeld/Ceršak interconnection (M1/3 Interconnection Ceršak)	Pipeline including CS	Yes; 6.26.1.5	√	√
Plinovodi d.o.o.	TRA-N-092	CS Ajdovščina, 1st phase of upgrade	Pipeline including CS	Yes; 6.23	√	√
Plinovodi d.o.o.	TRA-N-299	M3/1 Šempeter–Vodice	Pipeline including CS	No	×	√
Plinovodi d.o.o.	N/A	Transmission system upgrade project for achieving readiness for hydrogen blending and renewable gases*	Energy Transition Related Project	No	×	√

* Not included in TYNDP2020

2.2. INCREMENTAL CAPACITY PROCEDURE RESULTS

According to the CAM NC, TSOs are obliged to launch a non-binding capacity demand survey every odd year. The second market demand survey took place in 2019 and currently a new market test survey is running. Based on the 2019 procedure, southern Corridor GRIP TSOs submitted their data for this chapter. CAM NC regulates, at which IPs market survey is compulsory. IPs between EU member states are included in this scope (18 existing and 2 future prospective) while IPs on the border of EU are excluded (1 case). The non-binding capacity demand survey results are published on the TSOs' and ENTSOG's website in Demand Assessment Reports (DAR) according to ENTSOG's suggested structure.

DARs were published at every obligatory case. In 8 cases the incremental capacity procedure, as defined in the CAM NC, has been launched: 4 cases completed the process and the incremental capacity auctions were held (in 3 cases alternative capacity allocation mechanism was adopted). However these 4 cases ended with no binding bids received, while in the remaining 4 cases the incremental capacity allocation procedures are pending.



Detailed information related to incremental process can be found in the following table.

No.	Number of IP on ENTSOG Capacity map	Border	IP	Name of IP	Name of IP	TSO1/TSO2	Non binding demand survey	DAR published	DAR Link	Capacity demand
1	51	GR/BG	Existing	Kulata (BG)	Sidirokastro (GR)	DESFA/ Bulgartransgas	Yes	Yes	Link	14,45 GWh/d from 2019/2020 to 2023/2024
2	53	RO/BG	Existing	Negru Voda 1 (RO)	Kardam (BG)	Transgaz/ Bulgartransgas	Yes	Yes	Link	14,45 GWh/d from 2020/2021 to 2030/2031;
2	53	RO/BG	Existing	Negru Voda 1 (RO)	Kardam (BG)	Transgaz/ Bulgartransgas	Yes	Yes	Link	53,47 GWh/d from 2019/2020 to 2023/2024;
3	83	RO/BG	Existing	Ruse (BG)	Giurgiu (RO)	Transgaz/ Bulgartransgas	Yes	Yes	Link	No
4	57	HU/RO	Existing	Csanádpalota (HU)	Nadlac (RO)	FGSZ/Transgaz	Yes	Yes	Link	FGSZ: HU > RO 26,0 GWh/h; RO > HU 140,5 – 14,5 GWh/d Transgaz: HU > RO 50 – 26,0 GWh/h; RO > HU 140,5 – 14,5 GWh/d
5	47	AT/HU	Existing	Mosonmagyaróvár (HU)		GCA/FGSZ	Yes	Yes	Link	FGSZ/GCA: HU > AT 30,6 GWh/d; AT > HU 102,5 GWh/d
6	58	HU/HR	Existing	Dravaszerdahely (HU)	Donji Miholac (HR)	FGSZ/Plinacro	Yes	Yes	Link	FGSZ: HU > HR 0 GWh/h; HR > HU 14,6 GWh/d Plinacro: HU > HR 12,7 – 30,6 GWh/h; HR > HU 14,6 GWh/d
7	75	SK/HU	Existing	Vel'ké Zlievce (SK)	Balassagyarmat (HU)	Eustream/FGSZ	Yes	Yes	Link	FGSZ/Eustream: HU > SK 111,5 GWh/d; SK > HU 0 GWh/d
8	N/A	SI/HU	Non existing	Pince (SI)	Tornyiszentmiklós (HU)	Plinovodi/FGSZ	Yes	Yes	Link	FGSZ/Plinovodi: HU > SI 58,6 – 93,5 – 6,0 GWh/h; SI > HU GWh/d
9	25	AT/SI	Existing	Murfeld (AT)	Cersak (SI)	GCA/Plinovodi	Yes	Yes	Link	No
10	29	SI/IT	Existing	Sempeter (SI)	Gorizia (IT)	Plinovodi/ Snam Rete Gas	Yes	Yes	Link	SI > IT 58,6 GWh/d
11	30	SI/HR	Existing	Rogatec (SI)	Rogatec (HR)	Plinovodi (SI)/ Plinacro (HR)	Yes	Yes	Link	No
12	45	SK/CZ	Existing	Lanžhot (CZ)	Lanžhot	Eustream/Net4Gas	Yes	Yes	Link	No
13	46	SK/AT	Existing	Baumgarten (AT)		Eustream/GCA	Yes	Yes	Link	No
14	46	SK/AT	Existing	Baumgarten (AT)		Eustream/TAG	Yes	Yes	Link	No
15	21	AT/DE	Existing	Oberkappel (AT)		GCA/GRTgaz Deutschland	Yes	Yes	Link	No
15	21	AT/DE	Existing	Oberkappel (AT)		GCA/Open Grid Europe	Yes	Yes	Link	No
16	23	AT/DE	Existing	Überackern SUDAL (AT)	Überackern 2 (DE)	GCA/bayernets	Yes	Yes	Link	No
16	23	AT/DE	Existing	Überackern ABG (AT)	Überackern (DE)	GCA/Open Grid Europe	Yes	Yes	Link	No
17	26	AT/IT	Existing	Arnoldstein (AT)	Tarvisio (IT)	TAG/Snam Rete Gas	Yes	Yes	Link	No
18	N/A	AT/CZ	Non existing			Net4Gas/GCA	Yes	Yes	Link	30.65 GWh/d for gas years 2020/21 to 2034/2035
19	90	TAP/IT	Existing	Melendugno (IT)		TAP/Snam Rete Gas	Yes	Yes	Link	248,7 GWh/d
20	92	TAP/GR	Existing	Nea Messimvria (GR)		DESFA/TAP	Yes	Yes	Link	DESFA > TAP: 2022/23 – 2031/32: 6,8 GWh/d
20	92	TAP/GR	Existing	Nea Messimvria (GR)		TAP/DESFA	Yes	Yes	Link	TAP > DESFA: 2020/21: 88,8 GWh/d; 2021/22: 119,8 GWh/d; 2022/23: 140,4 GWh/d; 2023/24 – 2029/30: 169,4 GWh/d; 2030/31 – 2031/32: 83,3 GWh/d; 2032/33: 71 GWh/d; 2033/34 – 2040/41: 42 GWh/d; 2041/42: 11 GWh/d
21	233	non-EU (Turkey) – TAP	Existing	Kipoi (TAP-GR)		TAP	Yes	Yes	Link	2020/21: 1,3 GWh/d; 2021/22: 32,3 GWh/d; 2023/24 – 2024/25: 41,2 GWh/d; 2025/26 – 2029/30: 355 GWh/d; 2030/31 – 2031/32: 331 GWh/d; 2032/33: 326 GWh/d; 2033/34 – 2039/40: 268 GWh/d; 2040/41: 85,7 GWh/d; 2041/42: 54,7 GWh/d; 2042/43 – 2049/50: 49,2 GWh/d

Table 2.1: Detailed information related to incremental process

	Direction	Requested demand TSO1 side/ TSO2 side	Conditions	Incremental procedure started	Public consultation	Incremental auction on (if possible, please specifiy year)	Alternative capacity allocation mechanism	Project proposal to NRA's for aprroval	Comment
	GR > BG	No	No	No	No	No	–	No	The assessment of the non-binding demand indications and the historical usage patterns indicated that no demand levels for incremental capacity need to be developed, therefore no incremental capacity project was initiated and no technical studies for incremental capacity projects were conducted.
	RO > BG	Yes	No	No	No	No	–	No	The conclusion of the analized non-binding demands, in relation to the available technical capacity at the interconnection points between the border of the adjacent entry-exit systems of Romania and Bulgaria was: an incremental capacity project will not be initiated.
	BG > RO	Yes	No	No	No	No	–	No	There was a demand indication of 158,55 GWh/d which was received by only one TSO later than 8 weeks after the yearly capacity auction. It was considered in the DAR, however, both TSOs concluded that for the moment an incremental capacity project will not be initiated.
	RO > BG; BG > RO	No	No	No	No	No	–	No	The conclusion of the analized non-binding demands, in relation to the available technical capacity at the interconnection points between the border of the adjacent entry-exit systems of Romania and Bulgaria was: an incremental capacity project will not be initiated.
	RO > HU; HU > RO	Yes, but partially different levels.		No	No	No	–	No	It was an ongoing Open Season, which was closed in 2020, without requested capacity.
	HU > AT; AT > HU	Yes		Yes, in HU > AT direction	Yes	Pending 2022	–	No	
	HU > HR; HR > HU	Yes		No	No	No	–	No	The demand were less than the existing available capacities.
	HU > SK	SK Yes/HU Yes		Yes	Yes	Yes, 2020	–	No	Incremental capacity process at Balassagyarmat/Vel'ké Zlievce IP has ended with no binding bids received.
	HU > SI	SI Yes/HU Yes		Yes	Yes	Pending 2022	–	Yes	
		No	No	No	No	No	–	No	
	SI > IT	Yes	Incremental capacities are connected to the HUSI project.	Yes	Yes	Pending 2022	–	No	
	–	No	Depends on Krk LNG	No	Yes	No	–	No	
	–	No/No	No	No	No	No	No	No	Shippers did not submit any request for such capacity.
	–			No	No	No	not relevant	No	
	–			No	No	No		No	
	–			No	No	No	not relevant	No	
	–			No	No	No	not relevant	No	
	–			No	No	No	not relevant	No	
	–			No	No	No	not relevant	No	
	–						–		
	CZ > AT	CZ Yes/AT Yes		Yes	Yes	Pending 2022		Yes	
	TAP > IT	Yes	Please refer to the project proposal of TAP, Snam and DESFA for the 2019 Market Test approved by Italian, Greek and Albanian NRAs (Link)	Yes	Yes	No	yes	Yes	Incremental capacity process at Melendugno IP has ended with no binding bids received.
	DESFA > TAP	YES	Please refer to the project proposal of TAP, Snam and DESFA for the 2019 Market Test approved by Italian, Greek and Albanian NRAs (Link)	Yes	Yes	No	yes	Yes	Incremental capacity process at Nea Messimvria IP has ended with no binding bids received.
	TAP > DESFA	YES	Please refer to the project proposal of TAP, Snam and DESFA for the 2019 Market Test approved by Italian, Greek and Albanian NRAs (Link)	Yes	Yes	No	yes	Yes	Incremental capacity process at Nea Messimvria IP has ended with no binding bids received.
	non-EU (TANAP) – TAP	Requested on TAP's side	Please refer to the project proposal of TAP, Snam and DESFA for the 2019 Market Test approved by Italian, Greek and Albanian NRAs (Link)	Yes	Yes	No	yes	Yes	Incremental capacity process at Kipoi IP has ended with no binding bids received.

3 HISTORICAL AND FUTURE GAS DEMAND AND FUTURE EVOLUTIONS OF GAS INFRASTRUCTURE

The following chapter shows the historical and future gas demand evolution in the Southern Corridor Region.

The historical values have been provided by ENTSOG, unless otherwise stated, which have been collected directly from TSOs[3] for the process of Winter Outlook/Review and Summer Outlook/Review. The future evolutions of the energy system have been derived from the TYNDP 2020 Scenario Report jointly elaborated by ENTSOG and ENTSO-E which described modelled trajectories for the European energy system up to 2050[4].

Figure 3.1 shows the gas demand in EU-28 countries[5] in 2020. Among the SC countries Italy remains the largest gas market as it represents around 15 % of European gas consumption and around the 60 % of the Region.

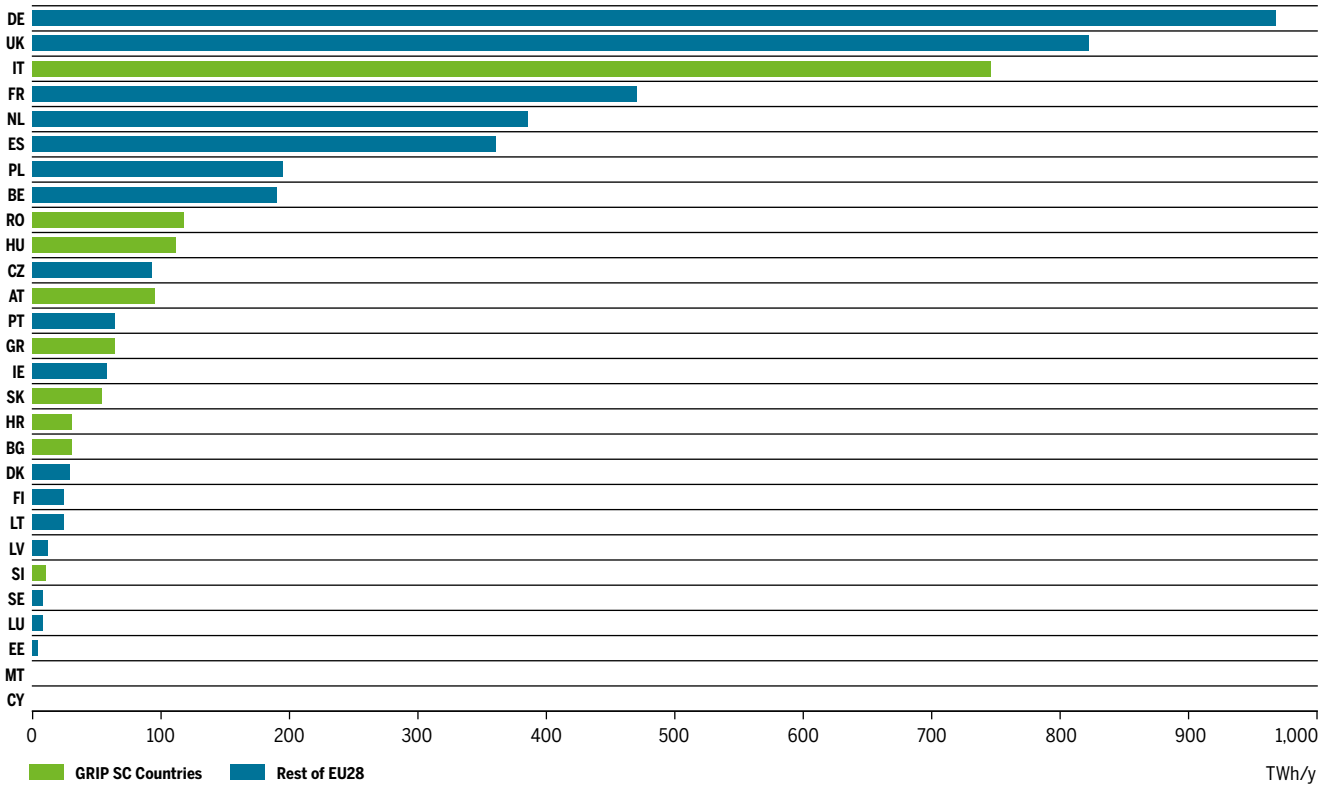


Figure 3.1: Annual gas consumption in the EU28 countries in 2020

3 For some countries, these data have been amended by TSOs in order to offer a most updated version or to provide the sectorial breakdown of the gas demand.

4 In the Scenario Report ENTSOG and ENTSO-E have identified three contrasting storylines to describe the future evolutions of energy system: National Trend, which take into account TSOs' best knowledge of the gas and electricity sectors in compliance with the NECPs, and Global Ambition and Distributed Energy which are built as full energy scenarios (all sectors, all fuels) showing a centralised or decentralised evolution of the energy system able to achieve the 1.5° target of the Paris Agreement and the carbon neutrality by 2050. Note that, if not specified otherwise, future gas demand evolutions refer to the Global Ambition Scenario.

5 As this report is based on the information and data included in TYNDP 2020, UK was still considered part of EU.

Observing most recent evolutions Figure 3.2 shows the variation observed for the SC countries gas demand in the last five years. The chart shows an upward trend with an overall increase of 116 TWh, with remarkable growth observed for Hungary, Greece and Italy.

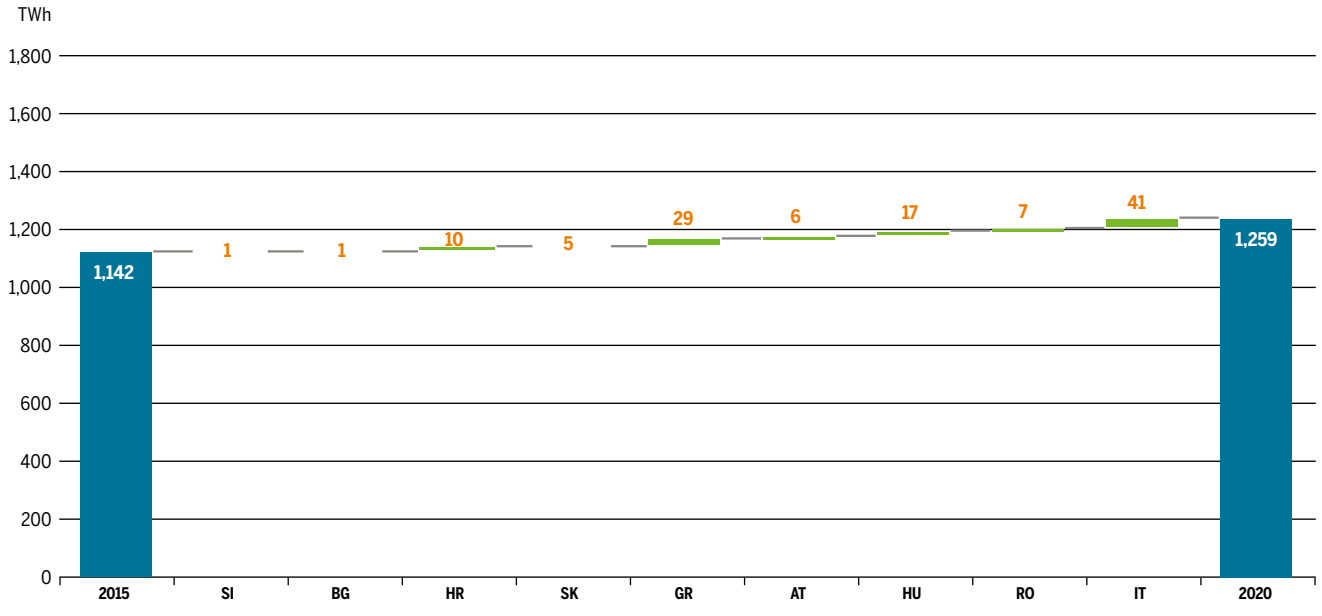


Figure 3.2: Gas demand evolution in SC countries from 2015 to 2020

3.1 ANNUAL DEMAND

Figure 3.3 offers an initial view of the historical and future gas demand of the Southern Corridor Region up to 2040, comparing the different modelled evolutions of the energy system depicted in the ENTSOs scenarios.

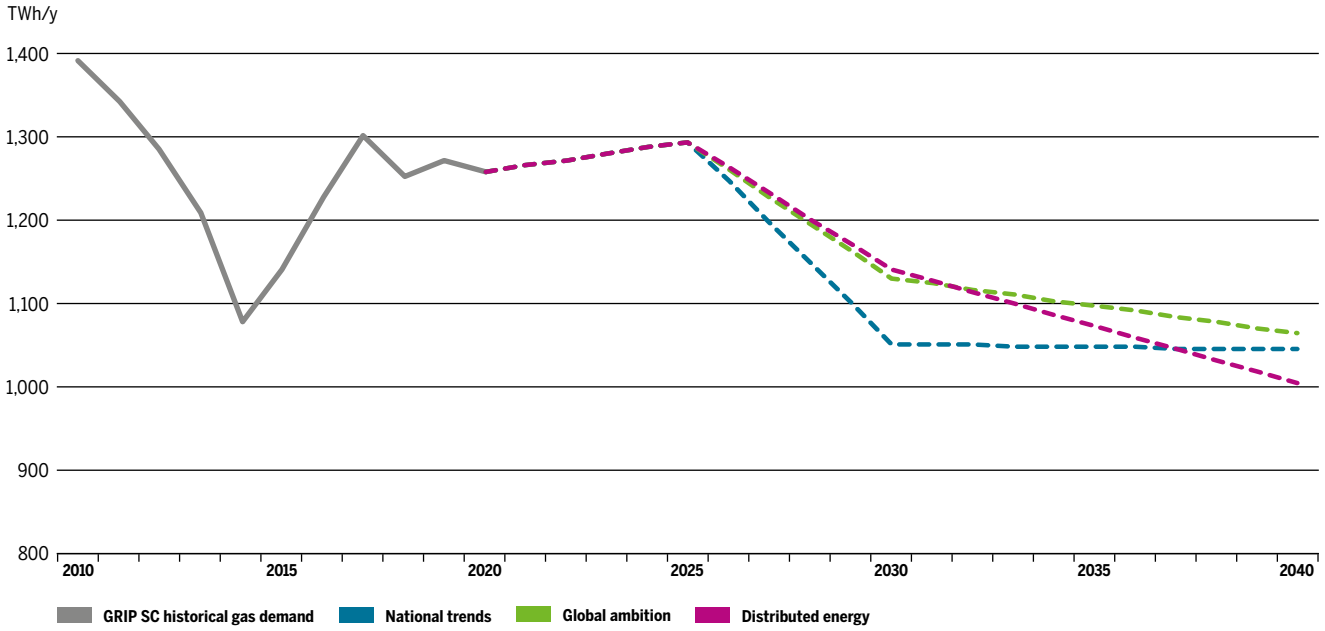


Figure 3.3: Historical and future gas demand in SC countries

The graph reveals an upcoming increase in gas consumption up to 2025 driven mainly by the increasing demand for power generation as gas will progressively substitute more pollutant fuels such as coal, lignite and oil achieving a significant, immediate and sustainable effect on the reduction of emissions. Such consumption level is currently forecasted to maintain approximately up to 2030. Afterwards a downward trend is expected due to a decrease of conventional gas consumption mainly in residential and tertiary sectors, determined by the achievement of energy efficiency and decarbonisation targets. This decrease is broadly counterbalanced by the development of sustainable gases (hydrogen, bio and synthetic methane) as unavoidable energy carriers for the adequacy and storability of the European energy system, highlighting the crucial role that gas infrastructure will continue to have in the next decades to provide to provide the required flexibility to integrate the electricity system.

Figure 3.4 enhance the analysis by showing the historical and future gas demand of the Southern Corridor Region compared to the rest of the European Union (EU)[6] between 2010 and 2040. The chart shows that historically the nine countries of the Southern Corridor Region made up more than 25 % of the total EU demand. Furthermore, Table 4.1 reveals that at 2025 this percentage is expected to increase to more than 26 % confirming the increase in gas consumption and reflecting the potential that will be exploited by some countries of the Region, where natural gas was only recently introduced in the energy mix and therefore the penetration will take place in the next years. Afterward this effect will be offset by the decrease expected in gas consumption in more mature markets.

6 As this report is based on the information and data included in TYNDP 2020, UK was still considered part of EU.

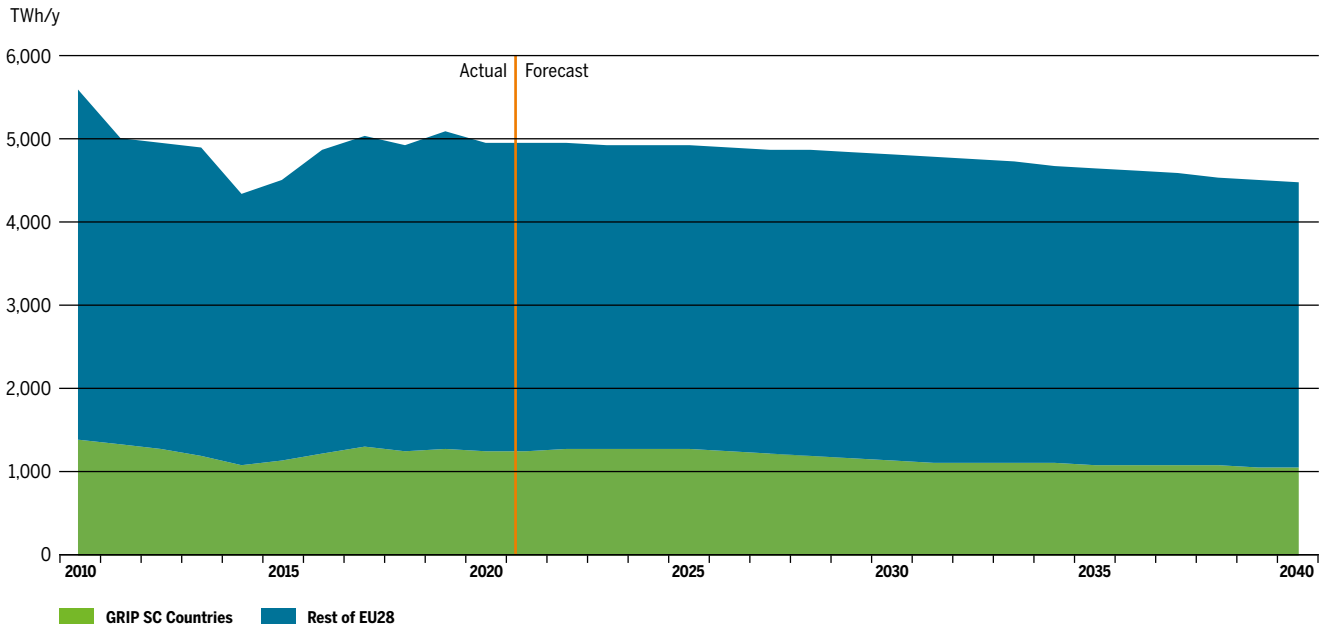


Figure 3.4: EU28 and Southern Corridor gas demand

2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2025	2030	2040
25 %	27 %	26 %	25 %	25 %	25 %	25 %	26 %	25 %	25 %	25 %	26 %	23 %	24 %

Table 3.1: Annual demand share of Southern Corridor Region

Picture courtesy of Plinacro

3.2 ANNUAL DEMAND BREAKDOWN & FORECAST

Figure 3.5 display the historical demand of the Southern Corridor Region for the last 10 years, offering a sectorial breakdown between Final demand (Residential, Commercial, Industry and Transport) and Power Generation demand.

Until 2014 a decreasing trend was observed in both Final and Power Generation demand, as consequence of the economic downturn and unfavourable conditions in energy markets that has made more advantageous to make use of coal fired instead of gas fired power plants. Furthermore, the progressive penetration of Renewable Energy Sources (RES) in electricity markets may have contributed to reduce the overall demand of gas for power generation, albeit CCGTs[7] have played a key role for the stability of electrical systems.

Starting from 2015 the downward trend was reversed, driven by the economic rebound and an increase in gas demand for power generation which have contributed to a recovery of the gas consumption, which has showed a stable path afterwards.

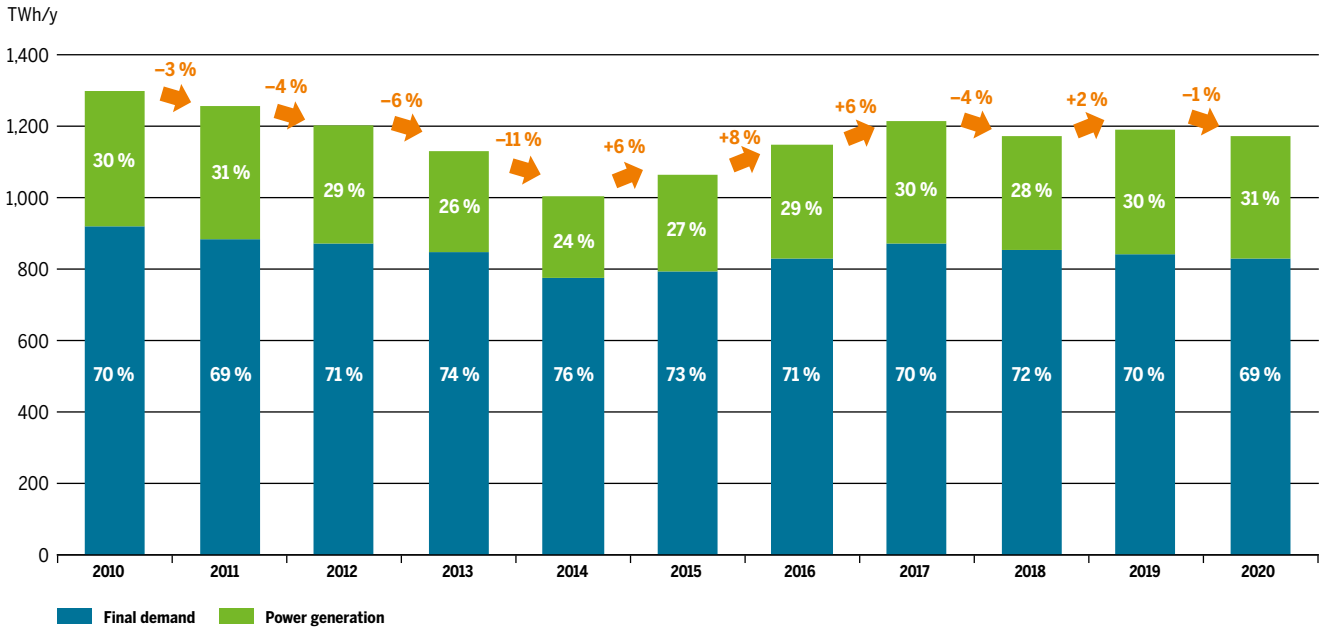
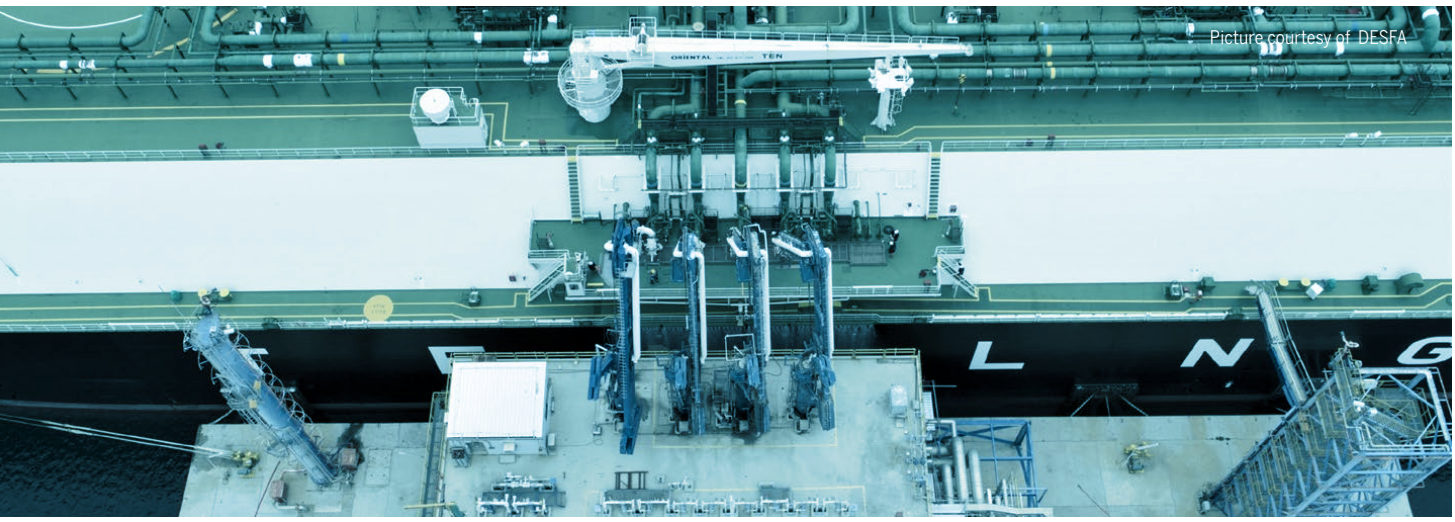


Figure 3.5: Breakdown of historical annual gas demand in Southern Corridor Region



7 Combined Cycle Gas Turbine

Figure 3.6 shows future gas demand breakdown for Southern Corridor Region. The projections confirm the increase expected in gas demand for power generation up to 2025 (+ 17 %), stemming from the coal phase out process in some countries of the Southern Region as well as for the progressive penetration of gas fired power plant for electricity generation in others. In this context, natural gas confirms its role as enabler for energy transition, contributing to the stability and resilience of the electrical systems and providing flexibility to systems characterised by a high intermittency of electricity generation from RES.

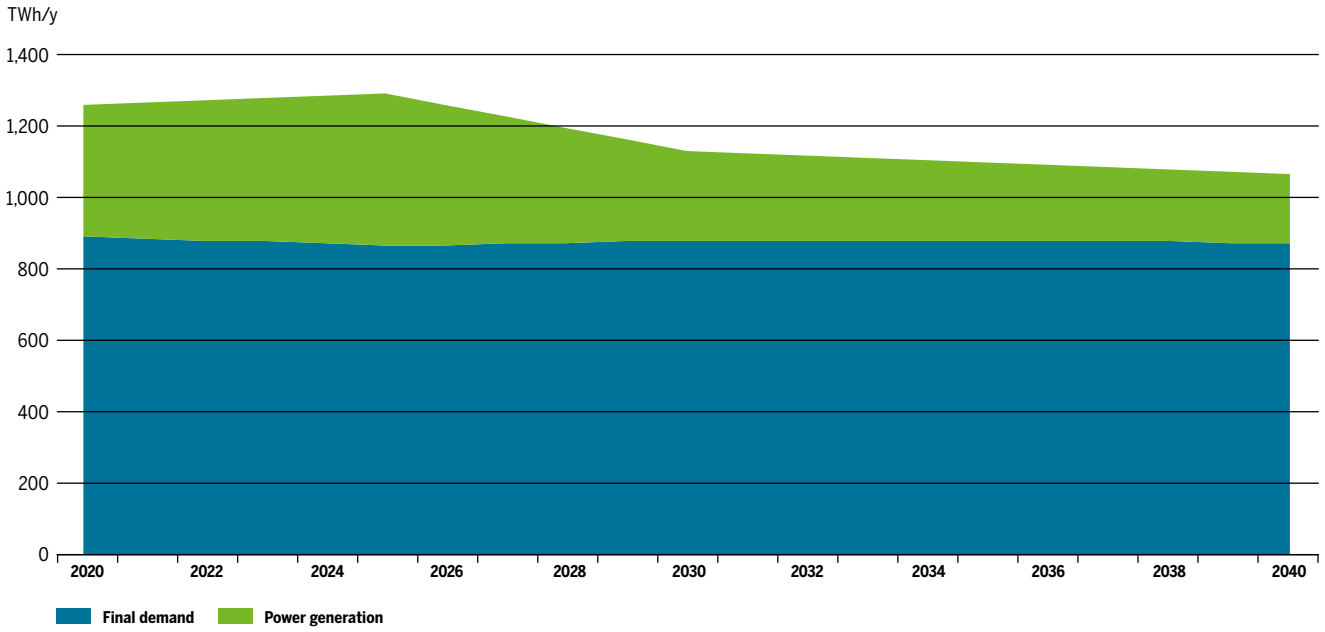


Figure 3.6: Southern Corridor annual demand breakdown (historical and forecast)


Picture courtesy of Snam

3.3 ANNUAL PEAK DEMAND EVOLUTION

Considering the evolution of energy system expected in the next years and the crucial role that natural gas will play for energy transition, this paragraph aims to provide an in-depth analysis of annual and peak daily demand of Southern Corridor Region.

Figure 3.7 confirms that until 2025 is expected a remarkable increase in the gas peak demand (+27 %) as effect of the increasing contribution that will be required to gas fired power plants in order to ensure the resilience of electrical system and therefore enabling the transition for those countries that has already planned a coal phase out. From 2025 until 2030 the increase in peak demand is expected to reduce as effects of efficiency measures that will lead to a reduction in final demand sectors. However, at 2040 gas peak demand is expected to be higher in respect to the 2020 value in all scenarios (ranging from +3 % to +11 %). Indeed, the significant development of intermittent electricity RES capacities will require the role of the gas infrastructure to back-up this non steerable variable power generation.

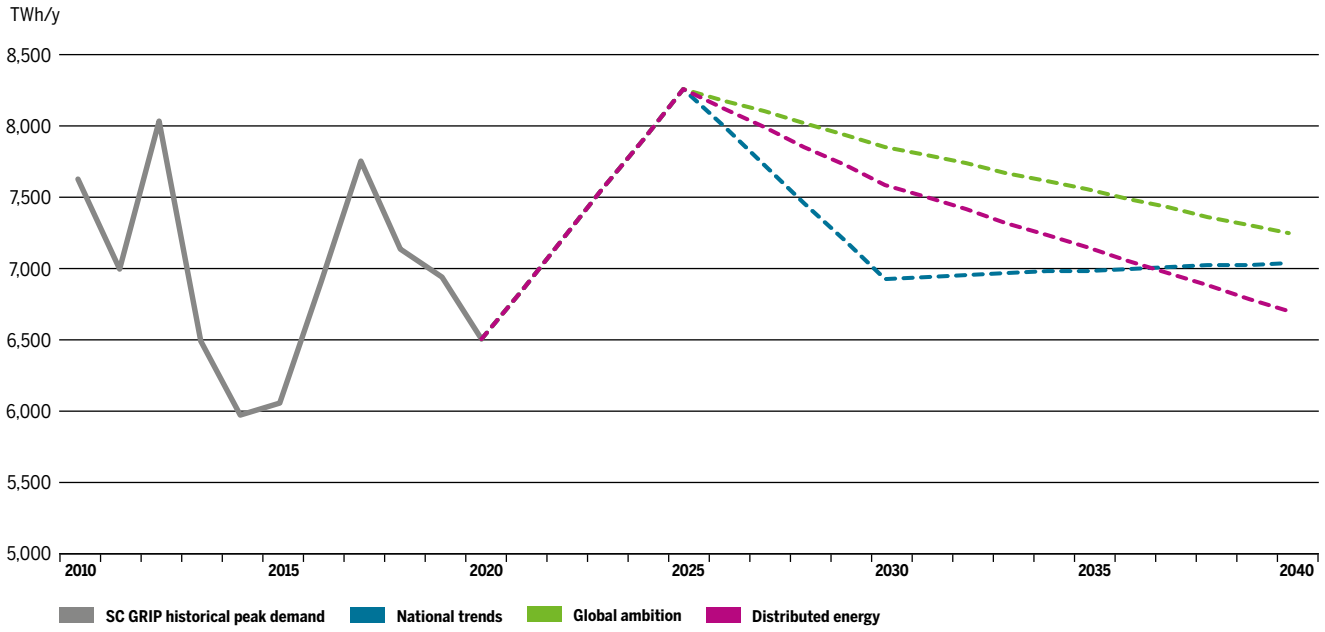


Figure 3.7: Historical and future peak demand of Southern Corridor Region

Figures 3.8.1–3.8.9 shows future data of annual and peak daily demand per country. From the charts result that demand for power generation is expected to increase in 2025 in all countries of the Region, insight already described in previous paragraphs and ascribable to the progressive substitution of more CO_2-intensive energy carriers (coal, lignite, oil) used for electricity generation. This will produce an impact on the evolution of peak demand that will mark a remarkable growth in all countries – in some case reaching an increase of 40–50 %. Contextually final demand is expected to slightly decrease in some countries (i. e. Austria and Italy).

Afterwards for most of the countries of the Region is foreseen a decreasing trend of conventional gas consumption for both final and power demand, except in Italy and Greece where final demand is expected to slightly increase in both 2030 and 2040.

However, in 2040 the peak demand will be higher compared to 2020 values in the majority of Regional States, particularly for Italy where the increase appears absolutely remarkable, suggesting that potential infrastructure developments may be needed in the future.

This insight is particularly relevant for those countries having still an important potential ahead, as well as for mature gas markets, for which peak demand is more stable and infrastructure enhancements could be more linked to the changing evolution of demand and supply patterns and to the needs to adequately refurbish gas system components and equipment.

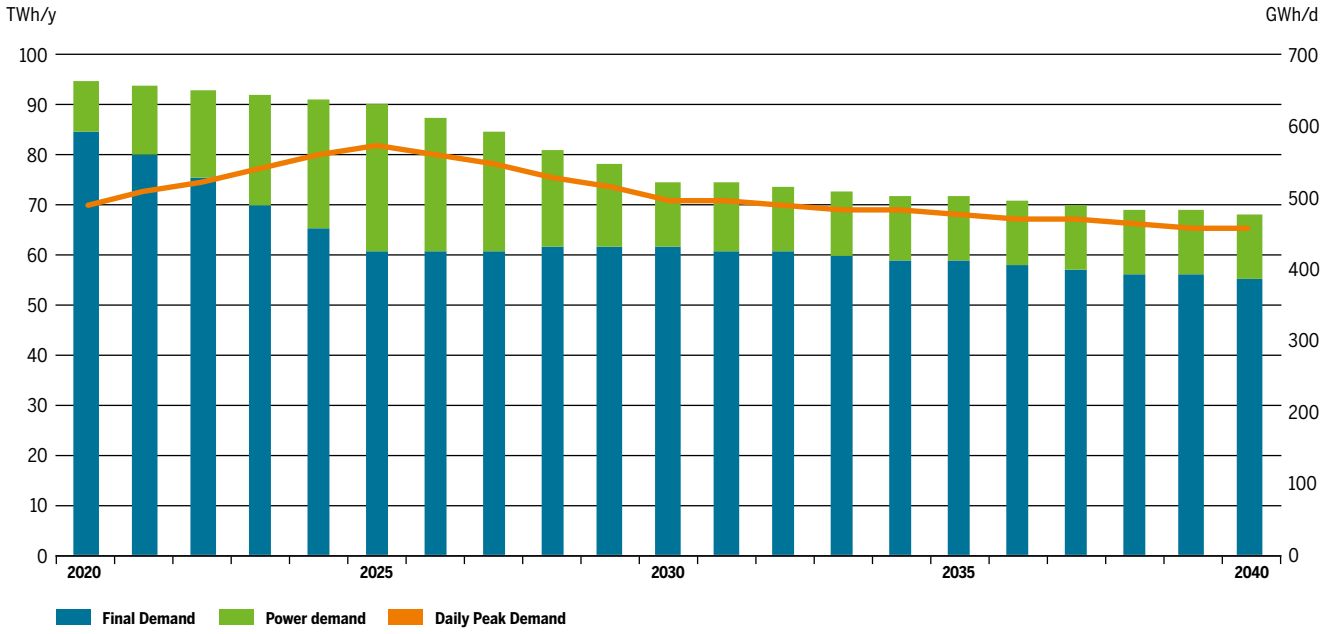


Figure 3.8.1: Evolution of annual and peak gas demand in Austria

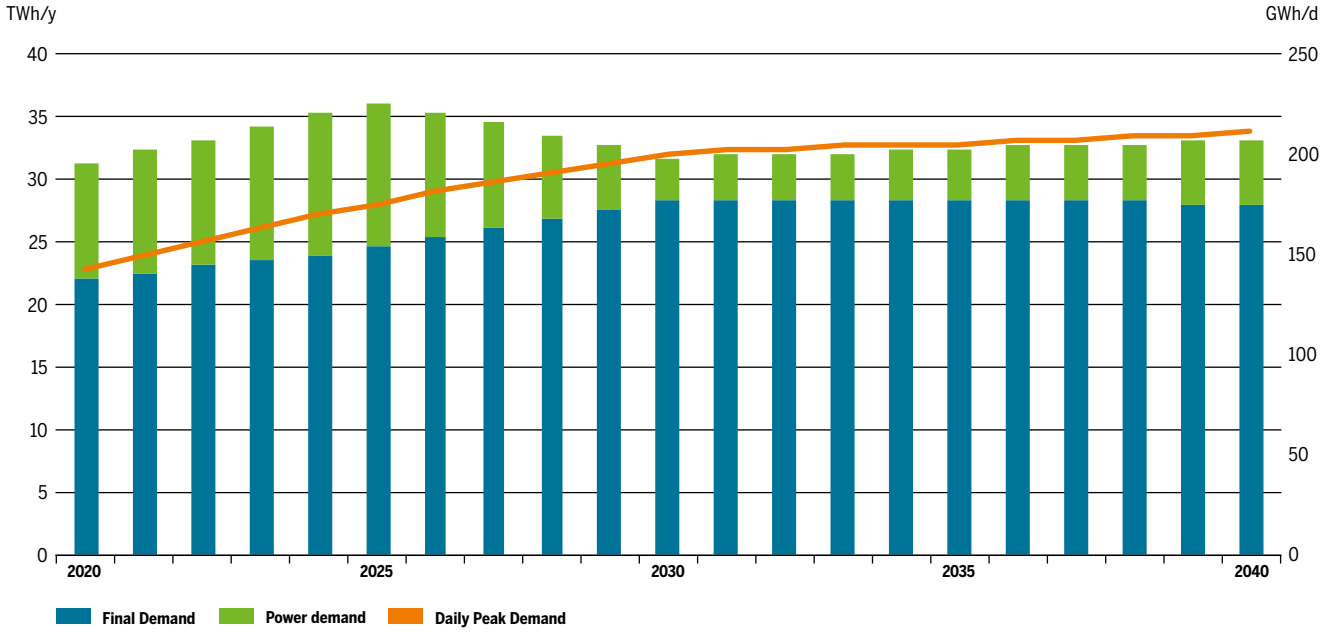


Figure 3.8.2: Evolution of annual and peak gas demand in Bulgaria

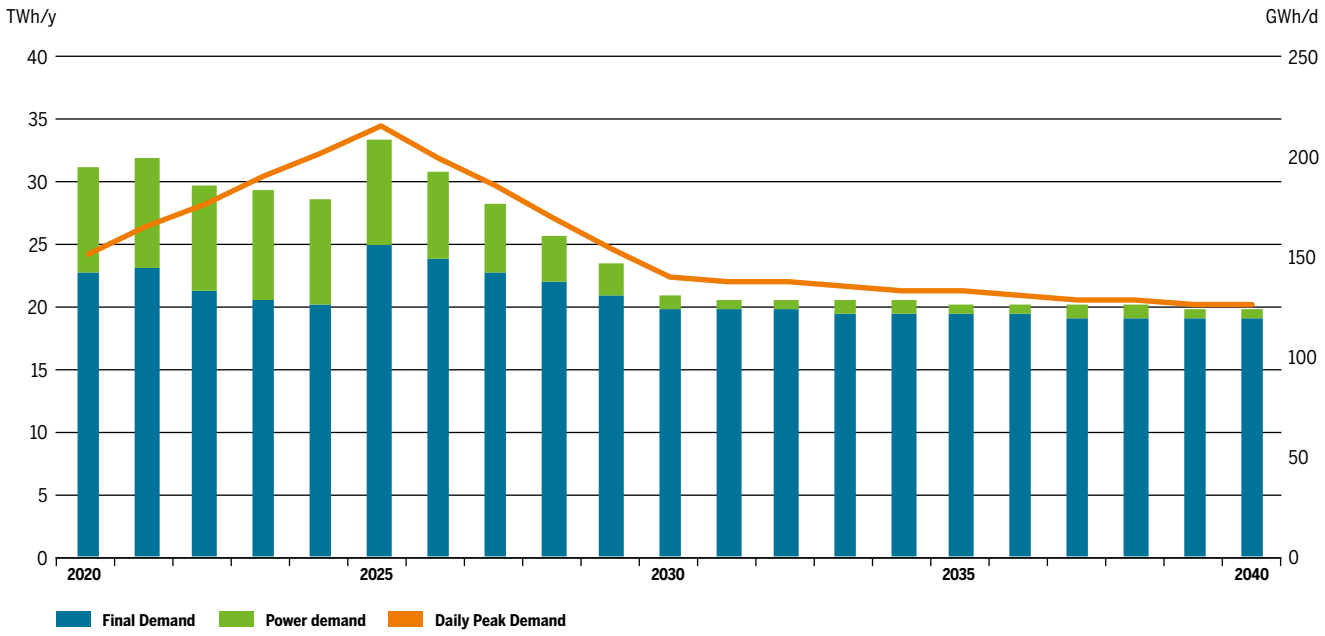


Figure 3.8.3: Evolution of annual and peak gas demand in Croatia

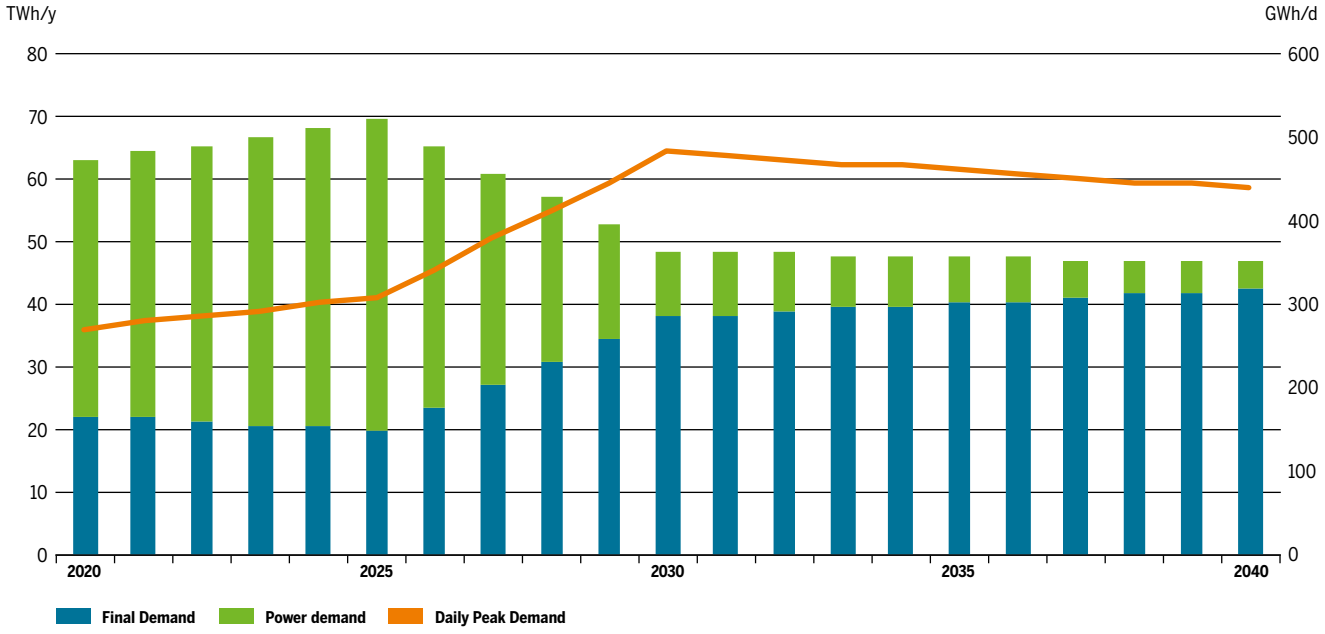


Figure 3.8.4: Evolution of annual and peak gas demand in Greece

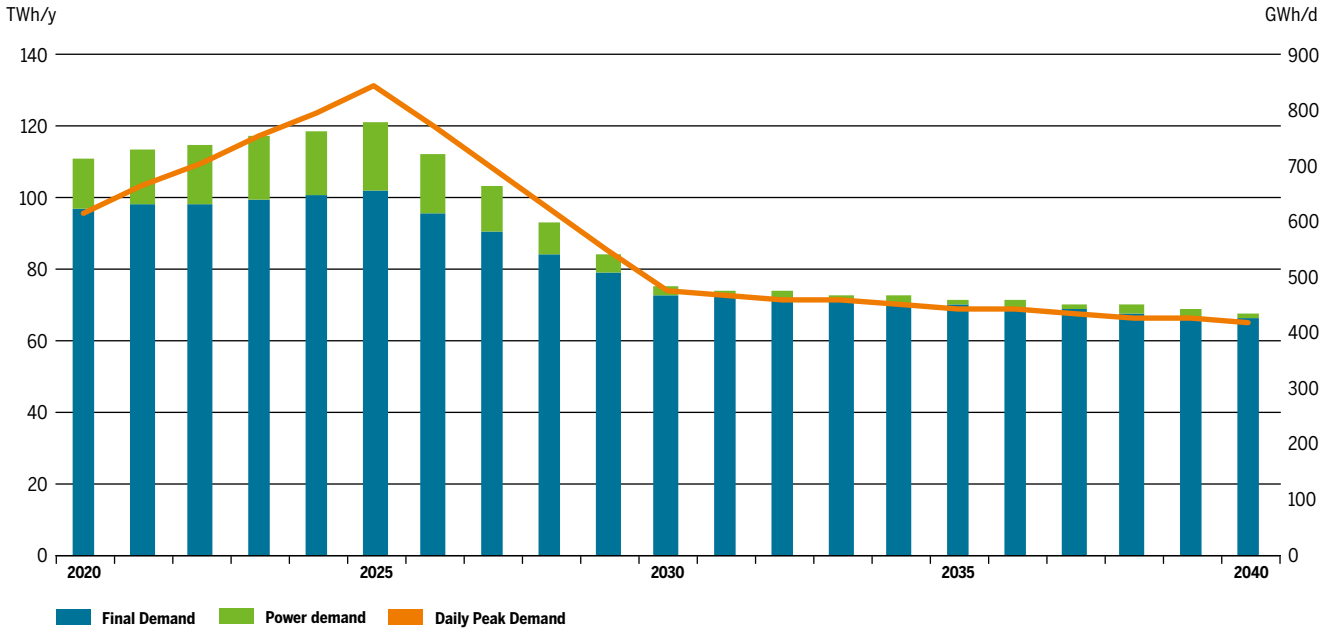


Figure 3.8.5: Evolution of annual and peak gas demand in Hungary

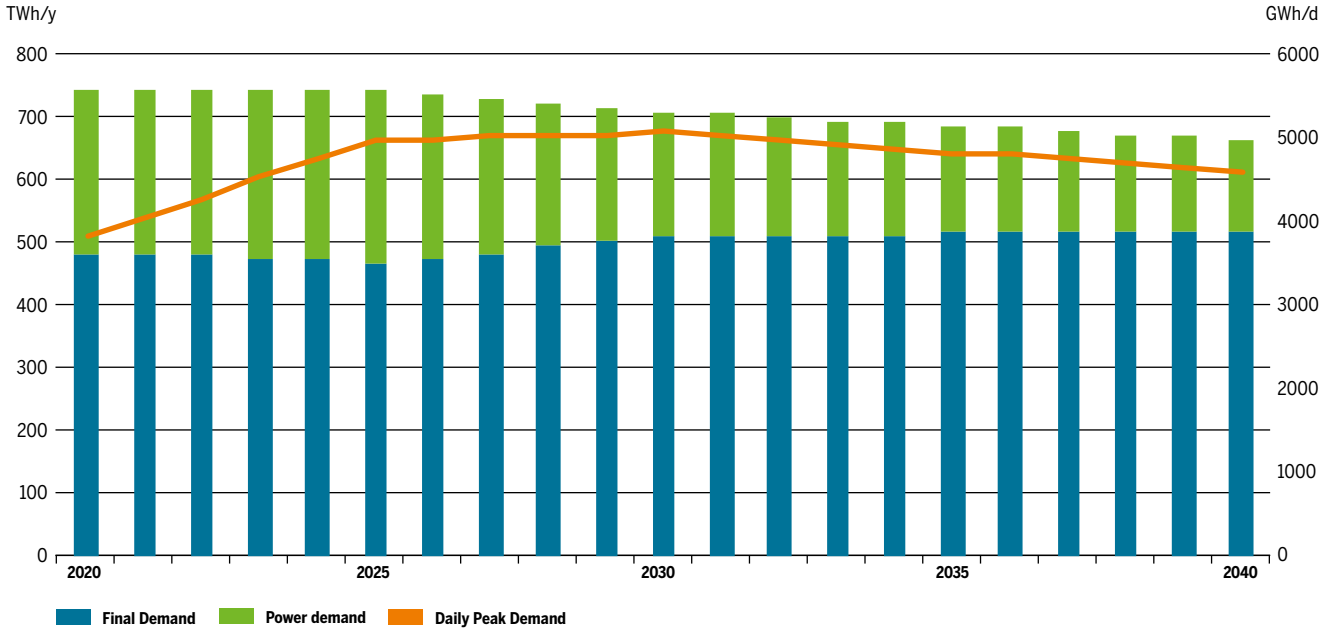


Figure 3.8.6: Evolution of annual and peak gas demand in Italy

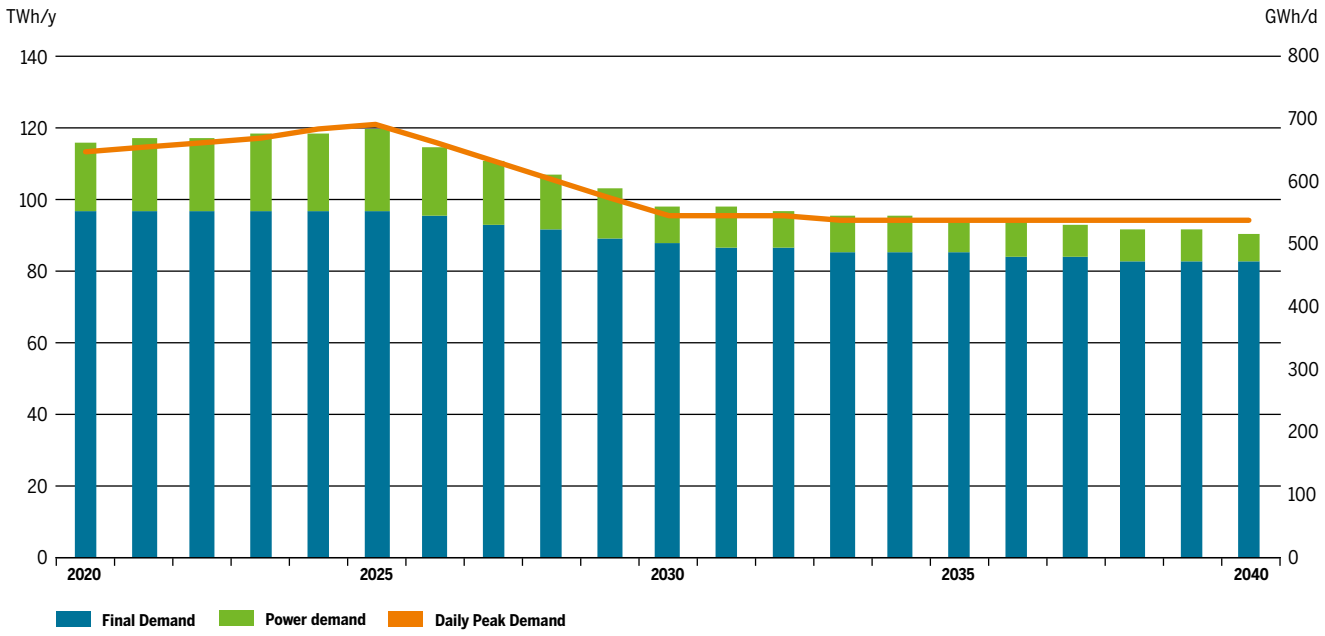


Figure 3.8.7: Evolution of annual and peak gas demand in Romania

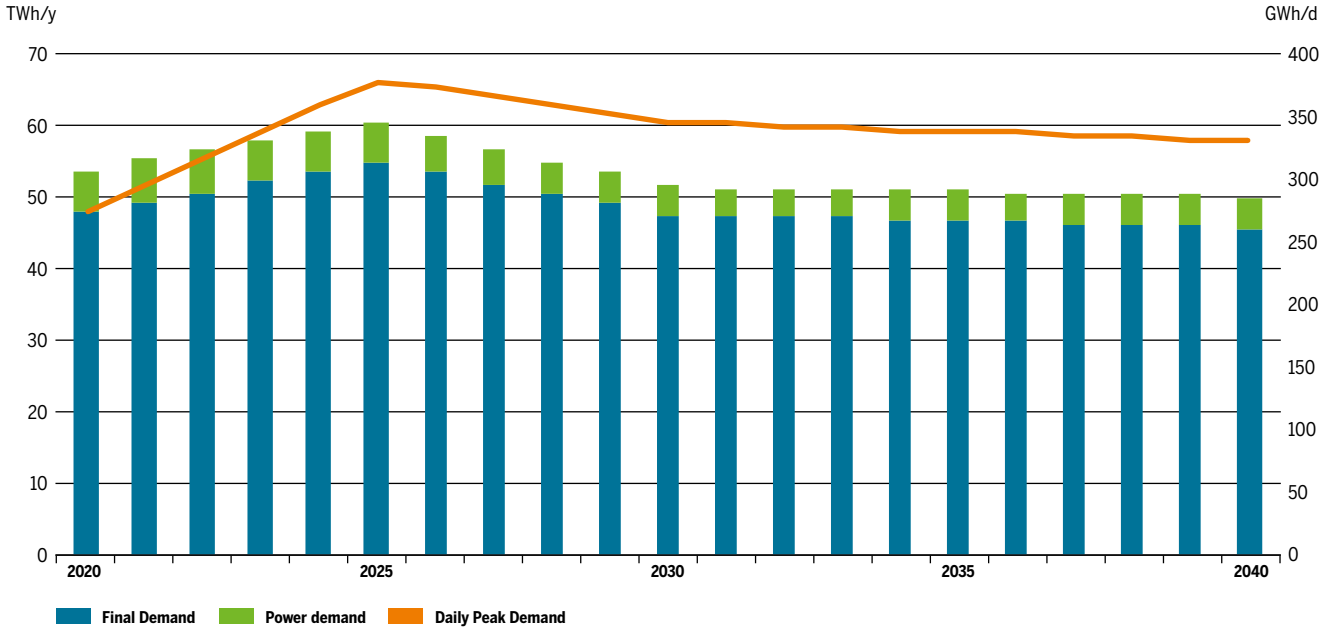


Figure 3.8.8: Evolution of annual and peak gas demand in Slovakia

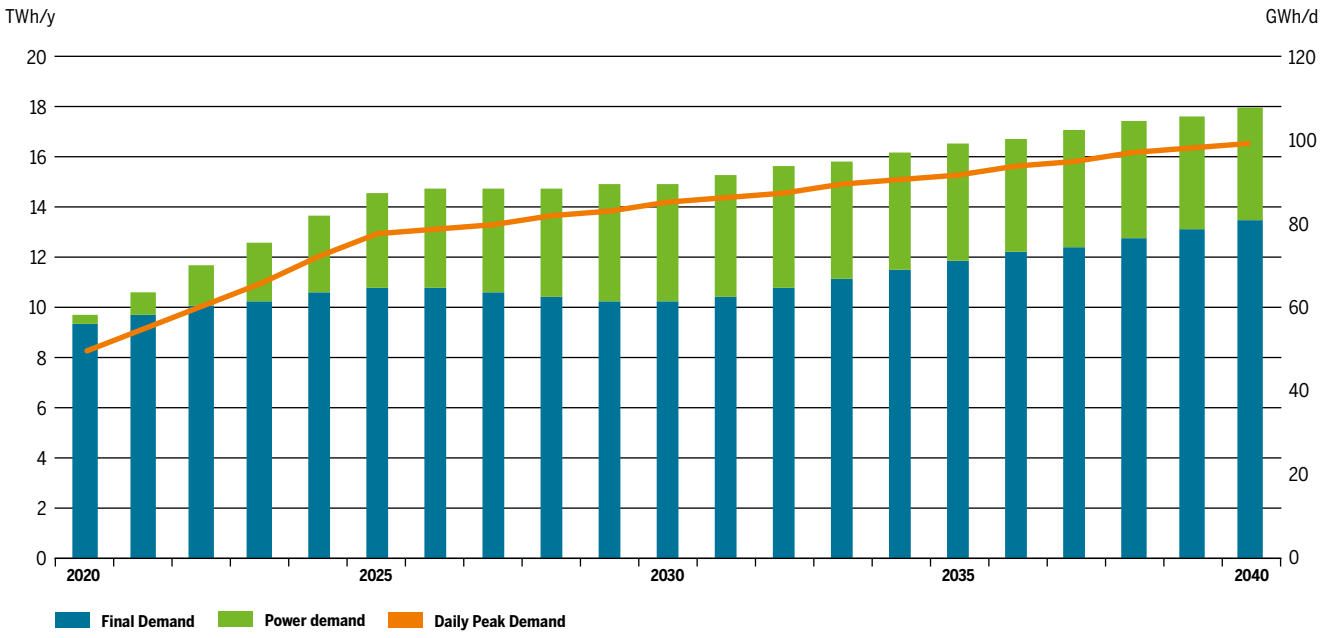


Figure 3.8.9: Evolution of annual and peak gas demand in Slovenia

3.4 THE ROLE OF NATURAL GAS FOR THE DECARBONISATION OF ENERGY SYSTEM

With the launch of the Green Deal the European Commission set a landmark initiative for Europe's commitment to decarbonising the energy system and reaching the 2030 and 2050 climate objectives. Hence, it is crucial to exploit the opportunities that all energy carriers will enable in order to contribute to the implementation of the European Green Deal.

In that respect gas infrastructure is expected to play a fundamental role enabling the energy transition, combining effectively well-functioning liquid gas market that assures security of gas supply with Europe's commitment to decarbonise its energy systems.

Indeed, as confirmed by the insights included in previous chapters, natural gas and biomethane will allow for quick decarbonisation wins enabling the coal phase out process at 2025, and therefore representing an immediate opportunity for major additional emissions reduction.

Furthermore, gas infrastructure is expected to be a direct enabler of energy transition allowing for the development and the uptake of new low-carbon and decarbonised gases that will be required in order to achieve decarbonisation targets.

Natural gas (with CCS), biomethane, hydrogen, synthetic methane and blending admixtures of methane and hydrogen, represent favourable solutions to decarbonise energy systems, exploiting the opportunities that the infrastructures already in place are able to offer. These are extensively detailed and analysed in Chapter 4 and 5 of the present report.

Figure 3.9 shows the evolutions expected in gas production for Southern Corridor Region. The growth currently expected in biomethane production is significant, increasing from 9 % share of total production in 2025 to a range of 27–29 % in 2030 and 48–57 % in 2040, more than compensating the expected decrease in indigenous natural gas production.

Contextually, as the integration between gas and electricity systems will increase in order to achieve decarbonisation targets, synthetic methane (obtained from methanation processes of H_2) and hydrogen produced via electrolysis from renewable electricity will emerge.

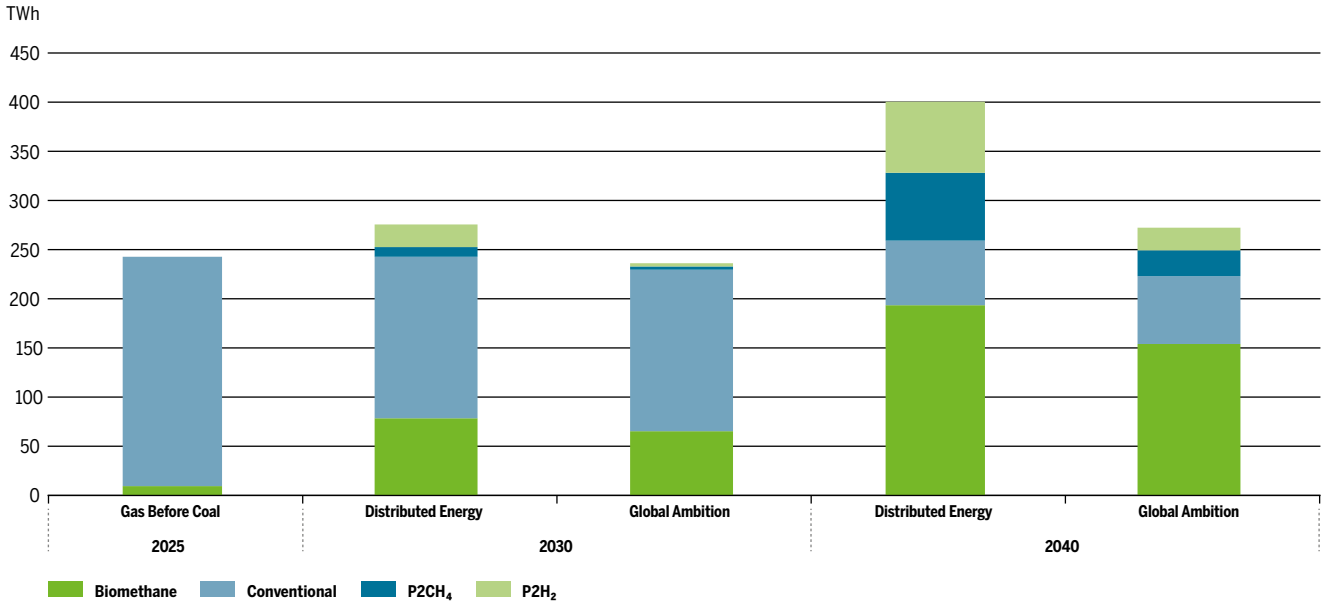


Figure 3.9: Methane and renewable gases production in Southern Corridor Region

Figure 3.10 details the breakdown of the future gas demand in ENTSOs COP 21 scenarios for EU 28, differentiating between methane and hydrogen. The chart suggests that the decarbonisation of the energy system will come with an uptake of hydrogen demand, as confirmed afterward by the European Hydrogen Strategy released by European Commission.

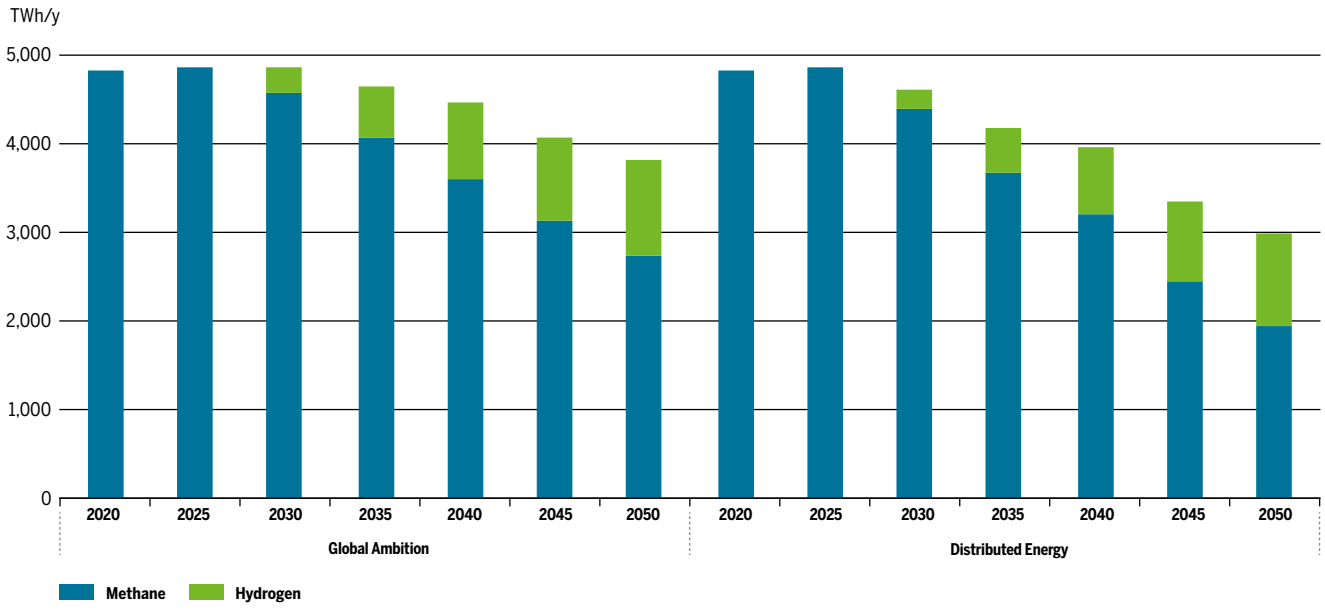
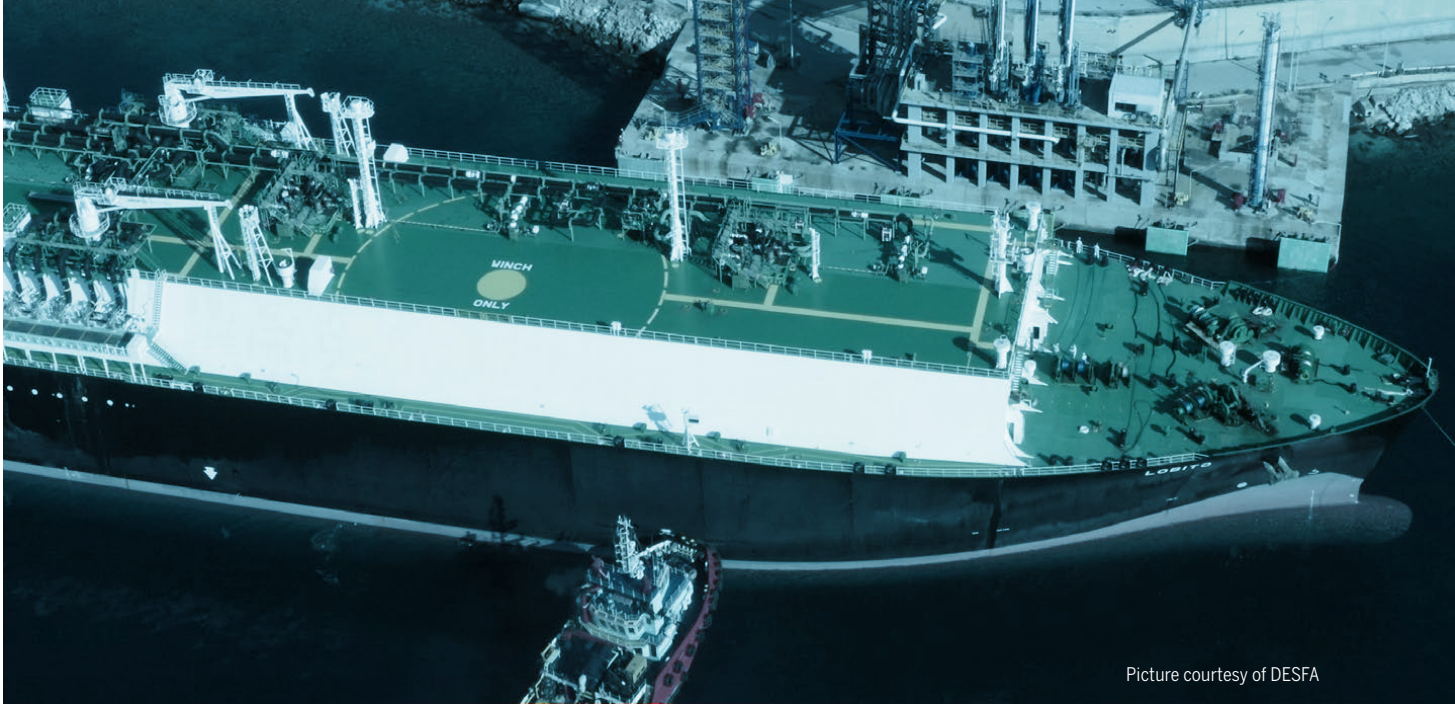


Figure 3.10: Total methane and hydrogen in ENTSOs COP 21 scenarios, EU 28



Picture courtesy of DESFA

4 THE ROLE OF THE SOUTHERN CORRIDOR REGION

4.1 THE SOUTHERN CORRIDOR REGION: A WELL FUNCTIONING GAS INFRASTRUCTURE THAT ENSURES SECURITY OF SUPPLY AND ENABLES EU LONG-TERM DECARBONISATION

In the frame of the energy-transition tasked by the European Union in terms of efficiency, decarbonisation and sustainability, the development of the Southern Corridor Region and its gas infrastructure represents the bridge for the next decades between further natural gas market integration and flexibilisation for the region and offering on the other hand the ideal connection for the uptake of low-carbon and decarbonised gases for the European decarbonisation.

The Southern Corridor Region infrastructure is further developing, connecting the needs of customers and market participants, stimulating the market activity and contributing to creating liquid and competitive gas markets. It brings different markets together in an easy and cost-efficient way allowing furthermore the achievement of the main principal objectives of European energy policy: market integration, security of supply, competition enhancement and sustainability.

Regarding sustainability, natural gas infrastructure in Southern Corridor Region is expected to play a fundamental role enabling the decarbonisation of energy system and contributing to the achievement of 2030 and 2050 climate targets.

In the short-term, natural gas represents a transition energy carrier as intermediate fuel in the process of transition to the zero-carbon GHG emission economy, and at the same time, it can lead to both improved energy efficiency and lower energy efficiency costs compared to other conventional technologies. Transitioning to natural gas will have a significant, immediate and sustainable effect on the reduction of emissions in the parts of the EU where dependency on coal, lignite and oil is high, optimising the costs by using and upgrading the existing transportation and storage gas infrastructure, thus contributing towards efforts focused on ensuring fair transition and acceptance by end users and civil society. Infrastructure specific to the Southern Corridor Region is one answer to the present market needs while adapting it to the European energy system transformation.

4.2 THE SOUTHERN CORRIDOR REGION – A PRIORITY FOR EUROPE

Since 2020, the Southern Corridor successfully provides Europe with a new route securing natural gas supplies from the gas-rich Caspian Sea Basin, contributing to the diversification of the natural gas sources in the whole region. The upside design of this pipeline route anticipates possible expansion to additional natural gas available in Azerbaijan and extension over the Caspian Sea, Turkmenistan seeking access to the South-European markets to diversify its own exports by adding a third route further to Russia and China.

Additionally, the Southern Corridor Region opens a new source for the region to benefit from new natural gas sources within the EU such as Black Sea gas. Also dependent on the capability to connect this source to further markets, Black Sea gas could contribute to the security of supply and market diversification of Central and South East European countries still partially dependent on a single supplier.

Ongoing priority gas projects for the Southern Corridor Region are:

- the Trans-Adriatic Pipeline, with the ramp-up of the gas delivery in South Europe and potential extension into the Western Balkans
- the Interconnector between Greece and Bulgaria
- the Interconnector between Bulgaria and Serbia and its prolongation towards Hungary and potentially Austria and Slovakia
- the reinforcement of the Bulgarian transmission system
- the reinforcement of the Romanian transmission system (part of the "BRUA" corridor)
- Interconnector Croatia-Slovenia
- the KrK LNG evacuation systems
- Ionian Adriatic Pipeline (IAP)
- the Adriatic line and Matagiola-Massafra pipeline
- EastMed pipeline
- a connection of offshore Romanian gas to the Romanian grid and enhancement of the national system
- a new Greek LNG terminal
- the first UGS in Greece
- the interconnection between Croatia and Serbia and
- the interconnection between Greece and North Macedonia
- a new interconnection between Hungary and Slovenia

For the European Union the infrastructure projects of the Southern Corridor Region are a top-priority. The social-economic benefits in terms of sustainability, security of supply and market development are recognised through their inscription into the 4th list of Projects of Common Interest (PCI). The status opens the next steps towards possible granting of EU-Funds, benefitting from streamlined permitting process, receiving preferential regulatory treatment, and applying for EU funding instrument, i. e.the Connecting Europe Facility.

The EU also cooperates closely with other gas suppliers in the wider Caspian and Middle East as well as Mediterranean regions, incl. Azerbaijan and other countries.

4.2.1 SOUTH/SOUTH-EAST GAS REGIONAL INITIATIVES

In 2014 the Commission's 'stress tests' revealed a region extremely vulnerable to a disruption in gas supply by its largest, and often sole, supplier. To solve this problem, the Commission launched the CESEC Initiative in 2015, with the aim of guaranteeing that all countries in Central and South Eastern Europe (Austria, Bulgaria, Croatia, Greece, Hungary, Italy, Romania, Slovakia and Slovenia) have access to a more varied mix of energy sources and are properly interconnected to the rest of Europe. CESEC has proven instrumental in the process of integrating the region's gas markets and has thus become a central channel for further consolidation across the energy sector and the promotion of the Southern Corridor. Most recent developments focused on the signing of interconnection agreements for several countries in the region, the harmonization of regulatory framework between the countries and the removal of several barriers to cross border trading.

4.3 KEY TRANSMISSION PROJECTS OF THE REGION

4.3.1 THE SOUTHERN GAS CORRIDOR

The Southern Gas Corridor (SGC) is one of the most complex and major gas value chains ever developed in the world. Stretching over 3,500 kilometres, crossing seven countries and involving more than a dozen major energy companies, it is comprised of several separate energy infrastructure projects representing a total investment of approximately US $ 33 billion: Shah Deniz Phase 2 field development (drilling wells and producing gas offshore in the Azerbaijani sector of the Caspian Sea), expansion of the natural gas processing plant at the Sangachal Terminal on the Caspian Sea ca. 40 km off of the capital and three pipeline projects, i. e. South Caucasus Pipeline (SCP), Trans Anatolian Pipeline (TANAP) and Trans Adriatic Pipeline (TAP).

The possible expansion of the SGC (including SCP Expansion, TANAP Expansion and TAP Expansion) could enable delivery of diversified energy supplies to further destinations throughout South East (incl. Western Balkans), Central and West European countries.

4.3.2 TRANS ADRIATIC PIPELINE (TAP)

Trans Adriatic Pipeline is the European section of the SGC and, as a cross-border energy transportation infrastructure, is playing a key role in supplying secure, diverse and affordable energy to Europe, while also contributing to the decarbonisation of European economies by accelerating the coal phase-out, especially in South East Europe (SEE) and Western Balkans. In addition, TAP is currently assessing the potential for the future cross-border transportation of a blend of hydrogen and other renewable/low-carbon gases on TAP pipeline. As a strategic energy transportation infrastructure and enabler of connection to the Western Balkans, TAP is set to significantly contribute to the 2050 climate neutrality goals of the European Commission. This contribution to the decarbonisation and to the realisation of the energy transition is expected to significantly foster economic recovery and growth in Europe, including in TAP's host (Greece, Albania, Italy) and neighbouring countries.

Connecting with the Trans Anatolian Pipeline at the Greek-Turkish border, TAP crosses Northern Greece, Albania and the Adriatic Sea before coming ashore in Southern Italy. Here, TAP connects to the Italian natural gas network of Snam Rete Gas. Along its 878 km long route, TAP can facilitate connections to a number of existing and planned infrastructure projects/pipelines, ensuring that the SGC opens up and extends into many different energy markets currently dependent on either a single supply source and/or without access to cleaner energy.

TAP started commercial operations on 15 November 2020 and on 31 December commenced the transportation of first gas flows to Europe.

TAP has been acknowledged as a strategic energy infrastructure project playing a strategic and fundamental role. As the EU institutions recognize TAP's role in addressing the energy policy objective of ensuring energy security of supply, market integration, competition and sustainability in SEE and Western Balkans, and has therefore been awarded the Project of Common Interest (diversification of supply to Europe, they have granted TAP the PCI) status 4 (four) consecutive times: 2013, 2015, 2017 and 2019 by the EC, EP & Council. In addition, the strategic importance of the project has also been underscored in the European Energy Security and Energy Union Strategies. and was reiterated in the Second Report on the State of the Energy Union. In addition to its PCI status, in 2013, the Energy Community Secretariat has named TAP as a Project of Energy Community Interest (PECI).

The European Commission has supported the construction of TAP as the strategic infrastructure to bring a new and sustainable energy supply from a non-traditional source to demand locations, thus enabling diversification of energy supplies, as well as fostering decarbonisation and energy transition in Europe. TAP's current capacity allows the transportation of approx. 10 bcm/a of natural gas from Azerbaijan to the European markets based on commercial arrangements.

TAP's initial capacity is almost entirely booked for the next 25 years, apart from the short-term capacity that TAP commercializes on PRISMA capacity booking platform, in accordance with TAP's specific regulatory framework.

At the same time, the current pipeline capacity can be expanded. There is a technical capability to double TAP's throughput capacity to 20 bcm/a with marginal investment connecting other energy sources to and from the wider region of South Eastern Europe. TAP, as the strategic infrastructure, can deliver new and sustainable energy supplies. New volumes, including hydrogen, and/or other renewable

Picture courtesy of TAP

and low-carbon gases may be transported once TAP's capacity expansion is realised as a result of the Market Tests which TAP conducts at least every two years according to TAP's specific regulatory framework. TAP launched its first Market Test in July 2019 and launched another one in July 2021. The 2019 Market Test has ended and no binding bids have been submitted.[8]

TAP's capacity expansion may facilitate the transportation of a certain percentage of hydrogen blend and other renewable gases through its system. This, in turn, would significantly decrease the presence of polluting fuels in the national and regional energy mixes, especially in the SEE and Western Balkans region, over a relatively short timespan.

Blending of hydrogen with natural gas is an efficient solution to foster quick decarbonisation wins in TAP's host and neighbouring countries, some of which are heavily reliant on more polluting coal, lignite and oil. To this end, TAP already started actively working on assessments of new technical solutions that are required and needed, for the retrofitting of the pipeline and for accommodating other energy carriers, apart from natural gas, in line with the EU Green Deal and 2050 decarbonisation targets.

Furthermore, TAP's infrastructure can complement the EU's Hydrogen Backbone initiative[9] and foster the cross-border transportation of H_2 produced in decentralised areas in SEE (incl. in Greece and Albania) towards demand locations. To this end, TAP is participating in the Greek White Dragon Hydrogen IPCEI project with its "TAP Hydrogen Readiness" project. TAP's Hydrogen Readiness project objective is to enable larger scalability of renewable hydrogen production in Greece (and foster similar activities in countries along the Southern Gas Corridor and its neighbourhood) by facilitating cross-border hydrogen transportation (and in the future also other renewable/low-carbon gases blend)[10].

Having in mind its cross-border character and considering the results of the current ongoing assessments TAP could potentially also facilitate the energy sector's integration by applying innovative, as well as smart grid solutions to unlock further potential advantages.

8 Details on the Market Tests and results can be found on TAP's webpage

9 Gas for Climate, European Hydrogen Backbone – How a dedicated hydrogen infrastructure can be created, July 2020

10 Please note that this report was written and covers the activity that took place during 2020 and 2021, without including the latest developments which surfaced starting from the beginning of 2022

4.3.3 TRANS ANATOLIAN NATURAL GAS PIPELINE (TANAP)

The Trans Anatolian Natural Gas Pipeline Project (TANAP), along with the South Caucasus Pipeline (SCP) and TAP, which form the Southern Gas Corridor, aims to bring natural gas produced in Azerbaijan's Shah Deniz-2 gas field and in the other areas of the Caspian Sea, to Turkey and on to Europe.

Construction started in March 2015, and the first gas deliveries to Turkey were in June 2018.

Besides being the alternative source and route TANAP pipeline is the only alternative source of natural gas for several EU Members. Therefore it can be instrumental in satisfying curtailed demand and the single largest infrastructure disruption.

To assess our contribution to sustainability EU Green Deal targets, TANAP conducted a desktop study from June 2020 till January 2021 to evaluate the option of transporting hydrogen through TANAP system to the EU. From technical aspect, hydrogen volumes up to 2 % of the existing natural gas volumes can be blended by replacing the relevant gas volumes with insignificant investments and technical re-modifications to the pipeline. On the other hand, hydrogen blending of any volumes higher than 2 % would require notable investments on the compressors and metering stations and hence, comprehensive study should be conducted to evaluate further the potential of the Project and the impact of such hydrogen blending on compressor and metering stations in detail. Besides, project shareholders assess the possibility of hydrogen deployment within the value chain and various energy segments.

4.3.4 BLACK SEA GAS

Additional European sources have a key role to play. There are prospects for conventional gas production in the Black Sea and as a result, special importance is placed on the Black Sea corridor. This has already been explicitly acknowledged by previous Gas Regional Investment Plans (GRIPs).

Whereas the infrastructure of other European countries is closely aligned with domestic consumption, the countries belonging to the Black Sea corridor play a major role in transit. Thus, utilizing this infrastructure to transport new potential gas volumes could have a positive impact on security of supply in Europe.

New gas routes however also enhance the security of supply of the transit countries themselves, considering that countries such as Romania and Hungary would in some cases be hard hit by any disruptions in supply. This could result in irregular peak loads – and the infrastructure has to be able to manage such peak loads. As this is currently not the case everywhere, it is of major significance to develop the corridor.

A key component of Black Sea gas exploitation is the final investment decisions of offshore blocks title holders. Such investment decisions have been postponed until now and depend to a large extent on the amendment of the national law establishing the conditions for the offshore exploitation of gas resources. The amendment to the law will encourage title holders to exploit Black Sea gas.

4.3.5 GAS TRANSMISSION CORRIDOR FROM BULGARIA TO AUSTRIA

In connection with the aforementioned upstream exploration projects in the Black Sea region, concerned Romanian, Hungarian and Austrian Transmission System Operators have received non-binding expressions of interest for the corridor route from the Black Sea to the Austrian hub Baumgarten (BRUA).

The initial proposal to meet the indicated market demand was to follow an alternative allocation mechanism procedure for gas transportation from Romania to Austria via Hungary (ROHUAT Open Season). Shortly after the Hungarian side had withdrawn from the ROHUAT Open Season procedure, two new capacity allocation procedures, independent from the one for ROHUAT, were proposed. An Open Season Procedure for the Romanian-Hungarian Interconnection Point (ROHU) and an incremental capacity procedure for the Hungarian-Austrian Interconnection point (HUAT). Both of them closed unsuccessfully due to lack of interest of shippers in 2020.

However, the BRUA-Phase I project (TRA-F-286) was completed in 2019 in Hungary, ensuring permanent bidirectional flow through the interconnections with Bulgaria and Hungary. A works execution contract is signed for the construction of the gas transmission pipeline Black Sea – Podișor (TRA-A-362) connecting the gas resources available on the Black Sea coast and the Bulgaria – Romania – Hungary – Austria/Slovakia corridor.

Picture courtesy of Gas Connect Austria

In order to increase the gas transmission capacity to Hungary, respectively Central Europe, Transgaz is considering the achievement of the BRUA Project – Phase II (TRA A 1322). Nevertheless, the completion of this project depends on the successful development of a future incremental capacity process, according to the provisions of CAM NC.

In this context and taking into account the volume of investments planned for the development of the transmission infrastructure in Romania (approx. 3.5 billion €, of which 555 million € for FID projects), in 2019 the Cooperation Agreement was concluded between SNTGN Transgaz SA and Central European Gas Hub (CEGH) Austria for the establishment of a gas HUB in Romania.

In Hungary, the transmission capacity from Romania to Hungary was increased up to 50.3 GWh/d in 2019 with the completion and commission of the Csanádpalota compressor station (TRA-F-286). From 2020 the technical capacity was further enhanced from 50.3 GWh/d to 77.5 GWh/d in HU>RO direction due to the completion of Romanian side development. Further development depends on the incremental procedure regulated by the provisions of the CAM NC.

A further project to bring gas from the Black sea region via Hungary and Slovakia to the liquid Baumgarten hub was envisaged by the development of the HUSKAT allocation procedure. The binding incremental capacity allocation procedure in 2020 resulted in no capacity allocation. At HU/SK border there are available capacity in SK>HU direction 128.9 GWh/d and HU>SK direction 50.9 GWh/d from 2019. Only short term within a year capacity were booked during the relevant capacity auctions.

4.3.6 BALKAN GAS HUB

The Balkan Gas Hub concept of Bulgartransgaz EAD aims to connect the main gas projects in Southeast Europe, Central and Eastern Europe, and the Balkan region, thus serving the natural gas markets of the member states in the region – Bulgaria, Greece, Romania, Hungary, Croatia, Slovenia and crossing their territory to the member states from Central and Western Europe and the countries of the European community – Serbia, the Republic of North Macedonia, Bosnia and Herzegovina and others. The project contributes to achieving a higher degree of market integration and securing the natural gas supply for the country and the region, providing access to various sources of natural gas and liquefied natural gas terminals.

The hub provides access to various sources of natural gas – Russian gas, natural gas from Black Sea shelf, the Southern Gas Corridor and LNG from terminals in Greece and Turkey.

The infrastructure required for the realisation of the concept is being built at an accelerated pace. The expansion of Bulgartransgaz EAD gas transmission system from the Bulgarian-Turkish border to the Bulgarian-Serbian border is already in operation with full capacity expected in October 2021. The projects for interconnections between Bulgaria–Greece and Bulgaria–Serbia are being implemented. The project for expansion of the UGS Chiren storage, injection and withdrawal capacity is also advancing.

A key element of the concept is the Balkan Gas Hub EAD trading platform. As of early 2020, the short-term segment (spot), long-term segment, and brokering service came into life in an environment of growing interest.

4.3.7 IONIAN ADRIATIC PIPELINE (IAP)

The IAP project has been based on the idea of connecting the existing gas transmission system of Croatia via Montenegro and Albania with the TAP gas transmission system (Trans Adriatic Pipeline). The total length of the gas pipeline from Split (HR) to Albanian Fieri is 511 km according to the accepted feasibility study. IAP is Project of Mutual Interest of Energy Community (PMI)

The initial capacity of 5 bcm/y has been planned for natural gas supply of Albania (1 bcm/y), Montenegro (0.5 bcm/y), the south of Bosnia and Herzegovina (1 bcm/y) and Croatia and further to CEE and CE (2.5 bcm/y). From Croatia, there is a possibility to transport the gas in two directions: 1) by existing interconnection HR-HU to Hungary and further 2) by new interconnection HR-SLO via Slovenia to Austria and Italy. The project will be hydrogen ready.

The implementation of this project would enable the gasification in Albania and Montenegro, as well as in the southern part of Croatia and Bosnia and Herzegovina. The implementation of the entire IAP project provides opening of the new energy corridor for the region within the Southern Gas Corridor, for the purpose of establishing a new natural gas supply route from the Middle East and Caspian region. The project will provide the SoS and Diversification of Supply for the SEE region.

IAP will have a potential to provide bi-directional gas flow. This gives the LNG terminal on the island of Krk a significant importance since it could be a source of gas for IAP, which means that IAP is fully compatible with the LNG terminal on the island of Krk.

4.3.8 CROATIAN LNG CORRIDOR

The Croatian LNG terminal at Krk island secures energy needs, contributes to diversification of sources and increases security of supply in case of possible disruptions of existing and other sources, by providing a new gas supply route for the Central and South-Eastern European countries. The LNG terminal represents an additional source of natural gas for Croatia as well as its neighboring countries, including Hungary, Slovenia, Austria, Bosnia & Herzegovina, and Serbia.

Main projects that will contribute to this effect are the new interconnections:

- between Croatia and Slovenia (Lučko–Zabok–Rogatec),
- between Croatia and Bosnia and Herzegovina (connections south Zagvoz-Imotski Posušje)
- between Croatia and Serbia (Slobodnica –Sotin–Bačko Novo Selo)
- between Slovenia and Austria (interconnection Ceršak /Murfeld)

All projects are designed to fit for H_2.

4.3.9 EASTRING

The project's economic feasibility is based on a positive, non-binding market survey and analyses of future market development. EASTRING is a project that offers direct routing between the developed EU markets and the South-East Europe region. As Turkey becomes a major gas hub with excess import capacities, it will look for a way to export surplus gas, while the same applies to the Balkan Gas Hub project in Bulgaria. New sources of natural gas (Caspian & Middle East Gas, Turkish Stream, LNG) will create an excess of natural gas in Turkey/Balkan region. Project Eastring will be H_2-Ready so if it required it will enable transmission of hydrogen. However, there is currently no infrastructure to transfer this excess natural gas or hydrogen further into Europe. Therefore, EASTRING becomes a required infrastructure to cover the needs of this region.

The EASTRING Pipeline is planned to be bi-directional, which would not only open up alternative import routes to the EU markets for gas transmitted through Turkey, but also create a way of supplying South East Europe and Turkey in the event of gas disruptions. A new route of 1,208 km between Veľké Zlievce (Slovakia/Hungary border) and Malkoçlar (Bulgaria/Turkey border) has been designed as the outcome of the feasibility study.

The bi-directional pipeline of a diameter of 1,400 mm and an operating pressure of 100 bar will have a capacity of up to 20 bcm/y in its first stage, with a potential upgrade up to 40 bcm/y in the next phase. The estimated CAPEX of the Phase I of the project is 2.6 billion €. If a positive investment decision is made, the new pipeline can be operational in the second half of 2028 to meet future market demands.

The detailed Feasibility Study for the EASTRING pipeline has been completed. It offers unique and workable solutions for a Single European Market. Connecting the main European Gas Hubs with the Black Sea and Turkey region will secure future deliveries from new alternative natural gas sources. It will enhance the European Union's energy security and strengthen the competitiveness of its natural gas market.

The Feasibility Study was co-funded by the EU's Connecting Europe Facility program. It was elaborated by the EUROIL consulting and engineering company with the active participation of all involved gas TSOs from Slovakia (Eustream), Hungary (FGSZ Zrt.), Romania (SNTGN Transgaz SA) and Bulgaria (Bulgartransgaz AED). EASTRING is part of the Ten-Year Network Development Plan, it is a Project of Common Interest.

4.3.10 ADRIATIC LINE AND MATAGIOLA-MASSAFRA PIPELINE[11]

The Adriatic line, which consists in 430 km of new on-shore pipelines and the enhancement of a compressor station (33 MW), is designed to allow new transmission capacity of approximately 24 Mm^3/d. The project is an enabler for new possible import opportunities, allowing the transport of additional new gas flows potentially coming from new initiatives in the Southern Gas Corridor and other Southern routes.

Matagiola-Massafra pipeline will allow to increase the maximum capacity of the entry points of Apulia region up to a maximum of 74 Mm^3/d and, similarly to the Adriatic line, is functional to the initiatives that focus on Southern Gas Corridor.

Both projects are subject to requests for incremental capacity (in a regulated regime or under exemption) to be made on existing Points in the South of Italy.

As part of infrastructure for gas transmission from the Eastern Mediterranean Basin, Caspian Region, Middle East and Central Asia, these projects will allow Europe to access new gas sources while providing the possibility to reinforce the import of the newest gas source available to EU (i. e.Azeri gas). As consequence, the initiatives are expected to improve the security of supply and flexibility by diversifying EU energy supplies with new sources and routes, with a final positive impact also in terms of supply cost savings, contributing to a reduction of gas prices and spreads.

Furthermore, allowing new competitive gas supplies to enter in EU, the projects also contribute to sustainability, with a reduction of emissions (CO_2 and other pollutants, e. g. NO_x, PM_x, SO_x) by displacing more pollutants fuels, such as coal (phase-out) and, as hydrogen-ready infrastructure, the initiatives will allow the progressive integration of renewable gases (i. e.biomethane and hydrogen).

4.3.11. UNDERGROUND GAS STORAGE IN SOUTH KAVALA

The South Kavala UGS project pertains to the conversion of the depleted natural gas field of South Kavala into the first UGS facility of the country. The field is located in the maritime region, approximately 30 km south of Kavala. According to preliminary plans, the storage facility's working gas capacity is estimated at 530,000,000 m^3. Currently Hellenic Republic Asset Development Fund (HRADF) holds the right to award a concession for the construction, maintenance, operation and exploitation of the depleted field as an Underground Natural Gas Storage. HRADF has initiated an international tender process to select the concessionaire with the submission of binding offers estimated at March 2022.

The UGS project is expected to have a substantially beneficial impact on decarbonisation efforts contributing to the target of reaching a carbon-neutral economy by 2050.

This will be achieved as a result of the substitution of fuels with higher carbon content, due to increased availability of natural gas during peak demand periods both in electricity generation (where natural gas-fired plants may switch to diesel fuel in times of peak demand) and commercial usage.

Furthermore, after serving its role as a natural gas storage facility, the UGS will be considered as a storage facility for hydrogen or other renewable gases, in line with current efforts at the EU level. The fact that depleted gas fields are considered eligible candidates for storage of renewable gases coupled with the facilities that would already be in place for the UGS operations driving the development cost down, make the UGS a suitable candidate prospect for retrofitting to store large amounts of renewable gases in the future.

11 https://www.snam.it/export/sites/snam-rp/repository-srg/file/it/business-servizi/Processi_Online/Allacciamenti/informazioni/piano-decennale/pd_2021_2030/consultazione/SRG_Piano_Decennale_2021-2030_final.pdf#page=72

4.3.12 LNG TERMINAL IN NORTHER GREECE, ALEXANDROUPOLIS

The LNG Terminal in Northern Greece, Alexandroupolis comprises of a Floating Storage and Regasification Unit (FSRU) and an offshore and onshore pipeline system which connects the FSRU to the Greek National Natural Gas Transmission System (NNGTS). The FSRU will be stationed in the Sea of Thrace, approximately 17.6 km SW of the port of Alexandroupolis, at an offshore distance of approximately 10 km from the nearest shore.

The FSRU will have an LNG storage capacity of up to 170,000 m^3, a nominal regasification and send-out capacity of 625,000 m^3/hour (5.5 bcm/year) and a peak technical regasification and send-out capacity of 944,000 m^3/hour (8.3 bcm/year). The total length of the pipeline is 28 km of which 24 km are located offshore and 4 km onshore. The project will be connected to the NNGTS through a new Metering/Regulating Station at Amfitriti which will be built and operated by DESFA.

The LNG Terminal in Alexandroupolis is a project of strategic importance for Greece and South Eastern Europe. It creates a new energy gateway, offers diversification of sources and routes of supply to Greece, Bulgaria, Romania, Serbia, North Macedonia and the wider region, enhancing the security of supply and the energy liquidity in the area and promoting competition to the benefit of the end users. It also contributes to a cleaner energy mix through increased utilisation of gas instead of coal, hence reducing CO_2 emissions and supporting the transition to meet the 2050 decarbonisation target.

The project has been included in all (4) PCI lists since 2013 and has been also included in the priority projects for the connectivity of gas infrastructures in Central and Eastern Europe (CESEC) in 2015 and 2017. In addition, the project is included in the National Energy and Climate Plan for Greece and it is considered as a project of high strategic priority.

In terms of timeline, the FID was taken and commissioning is expected in December 2023.

4.3.13 EASTMED & POSEIDON PIPELINE

The EastMed Pipeline Project, developed by IGI Poseidon S.A, is a natural gas interconnector which aims to connect energy sources in the East Mediterranean area to the European energy system, via Cyprus, Crete and mainland Greece. The project will integrate markets along the way, enhancing the diversification of the European energy supply. EastMed will provide Europe with completely new energy sources from a new and dedicated route, strengthening the security of supply and facilitating the energy transition within EU members currently dependent on coal and oil. By displacing coal and oil and boosting the penetration of gas in critical sectors, including industry and transport, the EastMed can promote, in a cost-efficient manner, the EU's long-term energy goals, taking into account the particular characteristic and level of development of respective energy markets in South-East Europe. The gas from the project will backup for intermittent renewables and for the electricity sector.

This 2,000 km offshore/onshore pipeline, is designed to transport up to 20 bcm/y. The project consists of five sections connecting the following areas: Levantine basin – Cyprus – Crete – Peloponnese – West Greece – Thesprotia, where it will be connected to Poseidon Pipeline.

The pre-FEED studies were co-financed by CEF and demonstrated that the project is technically feasible, economically viable and commercially competitive. Moreover, its added value was confirmed, as a project that complements the other export options for the development of the Eastern Mediterranean Corridor. On this basis, the project promoter is carrying out to the next stage of development, the FEED studies, which includes: Detailed Marine Survey, engineering details and permitting activities. The FEED phase is also supported by EU and co-funded through CEF grants.

The Poseidon Pipeline, developed also by IGI Poseidon S.A., is a multi-source natural gas interconnection, which aims to complete the SGC. The configuration includes 2 sections: a 760 km onshore section crossing Greece, from the border with Turkey to Thesprotia and 210 km offshore section crossing the Ionian Sea up to the Italian landfall in Otranto, linking the East Mediterranean energy resources to the Southeastern and northern European markets, thanks to the connection with the EastMed Pipeline.

The project being the final section of the EastMed Pipeline, aims to facilitate the connection between the European markets and the indigenous or close border sources available in the East Mediterranean area, enhancing connectivity and market integration, as well as strengthening Europe's security of supply by promoting diversified sources of gas

The project will provide a new energy backbone for an inclusive development of the area, reducing dependence from existing routes and sources of supply. The Poseidon Pipeline allows to reduce the bottlenecks of the existing gas networks and it will facilitate the energy transition of parts of the

EU currently dependent on coal and oil, boosting the penetration of gas in critical sectors, including industry and transport and thus promoting, in a cost-efficient manner, the EUs long term energy goals, taking into account the particular characteristic and level of development of respective energy markets in Southeast Europe.

The Poseidon Pipeline will be able to transport up to 20 Bcm/y according to the market needs, allowing the flow of gas coming from East Mediterranean region through the EastMed Pipeline, to which Poseidon will be connected in Thesprotia, Greece.

The project's main engineering activities have been completed, and the construction tender has been almost finalized. In Greece, the EIA decision was taken in July 2019 and in Italy all permitting procedures in place and aligned with the EastMed schedule.

Both Eastmed and Poseidon pipelines shall be built ready to transport hydrogen. The promoter is carrying out all the needed steps to ensure the transportability of the maximum hydrogen content. Furthermore, both projects are PCI in the latest list under cluster 7.3. PCI Cluster infrastructure to bring new gas from the East Mediterranean gas reserves.

On 2 January 2020, the Intergovernmental Agreement on EastMed Project was signed by Greece, Cyprus and Israel and was successfully ratified by the all the Parties. The IGA confirms that the Parties recognize the strategic importance of EastMed and acknowledge the significance to facilitate the timely development and realisation of the Project. In addition, on 5 May 2020, the Greek Parliament recognised the EastMed and Poseidon as projects of national importance and public interest for Greece.

4.3.14 TURKSTREAM TO EUROPE

At the first application of the Incremental capacity procedure, in 2017, two non-binding demand indications were received by European TSOs for the transportation of Russian gas quantities to be made through the TurkStream project. One of these involved the four TSOs of Bulgaria, Serbia and Hungary (Balkan route) and the other the TSOs of Greece and Italy (Mediterranean route). Following the procedures foreseen by Regulation 459/2017, some of the TSOs concerned in both cases published a Demand Assessment Report (DAR) and a Public Consultation Document and started discussions to study the technical, regulatory, legal and financial questions related to the possibility to design and realize the corresponding project. In the case of the Balkan route the gas transmission corridor is available along the countries BG-SRB-HU. In the main direction this corridor allows for physical flow from Bulgaria to Serbia from January 2021 and to Hungary through Serbia from October 2021. The deliveries further towards SK, UA, RO, HR and other countries in the region are available via existing IP capacities.

In the case of the Mediterranean route, the project considered is an extension of the IGI project (TRA-N-014) with an offshore section from the west coast of Greece to Calabria in Italy for a capacity of approximately 12 bcm. This project did not move forward as the promoters didn't receive any binding request in the incremental capacity cycle of 2017.

4.3.15 INTERCONNECTION BULGARIA-GREECE

The Greek-Bulgarian Interconnector Pipeline Project (IGB) consists of an approximately 182 km long pipeline (of which ~31 km located within the Greek territory), as well as the necessary supporting facilities (Metering Stations, Valve Stations, Operating Center). The pipeline's starting point is in Komotini and extends up to the area of Stara Zagora. IGB will have an initial transmission capacity of 3 bcm of natural gas per year, from Greece to Bulgaria, which can be upgraded up to 5 bcm of natural gas per year at a later stage, responding to market demand. In addition, the pipeline will be equipped to provide natural and/or commercial reverse flow. In 2015, with the support of the Bulgarian and Greek Governments and due to its various benefits for Europe, the IGB Interconnector was confirmed as a Project of Common Interest (PCI) and was also included by the European Commission in the fourth PCI List.

The construction phase is phasing a great progress with expected completion date within the first months of 2022, while the commencement of the commercial operation is expected by July 2022.


Picture courtesy of TAP

4.4 OTHER POTENTIAL SOURCES

4.4.1 PROSPECTS FOR GAS FROM TURKMENISTAN

Turkmenistan ranks among the countries with the largest gas reserves in the world, on the 4th place with about 10 % of total proved reserves of natural gas. The idea of exporting gas from Turkmenistan through a Southern corridor to Europe is widely discussed but transmission infrastructures are still missing. A potential opportunity is borne by the Trans Caspian Pipeline (TCP) project, which would connect Turkmenistan with Azerbaijan across the Caspian Sea. The TCP project is an offshore pipeline with a length of 300 km and a planned capacity of 32 bcm/y. The Caspian Sea is an area with a particular legal status that until recently prevented such projects. In August 2018 the five littoral states signed an agreement in Aqtau, which open the perspective of a development.

In January 2021 Azerbaijan and Turkmenistan states signed a memorandum of understanding on a joint exploration of the hydrocarbon field "Dastluk" located on the maritime border between the two states. This agreement is an important political signal that could give the necessary impulse for the next steps of the TCP. The progress of the projects within the Southern Gas Corridor together with the White Stream Pipeline could enable Turkmen gas to reach markets in Central and Northern European countries.

4.4.2 EGYPT[12]

According to the EIA country report 2018 (updated 24 May 2018), substantial natural gas discoveries have generated significant interest among business investors and may potentially boost production and allow Egypt to become a net exporter again in the medium term. Egypt is currently the third-largest dry natural gas producer on the continent, following Algeria and Nigeria.

Egypt held approximately 1,850 Bcm of proved natural gas reserves at the end of 2016, with about 850 Bcm only for the Zohr gas field. According to the 2020 BP Statistical Review of World Energy, production has re-bounced strongly from deepest production of ~40 Bcm in 2016 to ~65 Bcm in 2019 at a level above 2009. In August 2019, production of field reached more than 850 GWh/d, roughly five months ahead of the development plan. In 2020 development activities progressed at the Zohr project, targeting to ramp-up the field production capacity. The exploitation of the Atoll field follows a similar dynamic from February 2018: the development of the Zohr and Atoll fields has been fast-tracked by the Egyptian government under the umbrella of the West Nile Delta (WND) project.

Following the global gas demand and the effect of high gas prices and strong demand, after a 2020 year marked by COVID impacts, LNG facilities of Idku and Damietta have been restarted for feeding-in the Asian and European market, switching Egypt from a LNG importer to an LNG exporter according to the 2020 BP Statistical Review of World Energy.

Whether Egypt succeeds in becoming an energy hub and major exporter, depends on domestic factors and needs, its import (e. g. from Israel) and export (Jordan, Syria, through the AGP pipeline) balance and the international market.

12 This chapter has been updated collecting information from public accessible sources

5 CONTRIBUTION OF GASES IN THE SOUTHERN CORRIDOR TO MEET EU'S LONG-TERM DECARBONISATION OBJECTIVES

The world of energy is facing momentous challenges. The European Green Deal, presented by EC in 2019, set ambitious targets for Member States, in order to reach climate neutrality by 2050. The Commission's EU Green Deal communication concludes that greenhouse gas emission reduction goals for 2030 need to be increased from 40 % to either 50 % or 55 % to achieve this goal. These targets are being translated to climate laws adapted by each Member State. There is a growing realisation that significant public and private investments in energy efficiency, renewable energy, new low carbon technologies, renewable gases technologies and grid infrastructure will be needed in order to reach these ambitious targets.

Hydrogen and biomethane are expected to stand as key renewable gases and play an important role in the energy transition, as they are valuable energy sources that can be produced sustainably and distributed widely. Especially "green hydrogen", meaning the production of hydrogen from the water electrolysis using RES, is assumed to be the cleanest method by converting renewable energy to a storable and net carbon-free fuel.

However key elements remain to be identified in order to enable the creation of a liquid, pan-European renewable gases market. A clear and stable regulatory framework, policy developments and access to financial instruments (both national and European) will be needed in order to support the evolution of gas infrastructure to the future supply and demand of low carbon and decarbonised gases.

The decarbonisation of the electricity supply remains a key element towards a carbon-free system, however, "molecules" will still be needed for different parts of the value chain (e. g. balancing and storage, intensive and chemical industry, long-distance transportation, residential thermal needs).

5.1 ROLE OF GAS INFRASTRUCTURE AS ENABLER OF THE DECARBONISATION PROCESS

In this context the role that gas and related infrastructures play should be highlighted in achieving the targets for reducing emissions, promoting renewable energy sources and energy efficiency. In the energy transition, gas is able, on the one hand, to provide flexible, secure and diverse energy supply sources and on the other to support a process towards a low carbon economy at the lowest overall cost for the system, thanks also to the availability of an existing widespread infrastructure network.

The Southern Corridor infrastructure has seen decades of development. Existing infrastructure in the SC Region already supports decarbonisation through the displacement of more carbon intensive fuels (e. g. coal phase-out in heating, power and industry, or oil phase-out in the transport and marine sector) with the use of natural gas and through the medium to long term development of renewable gases such as biomethane, hydrogen and synthetic gas.

The gas Transmission System Operators (TSOs) of the SGC Region are ready to play their part in achieving a climate-neutral European energy system by mid-century and to facilitate the cost-effective transport of renewable and low-carbon hydrogen.

5.2 INITIATIVES ACROSS EUROPE TOWARDS ENERGY TRANSITION

The TSOs of the SC Region participate in various European initiatives towards clean energy transition and aim to leverage unique expertise among gas TSOs and energy companies in order to achieve the net zero targets in the most cost-efficient way. Below the focus is addressed to the most relevant ones.

5.2.1 EUROPEAN HYDROGEN BACKBONE

Twenty-three European gas TSOs from 21 countries participate in the European Hydrogen Backbone initiative, sharing the vision for the development of a nearly 40,000 km hydrogen pipeline network across Europe by 2040, at an affordable cost, based primarily on repurposed existing gas infrastructure and combined with targeted investments in new dedicated hydrogen pipelines and compressor stations.

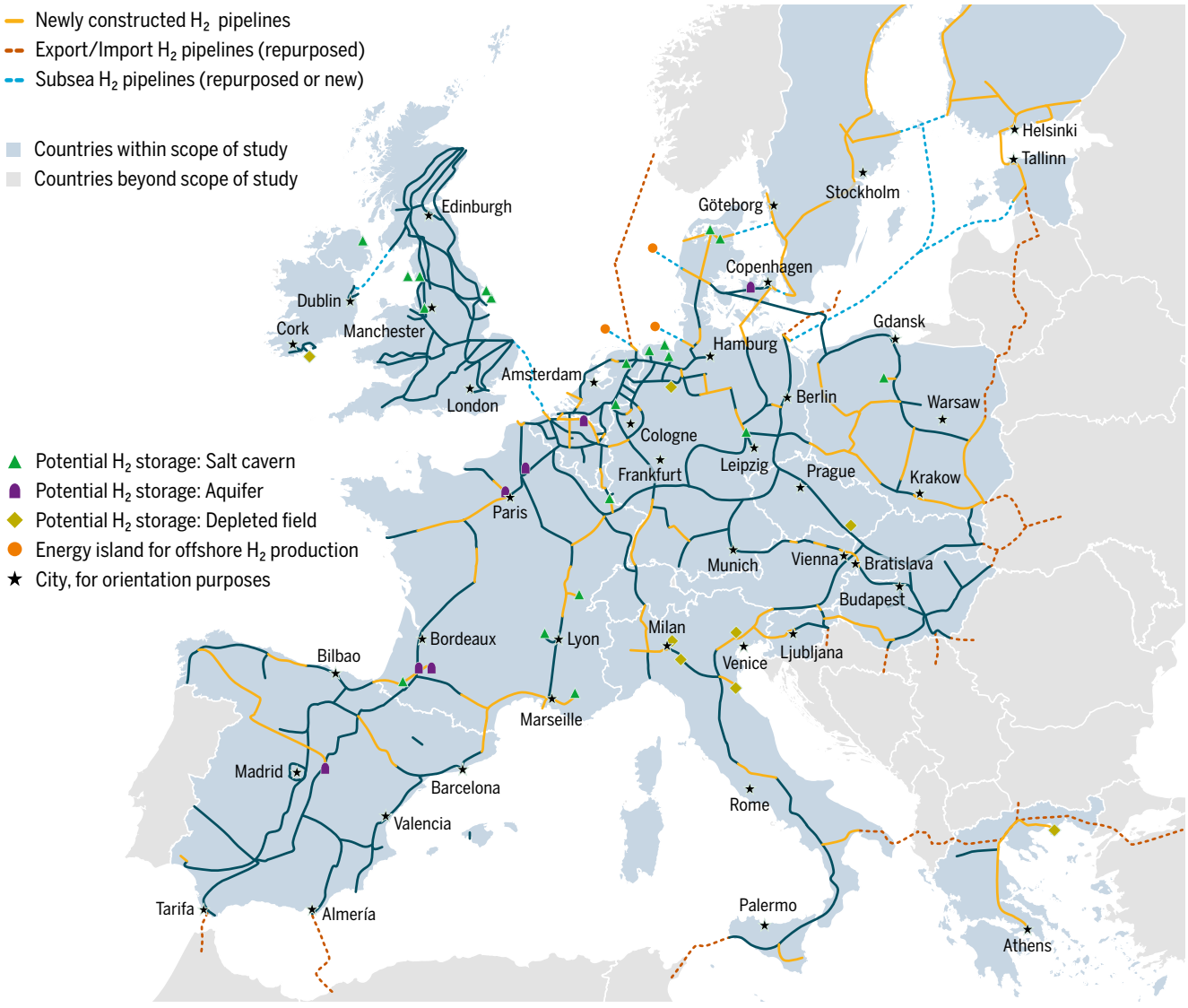


Figure 5.1: European Hydrogen Backbone by 2040 (Source: Guidehouse)

EHB published its report "Extending the European Hydrogen Backbone" in April 2021, presenting an updated and extended vision of the future European H_2 grid. More specifically, it presented updated hydrogen infrastructure maps for 2030, 2035 and 2040 with a dedicated hydrogen pipeline transport network largely based on repurposed existing gas infrastructure. The main outputs of the report were:

- By 2030, the EHB could consist of an initial 11,600 km pipeline network, connecting emerging hydrogen valleys.
- The hydrogen infrastructure can then grow to become a pan-European network, with a length of 39,700 km by 2040. Further network development can be expected after 2040.
- Possible additional routes could emerge, including potential offshore interconnectors and pipelines in regions outside the area where the EHB members are active
- An updated breakdown of repurposed versus new pipelines was presented and estimates of total investment costs up to 2040 (69 % of repurposed natural gas pipelines and 31 % new pipeline stretches)
- The investment per kilometre of pipeline is lower compared to the network investment costs as estimated in the initial European Hydrogen Backbone plan.
- The operating costs to transport hydrogen over 1,000 km are higher for smaller diameter pipelines compared to bigger diameter pipelines, confirming though that the EHB is an attractive and cost-effective option for long-distance transportation of hydrogen.

5.2.2 GAS FOR CLIMATE

Gas for Climate (GfC) is an initiative promoted by a group of leading European gas transport companies[13] and renewable gas industry associations[14], started in 2017 with the aim to analyse and create awareness about the role of renewable and low carbon gas in the future energy system in compliance with the Paris Agreement target to limit global temperature increase to well below 2 degrees Celsius.

GfC is committed to achieve net zero greenhouse gas emissions in the EU by 2050, supporting the transition to a fully renewable energy system in which biomethane and hydrogen play a major role in a smart combination with RES and Europe's well-developed existing infrastructure. This approach will help to reach this goal at the lowest possible costs and maximum benefits for the European economy.

These insights have been confirmed by a series of large studies, promoted by GfC consortium in the last few years, which indeed have analysed the future role and value of gas and gas infrastructure. More in detail, in March 2019 the consortium published the study "The optimal role for gas in a net zero emissions energy system" which assessed the cost optimal way to fully decarbonised the EU energy system by 2050 exploring the role and the value of gas and its infrastructure in achieving this goal. The study revealed that around 2,900 TWh of green hydrogen and renewable methane through existing gas infrastructure across the EU saves society over € 200 billion annually by 2050 compared to an energy system using minimal amount of gas.

Furthermore, in April 2020 the consortium published "Gas decarbonisation pathways 2020–2050", a study that develops possible pathways from 2020 to 2050 and identifies what investments and actions are needed across the energy system along the way.

5.2.3 EUROPEAN CLEAN HYDROGEN ALLIANCE

The European Clean Hydrogen Alliance (ECH2A) was announced as part of the New Industrial Strategy for Europe and it was launched on 8 July 2020 in the context of the hydrogen strategy for a climate-neutral Europe. ECH2A, which brings together industry, public authorities, civil society and other relevant stakeholders, aims at an ambitious deployment of hydrogen technologies by 2030, bringing together renewable and low-carbon hydrogen production, demand in industry, mobility and other sectors, and hydrogen transmission and distribution. With the alliance, the EU wants to build its global leadership in this domain, to support the EU's commitment to reach carbon neutrality by 2050.

The alliance brings together industry, public authorities and civil society, and can play a crucial role in facilitating the implementation of the European Hydrogen Strategy vision.

More recently, the ECH2A has published a report based on the contents and insights delivered by the participants to a series of operative roundtables on the main barriers that impact the roll out of renewable and low carbon production, transmission, distribution and to use, across the EU, the most relevant measures that should be addressed in the short or medium term to guarantee the ambitions of the European Hydrogen Strategy.

13 DESFA, Enagás, Energinet, Fluxys, Gasunie, GRTgaz, ONTRAS, Open Grid Europe, Snam, Swedegas, and Teréga.

14 Consorzio Italiano Biogas and European Biogas Association

5.3 DIFFERENT TECHNOLOGIES TOWARDS A LOW CARBON ECONOMY

5.3.1 BIOMETHANE

Biomethane is a fully renewable, flexible and efficient energy source, which is produced from biogas upgrading units. It can contribute to emission reduction targets by leveraging existing gas networks (having the same composition with natural gas) and increasing domestic methane production. This perspective would also have a positive impact on the agri-food sector, promoting an economic model based on sustainability and resource-friendliness, which at the same time significantly strengthens local economies. Biomethane is produced in two stages. First the production of raw biogas – mainly through anaerobic digestion of biomass takes place and following that any incompatible components (CO_2) are removed through a process known as "upgrading".

5.3.2 NATURAL AND RENEWABLE GAS FOR MOBILITY APPLICATIONS

Natural and renewable gas (in the form of CNG, LNG or bio LNG) as an alternative fuel for road and marine transportation offers important benefits for the decarbonisation of the transportation sector and provides a quick and cost-effective path towards meeting EU key objectives towards a net zero economy.

5.3.3 SECTOR COUPLING GAS-ELECTRICITY

Cooperation between the energy sectors, in particular electricity and gas, will reduce the costs of the energy transition and gas sector's decarbonisation. In that perspective and as also identified by ENTSO-G and ENTSO-E in their common position paper technologies such as Power to Gas (P2G)– and other P2X (e. g. Power to Liquid, Power to Heat, etc.) may have the potential to reduce the cost of the decarbonised energy system in particular when the end consumption is either gas or other high value energy forms.

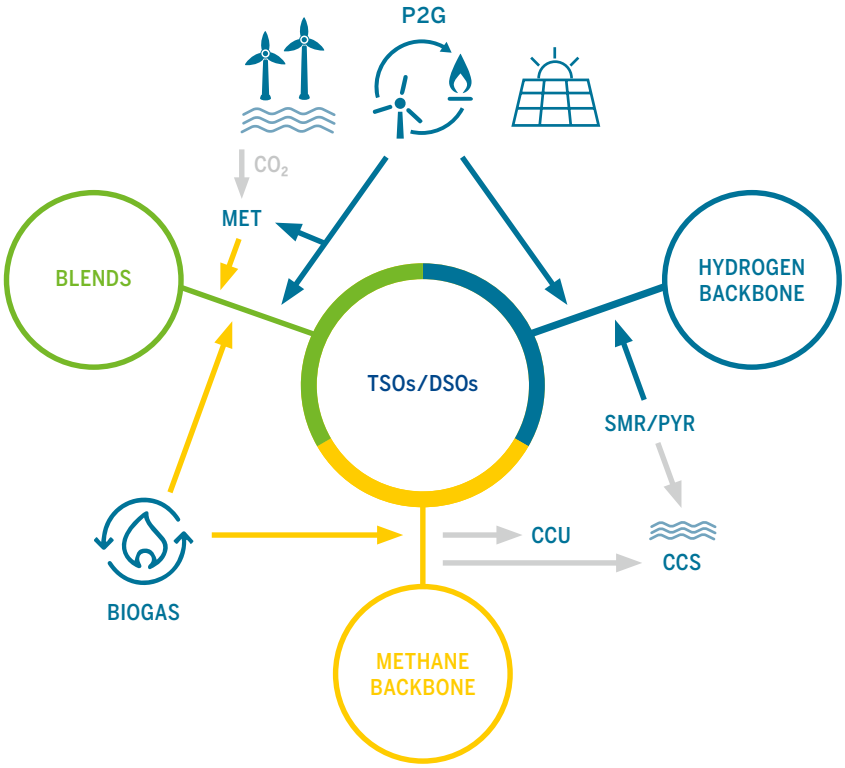


Figure 5.2: Principles for new gases transportation (ENTSOG 2050 Roadmap for gas grid)

Picture courtesy of Snam

5.3.4 H_2 PRODUCTION AND GRID DEVELOPMENT

Hydrogen is the cleanest possible, non-polluting fuel, that can be used to store, move, and deliver energy produced from other sources. It has potential uses in various end-use sectors, including industry, transport, power and distributed energy. Hydrogen is already used today in specific sectors, but most of it is produced directly from fossil fuels using – natural gas, coal and oil – leading to high CO_2 emissions. However when combined with carbon capture and storage (CCS) technologies the resulting product is highly decarbonised. Rapid technological advancements have led to more efficient ways of producing hydrogen through water electrolysis using as a primary source renewable energy resulting in green hydrogen. This is assumed to be the cleanest method of converting renewable energy to a storable and net carbon-free fuel.

5.3.5 CARBON CAPTURE STORAGE (CCS)

Carbon capture, utilisation and storage is an important emissions reduction technology that can be applied across the energy system in order to reach the net zero target. The Commission's proposal for a 2030 climate and energy policy framework acknowledges the role of CCS in reaching the EU's long-term emissions reduction goal.

5.4 SUSTAINABLE PROJECTS IN THE SGC REGION AND THEIR ROLE FOR DECARBONISATION PROCESS

In TYNDP 2020 ENTSOG, for the first time, opened for the submission of Energy Transition (ETR) projects which are defined as "any project which facilitates the integration of renewables, the achievement of decarbonisation and efficiency targets, reduction of other air pollutants, sector coupling initiatives and, more generally, all projects specifically aimed at the energy system transformation for reaching sustainability goals...". Along with the "traditional" projects described in previous chapter, the TSOs of the SGC Region have developed initiatives and innovative or pilot projects within their country that aim at taking steps towards sustainable transition to a greener energy system. In the following sections we present a country-specific overview of these projects that are relevant for the Southern Corridor Region.

5.4.1 AUSTRIA

Austria's vision to become a hydrogen nation

In the 2020–2024 programme[15] Austrian government revealed that hydrogen is expected to play a crucial role for energy system, recognising it as the energy carrier of the future. With the national hydrogen strategy still under development the Austrian Transmission System Operators Gas Connect Austria (GCA) and TAG have been active by drawing a vision on how the potential hydrogen infrastructure might develop in the next decades.

Renewable, decarbonised and low-carbon gases, especially hydrogen and biomethane, as well as sustainably generated electricity will be the backbone for achieving the European and national climate targets. As starting point, the focus is on the CO_2 reduction potential through substitution of existing fossil-based hydrogen applications, as well as future new hydrogen applications and process conversions up to space heating, combined with corresponding upscaling and adapted energy and feedstock management.

GCA and TAG projects

Category: Hydrogen

With the international and national transport of hydrogen via existing and future gas pipelines, a cost-efficient connection can be established between hydrogen production and hydrogen consumers. The transport of hydrogen via existing and future gas pipelines can be achieved by blending and deblending hydrogen into/from the existing gas network. An additional possibility how existing infrastructure could be used, is the repurposing of the existing infrastructure for dedicated pure hydrogen transportation.

Already today, the existing Austrian network has the potential to transport a content up to 4 % in the form of hydrogen blended with natural gas.

A vision for a dedicated hydrogen network is being developed in cooperation between GCA and TAG in the frame of the EHB initiative, presented at the beginning of this chapter, together with the other involved gas TSOs. The existing gas network is being examined for hydrogen compatibility with the help of comparative data and it is being determined which lines are basically suitable for transporting hydrogen. In a first extent, 2 categories were created:

a) Pipelines that are separated from the methane network and can be converted to hydrogen pipelines with relatively little effort. A parallel methane pipeline is still available. These lines are shown in blue in Figure 5.3

b) Necessary gap closures for a newly installed hydrogen network. These lines are shown in yellow in Figure 5.3

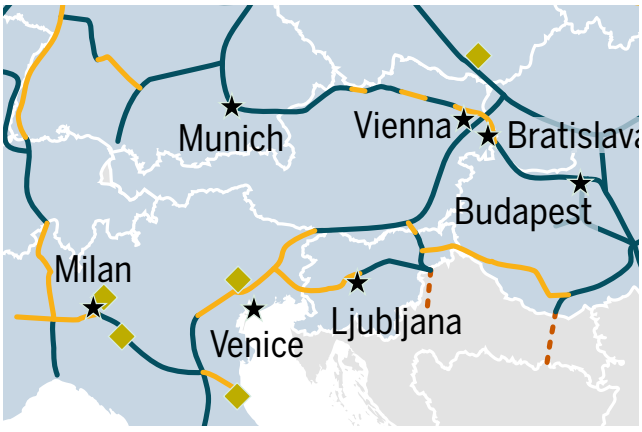


Figure 5.3: Austrian section of European hydrogen backbone (Source: Guidehouse)

15 Page 82; 23.10.2020 „ ... soll Österreich zur Wasserstoffnation Nummer 1 werden."

The foreseen timing for implementation could start in 2030, when a first step towards a dedicated hydrogen network could be reached via blending and deblending into/from the existing infrastructure connecting Slovakia, Hungary, Slovenia, Italy and Germany.

By 2035, one of TAGs parallel pipelines could be repurposed to transit H_2 in both directions (from north to south and vice-versa). Furthermore, 3 interconnectors from Italy, Slovenia and Hungary could already emerge enabling H_2 transportation from North Africa and Ukraine to Slovenia, Hungary and Germany via Slovakia and Czech Republic. Finally, by 2040 an additional interconnector to Germany could be added by entirely looping GCA's WAG pipeline offering an alternative transport route of Ukrainian H_2 to Germany (Slovakia to Germany). Upon completion, Austria's high-pressure grid would be ready to serve as a H_2 hub in the region. From then bidirectional H_2 transportation possibilities, at all interconnection points would be in place.

Although the timing is heavily dependent on both supply and demand of H_2 taking off and decreasing gas flows, the transported energy could provide security of supply when domestic production of hydrogen in North Europe is limited. In addition, GCA's network would also transport H_2 to Austrian (industrial) customers, such as one of Europe's largest steel plants in Linz, which is already running trials for hydrogen-based steelmaking and to a big refinery located near Vienna.

Category: Sector coupling gas-electricity

P2G4A (ETR-N-896)

The underlying (sandbox) project promoted by Gas Connect Austria GmbH represents a Power-to-Gas project at a strategically important location in Austria with the aim to convert renewable electricity into hydrogen and to inject it into the existing gas grid. The expected size of the electrolyser amounts to approximately 50 MW, that could be characterised by the following technical parameters:

The plant is operation when excess electricity is generated from wind energy (current assumption), more in detail a wind turbine in operation 1800 hours per year

In this calculation, the plant is operated grid-supportive. Hence, synergies with PV plants and other excess energy producers are not factored in

Estimates are currently difficult because the legal framework (national and European) is still lacking. However, according to the aforementioned conditions a potential hydrogen production in the amount of approximately 50.5 GWh/a has been calculated.

5.4.2 BULGARIA

Green transition at the heart of the Bulgarian Recovery and Resilience Plan

To meet EU's decarbonisation targets the Integrated Energy and Climate Plan (INECP) of the Republic of Bulgaria 2021–2030 envisages many measures aiming at reducing GHG emissions and increasing the share of energy from renewable sources in gross final energy consumption.

Natural gas is considered a transition fuel in the process of transition to the zero-carbon GHG emission economy. Thus, it is a priority for Bulgaria to diversify the sources and the routes for its natural gas supply.

In Bulgaria the energy sector has the highest share in total GHG emissions. Coal-fired generation of electricity and heat contributes to over 90 % of the GHGs in the sector therefore the main potential for emission reduction is concentrated here. According to the INECP, the GHG emission levels in the energy sector will decrease by approximately 19 % until 2030 as compared to 2015.

The INECP sets out the main objectives and measures for the implementation of Bulgaria's national energy and climate policies and the principles and priorities for energy sector development.

The objectives set out in the INECP are as follows:

- promoting low-carbon economic development
- developing a competitive and secure energy sector
- reducing dependence on fuel and energy imports
- ensuring that energy is available at affordable prices to all consumers

In terms of hydrogen, the draft Bulgarian Recovery and Resilience Plan envisages:

- Adoption of a National Roadmap to improve the conditions for unleashing the potential of hydrogen technologies and mechanisms for production and supply of hydrogen
- Designing, building, and commissioning of infrastructure in Maritsa East coal basin, adequate for the transmission of hydrogen and low-carbon gaseous fuels
- Scheme to support pilot projects for production of green hydrogen and biogas

Another initiative in which Bulgaria intends to participate is National research programs of the Ministry of Education and Science, aiming to generate know-how with a focus on the storage and conversion of renewable energy, hydrogen-based technologies, and eco-mobility, conducting fundamental and applied research. The programs will be implemented over 3 to 5 years.

Bulgatransgaz projects

Category: Hydrogen

A pilot project for a hydrogen plant with a total installed capacity of 20 MW is planned to be developed. Based on project results an analysis of the further development of hydrogen power plants after 2030 will be conducted.

In terms infrastructure the draft Recovery and Resilience Plan envisages construction of about 125 km gas transmission infrastructure in the Maritsa East coal basin, suitable for transport of hydrogen and low-carbon gaseous fuels. The new infrastructure is planned to be part of Bulgartransgaz EAD network. It will be accessible to all consumers, including coal-fired power plants.

The main purpose of the scheme to support pilot projects for production of green hydrogen and biogas is to provide support for designing pilot projects enabling the introduction of green hydrogen and biogas with application in industrial productions, as well as to be used in the future in transport and for electricity and thermal energy production. The specific objectives of the scheme are:

- Establishing strategic frameworks to identify potential opportunities and challenges through consultation with stakeholders
- Development of pilot projects allowing the introduction of green hydrogen and biogas in industrial processes, with a view to their future use in transport and for the production of electricity and heat
- Create a knowledge cluster and solutions for the production of renewable gases, their application for sector integration, in order to stimulate innovation through promotion, exchange of knowledge and experience, knowledge transfer, building a platform with a database of knowledge and innovation, dissemination of information and cooperation between enterprises.

As a first step, a report for evaluation of the potential for the development of hydrogen technologies will be prepared. The barriers to the development and implementation of these technologies will be identified and proposals for regulatory changes will be prepared to improve the conditions for unleashing the potential for development of hydrogen technologies and the mechanisms for production and supply of hydrogen. Indeed, as part of the Plan, 55 MW electrolyser projects that will produce 7800 tonnes per year of green hydrogen are envisaged.

Finally, the draft Recovery and Resilience Plan envisages also a project for the construction of highly efficient combined cycle gas plant which will replace at least 1.0 GW coal based capacity in TPP Maritsa East 2. As a next step, by the end of December 2029, the installed 1.0 GW coal based capacity will be transferred to a hydrogen power plant.

5.4.3 CROATIA

Croatia has a well-developed gas transmission and distribution system. The total length of the gas transmission system is over 2,500 km and of the distribution system over 18,000 km. More than 680,000 consumers in 19 out of 20 counties and the city of Zagreb (the number of direct natural gas users via the district heating system is significantly higher) are supplied with gas directly via the distribution system. With the regional and the European gas system, the gas transmission system is connected via interconnections with Hungary and Slovenia, and with the LNG world market via the LNG terminal and evacuation gas pipelines, providing the transmission of gas towards the regional and European markets.

Plinacro projects

Category: Hydrogen

Infrastructure requirements for hydrogen transmission will remain limited in the first phase since the demand will initially be met by the production in the vicinity or at the point of consumption. Mixing with natural gas is expected in certain areas. The planning of transport infrastructure for the transmission of clean hydrogen, and infrastructure for the capture and use of CO_2 will begin immediately to facilitate the use of certain forms of hydrogen with a low share of CO_2 emissions. Planning the development of the network for the transmission of hydrogen and CO_2 will be based on the principle of the lowest cost, i. e.on optimising the use of the existing gas infrastructure and the conversion of the existing gas pipelines into the pipelines for the transmission of hydrogen and CO_2.

In the second phase, infrastructure intended for hydrogen (newly built or infrastructure from the converted gas pipelines for natural gas) will transport hydrogen not only for industrial and traffic use and for the purpose of electricity balancing, but also for the heat supply for residential and business buildings. At this stage, there will be a need for the transmission infrastructure at the level of the whole Croatia and the EU. All necessary steps will be taken to enable the transmission of hydrogen from the areas with high renewable potential to the demand centers located in areas with lower renewable energy potential, as well as to other EU or EC Member States. Croatia will be actively involved in the development of the backbone of the future pan-European infrastructure for hydrogen transmission. Wherever technically and economically justified, the existing gas network will be adjusted for the transmission of renewable hydrogen over longer distances, while larger hydrogen storage facilities, assumed to become needed in this phase, will be considered, and developed. The European Union expects the development of international hydrogen trade, especially with the EU's neighboring countries in Eastern Europe and the southern and eastern Mediterranean countries, so Croatia will take all necessary actions to participate in the development of the open international hydrogen market with its geographical and infrastructural potential. Depending on the market developments and achieved national potentials for hydrogen production, the existing location for the LNG terminal will be converted into a location for the supply or export of renewable hydrogen.

Croatia will take advantage of its favorable geographical location and the potential of the existing gas transmission system, and, when needed, it will build new gas pipelines for the transmission of hydrogen to position itself as an important link for the transmission of hydrogen from Eastern Europe, the Balkans, and the southern and eastern Mediterranean countries to hydrogen users in Croatia and towards a growing regional and European hydrogen market.

Category: Mobility applications

CNG filling station system development (CroBlueCorr project) (ETR-N-898)

Plinacro is planning to initiate activities to encourage the construction of compressed natural gas filling stations (CroBlueCorr project) at 11 locations of petrol stations on motorways and other main traffic routes in Croatia. Initially, funds should be provided for 10 connections to the high-pressure transmission system. The project is expected to be commissioned between 2024–2026.

5.4.4 GREECE

Integration of new gases into DESFA's business will be vital

DESFA aims to become an essential driver of tomorrow's energy system by promoting and accepting renewable gases to its pipelines. Hydrogen and biomethane stand today as the two most promising renewable gases of a decarbonised future and DESFA is developing towards both of them.

The fact that the existing, planned and future natural gas infrastructure could transport (up to a level) blends of hydrogen, provides a solid first step for the development of the market and connecting hydrogen production sites with potential demand, until dedicated (or repurposed) hydrogen pipelines are used to transport pure hydrogen. DESFA and TAP through their participation in the "White Dragon" and other similar energy transition projects in South East Europe, validate their commitment to identify hydrogen and other low carbon gases business opportunities over the next years, in line with the regulatory developments at both EU and national levels, with a view to contributing to the achievement of decarbonisation goals of the EU Green Deal. At the same time, DESFA investigates the opportunities to develop the emerging biomethane market in Greece, by contacting potential producers and assessing the opportunity to inject biomethane to the HP gas network.

At a national level, a Committee for the national H_2 strategy has been formed, with the participation of all the national major stakeholders. The National Hydrogen Strategy is expected to be published in the beginning of 2022 and will include alternative scenarios regarding the development of the hydrogen market in Greece along with several roadmap proposals, also including potential pilot projects and required regulatory adjustments.

Category: Sector coupling

White Dragon project – a complete "green" hydrogen value-chain

Ten key players[16] partner for the development of an innovative integrated green hydrogen project in Greece which covers the entire hydrogen value chain (Fig 5.4). The core of the White Dragon cluster project is based on utilisation of GW-scale variable renewable electricity, short-term energy hydrogen storage and green combined heat and power (CHP) production through high-temperature fuel cells.

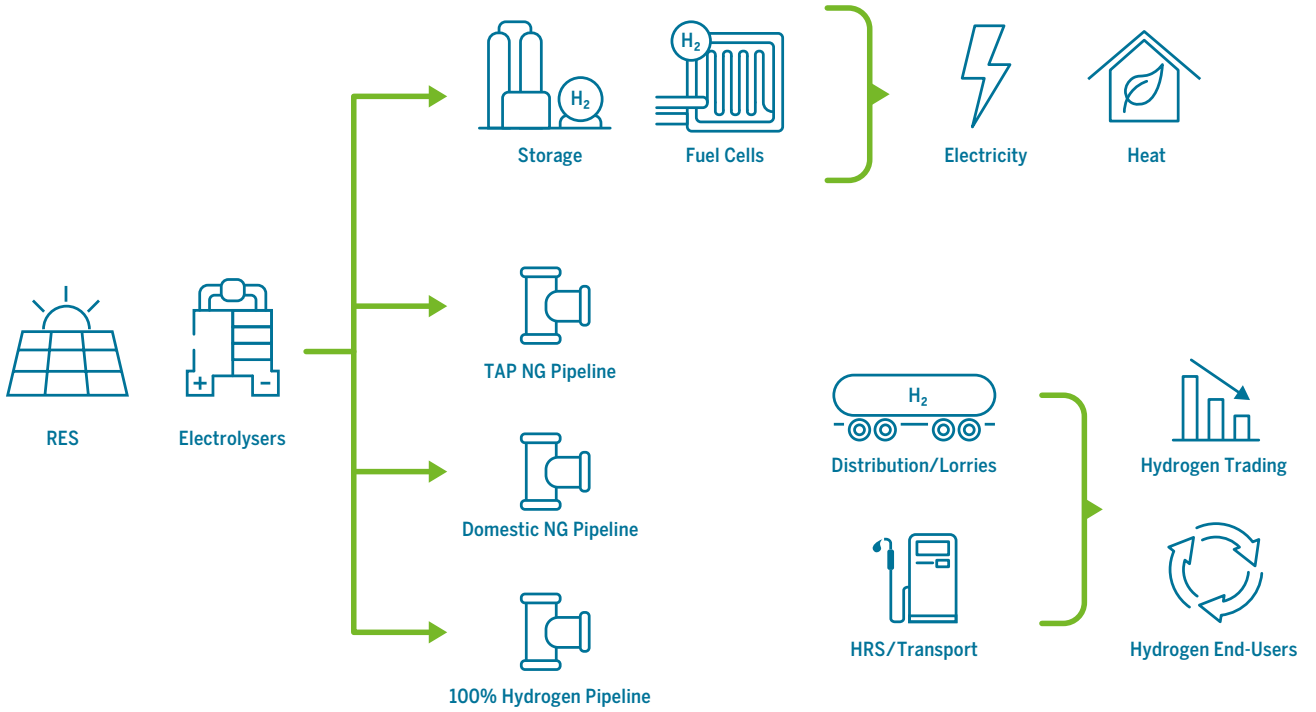


Figure 5.4: White Dragon value chain

16 The partners of the White Dragon are the following companies DEPA Commercial, as project coordinator, in collaboration with Advent Technologies, Damco Energy (Copelouzos Group), PPC, DESFA, HELLENIC PETROLEUM, Motor Oil, Corinth Pipeworks, Trans Adriatic Pipeline (TAP) and Terna Energy.

Furthermore, additional key objectives of paramount importance are considered:

- the development of a high-tech R&D&I hydrogen research center and hub in Greece,
- the capitalisation of the existing energy infrastructure and natural gas pipelines for long-term storage and transportation of green hydrogen with the establishment of an Energy Net Metering Scheme,
- the implementation of a dedicated hydrogen backbone infrastructure in Greece and,
- the build-up of a national hydrogen mobility sector (distribution/HRS).

The project has been included in the application process for the Important Projects of Common European Interest (IPCEI) status[17].

With the participation of TAP, the cross-border transportation of blend of hydrogen may be enabled from Greece to Italy. TAP participates in the White Dragon IPCEI cluster with its "TAP Hydrogen Readiness" project, whose objective is to enable larger scalability of renewable hydrogen production in Greece by transporting hydrogen in blend (and foster similar activities in countries along the Southern Gas Corridor and its neighborhood).

Specifically, the role of TAP, subject to certain conditions as described in the relevant application, is envisaged as an enabler of the cross-border transportation of hydrogen in a blend with natural gas, allowing the access of a wider network (including Italy), to hydrogen potentially produced in Western Macedonia from the surplus of electricity obtained from renewable energy sources and which may not be consumed locally by Greek domestic consumers.

TAP's role in the White Dragon cluster could therefore be a backbone infrastructure & enabler of cross-border transportation of hydrogen produced in West Macedonia up to Italy. TAP could therefore be a long-term safe and reliable transportation means for hydrogen blended with natural gas, from West Macedonia to Italy, where TAP then interconnects with the domestic natural gas transmission system of Snam Rete Gas. All in all, TAP's Hydrogen Readiness project could ultimately facilitate the establishment of an important hydrogen downstream market in South East Europe and Western Balkans, while functioning as a flexible offtake source, enabling a positive cross-border impact, and promoting the role of Greece as a hydrogen hub in the future.

The TAP Hydrogen Readiness potential project implementation (construction/engineering) may potentially include, amongst others:

- Retrofit of existing pipeline facilities, as required.
- Provision of additional compression power/unit in its current and/or additional compressor stations to transport the additional volumes, especially considering the lower energy density of hydrogen and hydrogen blends.
- Potential installation of blending/deblending facilities, as required by the project.
- Installation of smart metering equipment along with the application of digital solutions for gas quality tracking.
- And any other solution needed to provide a safe and reliable transportation for the hydrogen blend.

Figure 5.5: DESFA and TAP network in Greece

Due to its role in Greece and the South-East European region, DESFA as the national TSO can act as an important enabler for the development of the hydrogen market of the region in the coming years.

DESFA's existing and future network (Figure 5.5), through progressive incorporation of growing quantities of hydrogen, can create the conditions for initiating a clean hydrogen value chain in Greece, by the development of infrastructure which could connect future hydrogen production and consumption sites and thus link all hydrogen clusters. With the growth of domestic production and demand and consider-

17 Please note that this report was written and covers the activity that took place during 2020 and 2021, without including the latest developments which surfaced starting from the beginning of 2022 in relation to the IPCEI application process.

ing the specific nature of the hydrogen market in Greece, where the large majority of consumption is expected to come from industrial uses of pure hydrogen as feedstock product, the development of a future dedicated hydrogen pipeline system, running in parallel to a section of the national gas transmission system, is envisaged.

DESFA's contribution to the White Dragon project consists of two sub-projects:

- A comprehensive assessment and gap analysis of the gas transmission system shall be conducted regarding its readiness to accept and transport growing percentages of hydrogen blended into the natural gas. All necessary adaptation measures for up to a specific hydrogen blending percentage, depending on the level of identified gaps, shall be performed. This will support all initiatives of early clean hydrogen production on the route and a possibility for gas consumers to lower their carbon footprint. A detailed market assessment shall be performed, which will identify, at a region-by-region basis, along the whole existing and anticipated DESFA network, the potential for production, consumption and storage of hydrogen.

- A dedicated hydrogen pipeline will be designed, based on the assessment results and constructed. The pipeline shall operate in parallel with the gas pipeline and will connect the main industrial areas with the possible production and storage sites.

In the short-term horizon, DESFA plans a 156 km of high-pressure pipeline, connecting the region of Central & Western Macedonia with the main transmission system designed to also transport hydrogen, up to 100 %. This pipeline will carry necessary natural gas quantities when production in the area of Western Macedonia starts and enable the blending of excess Hydrogen quantities. If produced quantities exceed local demand, such quantities will be transferred, through reverse flow, to the main DESFA network.

H_2 production and grid injection pilot project

DESFA plans to implement a pilot project as small scale R&D facility that will be used for testing the natural gas pipeline and accompanying equipment for the max percentage of hydrogen which can safely be injected in the gas network. As described in figure 5.6 hydrogen will be produced by electrolysis from electricity generated at a nearby photovoltaic park (Green Hydrogen). The green hydrogen shall then be injected before the entrance to the 70/19 M/R Station in the metallic shed training facility and, following the process of gas pressure reduction and measuring, will end to the central heating facility of Nea Messimvria O&M main building. The project is related to the hydrogen readiness transformation of DESFA's network and along with a relevant study can contribute to industrial scale hydrogen-friendly solutions.

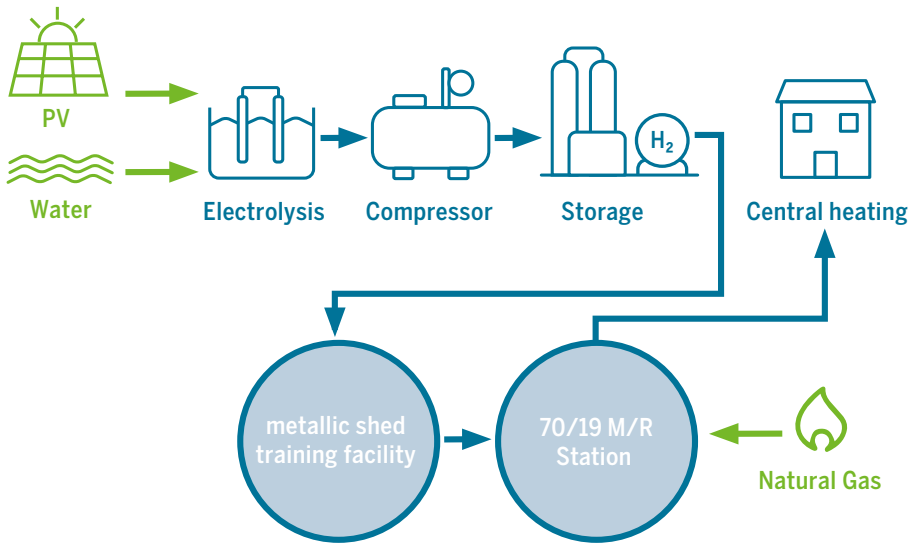


Figure 5.6: Pilot H_2 production and grid injection

Blue Med project
DESFA participates in this project with commercial companies Motor Oil and PPC for the production of blue hydrogen of a very low carbon footprint as well as green hydrogen with an implementation timeline of 2025. The goal is to produce green and blue hydrogen for the transmission and distribution to industry (refineries) and transportation (buses and ships).

Category: Biomethane

Biomethane production and grid Injection pilot project
Biomethane is a promising solution in meeting the challenge of transitioning to a green energy system at affordable cost while maintaining high energy security.

DESFA, committed to its strategic goal to explore solutions that combine environmentally friendly and state-of-the-art solutions that mitigate its carbon and methane emissions footprint, considers developing a large scale biomethane production and grid injection plan, with the scope to turn waste into biomethane to be used for its own consumption requirements (for instance the existing and the new compressor stations), as well as for being injected to the national gas grid in order to neutralize its emissions footprint. Taking into account that biomethane conversion and injection technology is at its nascent stages, implying high entry costs, DESFA plans to explore the opportunity and challenges by implementing a pilot project.

This project entails the upstream and downstream development of a biomethane pilot business model to produce and inject biomethane to the National Natural Gas Transmission System from agricultural and farm feedstock in the area of Serres, Central Macedonia or in the area of Ampelia, Thessaly for own consumption purposes, such as replacing natural gas consumed for the operation of its current compressor station in Nea Messimvria or future compressor station in Ampelia, respectively. The final selection of the development site will be determined after assessment of the available feedback on feedstock availability and other critical criteria such as (land and soil quality, protected areas, availability of water, distance from urban, commercial and infrastructure areas, adequate shape and available area for potential site etc).

The project consists of:
- the collection and processing of necessary portfolio of agricultural/farm and industrial waste
- the construction of a digester facility to convert waste to biogas
- the construction of the upgrading facilities to convert biogas to biomethane
- the construction of the connection pipeline to inject gas in the CS

Category: Natural and renewable gas for mobility applications

Truck loading pilot station in Revithoussa LNG Terminal
Following the strong interest expressed my market players for the supply of off-grid customers DESFA has included in its National Development Plan the construction of a pilot truck loading station. The project will give the possibility for the use of natural gas in off grid areas, where the natural gas transmission system is not developed yet (e. g. islands and western Greece), along with its use in shipping for the fueling of vessels (for vessels using LNG as marine fuel).

The station will have one loading bay for 50 m³ trucks with a loading capacity of 100 m³/h. It will also include provision for a future second bay. The station will be located on the existing LNG terminal of Revithousa. The project will be ready for commercial operation until May 2022.

Small Scale LNG jetty in Revithoussa Terminal
Construction of a new jetty in the LNG terminal of Revithoussa that will serve the loading of LNG to small scale ships (1,000 m³ and up to 30,000 m³ of LNG). The smallest ships will primarily be used to supply vessels powered by LNG (cruisers, containerships, Ro-Pax), in the port of Piraeus primarily and possibly other ports in the vicinity of Revythoussa. The larger ships will transport LNG to satellite LNG storages and distribution stations in other coastal locations in in Greece, either to ports (such as Patras), or off-grid installations where gas consumption will be regarded as feasible, including islands, through virtual pipeline schemes. The project will be operational by beginning of 2023.

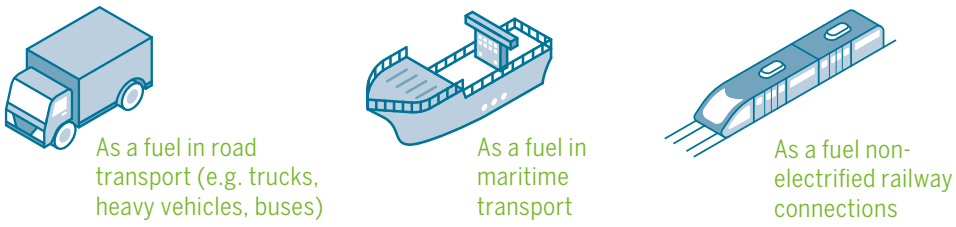


Figure 5.7: Small scale LNG applications

Picture courtesy of FGSZ

5.4.5 HUNGARY

Hungary's green path

In May 2021 the Hungarian Government accepted Hungary's National Hydrogen Strategy (NHS). The main goal is the establishment of a hydrogen economy in Hungary, therefore contributing to the achievement of decarbonisation goals and providing an opportunity for Hungary to become an active participant of the European hydrogen sector. The strategy, which plans to establish two new hydrogen valleys by 2030, also define the conditions necessary to produce low-carbon and carbon-free hydrogen that is in compliance with user requirements. More in detail, the hydrogen production will be competitively priced by promoting the implementation of centralised and low-carbon production methods able to satisfy large volumes of local, industrial demand, and decentralised carbon-free production methods able to satisfy minor demand.

At first, NHS's goal is to promote hydrogen usage in industrial sector with the aim to reduce the carbon footprint of industrial processes and product use is to be achieved through the usage of low-carbon hydrogen, with a shift to carbon-free hydrogen in the longer term. Furthermore, the general goal of the NHS as regards the transportation is speeding up the transition to clean methods of traffic partly by way of hydrogen usage, promoting the expansion of hydrogen mobility to bus traffic and waste collection, and, at the same time, the construction of a hydrogen refuelling infrastructure based on an island, as well as a corridor logic.

To implement the Strategy there are 6 comprehensive "prioritised projects", which, till 2030, are complemented by professional measures scheduled along 3 timelines. These projects, which are meant to implement the primary goals of the Strategy and which should be launched as soon as possible, are as follows (with the estimated subsidy requirements in parentheses):

1) Green Truck Programme for making freight traffic greener (HUF 35–40 bn)

2) Green Bus Programme Plus for making public services, concerning transportation at the local level, greener (HUF 10–20 bn)

3) Establishment of hydrogen valleys in Hungary to promote the establishment of interconnected networks of the hydrogen value chain within the given geographical regions (HUF 10–15 bn)

4) Hydrogen Highway Project for creating a foundation for carbon-free hydrogen production, transportation and energy storage (HUF 20–30 bn)

5) Blue Hydrogen Project for reducing the carbon footprint of industrial hydrogen usage (HUF 20 bn)

6) Research, development and innovation in service of the establishment of a hydrogen economy (HUF 10 bn)

2021-2023 ESTABLISHMENT OF FRAMEWORKS	2024-2025 FIRST RESULTS	2026-2030 RISE
The development of the implementation framework of the Strategy and the operational plans of the hydrogen economy, the establishment of the conditions necessary for producing low-carbon hydrogen, the launch of electrolysis-based hydrogen production and prioritised comprehensive projects, and the preparation of associated test projects will be in focus during this stage. In addition to all this, the installation of hydrogen refuelling points, the development of an educational-training background, and the establishment of international cooperative partnerships will also begin. Since hydrogen demand will be satisfied at first near or at the site of production, the need for transportation infrastructure will be limited to a minimum.	Developments concerning all pillars of the Strategy will be launched, with particular attention being paid to the building of domestic manufacturing and service background capacities. The reduction of the carbon footprint of existing hydrogen production and usage will gain momentum in the refinery sector, in the petrochemical industry and in ammonia production. Hydrogen production through electrolysis will expand, and hydrogen-based mobility will be introduced to heavy-duty vehicle traffic. The infrastructural requirements associated with hydrogen transportation will remain limited, as, in the beginning, demand will be satisfied near or at the place of production. However, in certain domains, the small scale blending of hydrogen and natural gas may alreahy occur in certain sectors. Additionally, the drawing up of the concept of regional connection to the European Hydrogen Backbone and the expansion of the hydrogen refuelling infrastructure network will continue.	As the previously initiated developments become productive, the partial decarbonisation of existing industrial hydrogen usage will be realised, industrial production processes will be made more green, and the transition to clean methods of transportation will become more accelerate. The basis for the countrywide network of hydrogen refuelling stations will be established, and the natural gas transportation, storage and distribution network and the user systems will be prepared for the uptake of larger rates of clean hydrogen will begin. The first hydrogen valleys will also serve as proof of the successful implementation of the Strategy. By the end of the period, our hydrogen economy will be integrated into the European hydrogen economy. As regards costs, low-carbon and carbon-free hydrogen is becoming increasingly competitive against “grey” hydrogen. Expanding hydrogen uses to cover additional domains (steel production, cement industry) will require additional intervention.

Figure 5.8: The scheduling of the policy actions up to 2030

Between 2030 and 2040, with the advancement of technology, it can be expected further increases in the use of hydrogen. In the period after 2040, the use of hydrogen technology may further expand in the natural gas network and the cooling-heating sector.

FGSZ’s vision in short and medium term envisage:

- In the first five years, the introduction and consequent uptake of blended hydrogen with natural gas
- New entry points for the injection of pure or blended hydrogen
- Upgrading of the gas quality requirements due to the introduction of blended gases, that will require the establishment of a gas quality management system
- Repurposing of existing natural gas pipelines for the transportation, according to the demand evolution, of hydrogen blended with natural gas or pure hydrogen. Moreover, FGSZ looks to the possibility to connect to the European Hydrogen backbone system
- Possible substitution of some of the current gas driven turbine compressor unit with electric driven compressor unit

5.4.6 ITALY

Italy's commitment to energy transition: the role of Snam

The fight against climate change and a shift towards a full decarbonised economy require the containment and reduction of greenhouse gas emissions, energy efficiency and the search for innovative and low-impact solutions. In this context, gas infrastructure not only will continue to provide a flexible, secure and resilient energy source, but it will also support the process towards a low carbon economy at the lowest overall cost for the system, allowing the decarbonisation process through the development of renewable gases such as biomethane, hydrogen and synthetic gas.

Snam is focusing on these challenges by leveraging on sustainable, safe and technologically advanced infrastructures, suitable to transport and store natural gas, as well as increasing shares of renewable gases such as biomethane and hydrogen.

In this context, Snam focused on further strengthening its efforts to be fully aligned with the Paris objectives and substantiated its commitment for the future by defining a strategy to achieve carbon neutrality by 2040. Indeed, leveraging on its assets and competences Snam is playing a fundamental role to delivering the energy transition, confirmed by the planned investments that will aim to constitute a multi-molecules energy networks, that will be characterised by the coexistence of methane, biomethane, and hydrogen that could be safely injected, transported and stored in the infrastructure network.

These efforts are reflected by the numerous new initiatives that Snam has planned and launched in the last period years and characterised by a direct focus on energy transition: many of them were already part of the last TYNDP 2020 as ETR projects, but additional projects emerged most recently.

Snam projects

Category: Natural and renewable gas from mobility applications

CNG and LNG Station (ETR-F-516), Microliquefaction plants (ETR-N-528), H_2 Stations Development (new)
Natural gas in the form of CNG (compressed natural gas), LNG (liquified natural gas), biomethane, and BIO LNG (liquified biomethane), represent the green alternative to traditional fuels, improving the decarbonisation process of the transport sector as these fuels cut down particulate emissions and significantly reduces carbon dioxide and nitrogen oxides.

Snam has promoted and developed innovative and green solutions by allowing, leaning on an extensive and interconnected gas network, the decarbonisation of the transport sector. More in detail, with the **project CNG and LNG station**, included in the last TYNDP 2020 **(ETR-F-516)**, Snam goal is to contribute to develop around 150 CNG and L-CNG stations in Italy to be connected to the gas network, in order to make this solution increasingly available to cars, buses, trucks and potentially also ships and trains. According to the technical features, the 150 stations will be able to deliver up to 910 GWh/y. Up to now over 150 stations have been effectively contractualized, of which 36 are already operational and the aim is to increase this number reaching the target of 150 stations connected to the grid by 2025.

Furthermore, biomethane makes mobility renewable and even more green, as this resource emits almost zero levels of dust and it further reduces CO_2 down to zero compared to methane and traditional fuels. Particularly, its liquefaction and consequent transformation into bio-LNG is the already available technology for the development of fully renewable fuels and zero CO_2 for heavy vehicles. In this context, Snam is developing the **project Microliquefaction Plants**, also included in the last TYNDP 2020 **(ETR-N-528)**, which consists in developing the required grid interconnection for 2 micro-liquefaction plants in Italy dedicated to LNG and bio-LNG, which aims to develop sustainable mobility by making these decarbonised fuels increasingly available in the heavy transport, marine and rail sectors.

Finally, to further boost the energy transition in energy sector, Snam is planning investment to support hydrogen uptake also in mobility sector by developing **H_2 refuelling stations** for light and heavy vehicles evenly distributed over the country, which could materialise as soon as the hydrogen network will start to emerge. The hydrogen is expected to come from renewable sources, both from local and centralised production sites, exploiting the potential of future hydrogen network.

Category: Sector coupling

Hybrid Compressor Stations (ETR-F-599)

With the aim to support and promote sector coupling initiatives, Snam has launched the project **Hybrid compressor station (ETR-F-599)**, which consist in the installation of new electro compressors in partial substitution of gas compressor power (particularly the elders). In more detail the project foresees the installation of:

- two new electro compressors in Malborghetto compressor station for a total of 24 MW (FID);
- two new electro compressors in Messina compressor station for a total of 24 MW (FID);
- one new electro compressor of 15 MW in Poggio Renatico compressor station (FID);
- three new electro compressor of 25 MW each for a total of 75 MW, respectively at Istrana, Montesano and Gallese compressor stations (Less Advanced);

The project, enabling the coupling of electricity and gas sectors, represents an important step in the energy transition process, contributing positively to the efficiency and the decarbonisation of energy system, as the increase in efficiency determined by the electro compressors allows to cope gas compression needs with a lower consumption of primary energy, with consequent cost savings and, at the same time, a reduction of greenhouses gases and other negative externalities.

Therefore, in a sector coupling perspective, the new electro compressors will represent an additional flexibility resource for the electricity system, reducing the costs and allowing for a more efficient integration of renewable generation.

Category: Biomethane

Biomethane Plants Developments (ETR-F-523)

The contribution of biomethane to the decarbonisation objectives is not limited to the energy consumption phase only, as it can help to significantly reduce emissions in the farming sector and restore organic matter to the soil.

In this context Snam is promoting initiatives aimed at supporting, by the use of gas infrastructures, the uptake of biomethane and its use in different sectors, consistently with its commitment to foster energy transition. Indeed, with the project **"Biomethane Plants Development"**, included in last TYNDP 2020 **(ETR-F-523)**, on one hand Snam is promoting the realisation of 150 MW biomethane plants all over Italy, derived from the treatment of urban and agriculture feedstock, however assuring, on the other side, all the network developments needed to connect plants to the existing gas network **(ETR-N-617)**, allowing biomethane transport and therefore unlocking the full potential on this resource.

Category: Hydrogen

Snam commitment for hydrogen uptake

Hydrogen is expected to be the "game changer" of energy transition, as it can efficiently contribute to the transition of the current energy system into a carbon neutral and more integrated system, achieving emission savings and unlocking the full potential of renewable electricity resources. The Hydrogen Strategy depicted by the European Union and the national strategies announced by some countries, including Italy, mark an important step in the right direction to enable hydrogen to contribute to meeting the target of making Europe the first continent to achieve net zero CO_2 emissions by 2050. In the case of Italy, the preliminary strategy calls for 5 GW of installed capacity for the production of green hydrogen and a first target of 2 % of the energy mix by 2030, with an expected growth of up to 20 % in 2050. In this context of future evolutions Italy is ideally positioned – both in terms of expertise and geography – to play a primary role. Today Italy already is a gas hub on the Mediterranean, one of the key intersections for present and future energy supplies, and considering the significant potential for hydrogen production from renewable sources in Southern Italy and North Africa, it could provide an infrastructure bridge to North-Europe, which will play a key role in the global hydrogen economy.

In this context, Snam is focusing on three fundamental pillars:

1. **Asset readiness**, to assess the compatibility of Snam existing infrastructure to accommodate the transport of hydrogen (transportation, storage, measure and compressor stations). Results suggest that almost all of Snam's pipelines are capable of transporting up to 100 % hydrogen[18] and the aim by 2050 is to transport entirely decarbonised gas (not only hydrogen, but also biomethane), helping to strengthen Italy's role as a European hub.

18 Certification of the H_2-ready network has been conducted by RINA, with an assessment of the compatibility of each pipeline of Snam's network to transport up to 100 % hydrogen. Based on option A of ASME B31.12 regulation almost the entire network is ready to transport 100 % H_2. Furthermore, approximately 70 % of these pipes can transport pure hydrogen with no or limited reductions on the maximum operating pressure, whereas around 30 % needs more significant reductions. These limitations could be overcome by means of future evolution in the technical standards.

2. **Encouraging and promoting initiatives** that would contribute to kick off hydrogen market and to support the development of hydrogen value chain.

3. **System design:** defining the roadmap for integrating hydrogen into the existing energy system with a focus on the analysis of medium-long term scenarios for the role of hydrogen in the energy mix, and on the evolution of the regulatory framework.

Furthermore, Snam participated at the **European Hydrogen Backbone** (EHB) initiative which, as described at the beginning of this chapter, have depicted the potential Italian hydrogen transmission system for the purpose of the EHB final report. By 2040 the Italian backbone may stretch all along the country, allowing the transport of hydrogen, potentially produced in North Africa and Southern Italy, up to the most industrialised regions located in the North.

Further elaborating this first analysis of own network, Snam has come to define its vision for the development of a well interconnected hydrogen backbone. Indeed, by 2030 a first section of 2,700 km of H_2 network is expected to be developed, to bring production from North Africa and Southern Italy to high consumption areas and reaching the export locations in Passo Gries and Tarvisio. More in detail, the 75 % of the backbone could be composed by repurposed pipelines, with the inclusion of 50 MW of compressor stations to ensure suitable pressure on the network, and will connect the green hydrogen areas in the South and potential blue hydrogen supply in the north-east with industrial customer throughout the country.

This significant step forward is the results of numerous initiatives developed in the last two years which have paved the way for the development of a hydrogen market. Here below some example

- **"Transport of hydrogen into natural gas network for industrial customers" (ETR-N-595):** after having successfully introduced for the first time in 2019 a 5 % blending into the grid (doubled to 10 % after few months), the initiative aimed at decarbonizing group of industrial customers transporting hydrogen in various locations.

- **Green Crane – Italy (ETR-N-598):** A joint initiative Snam and Enagás to deploy renewable hydrogen value chains at scale, boosting local hydrogen demand as well as export routes to North and Central Europe.

- **World's first test with 30 % hydrogen/natural gas blend test in steel forging** (Snam, RINA, GIVA): The initiative represents the world's first test of a 30 % hydrogen/natural gas blend in the forging processes used in industrial steelmaking confirming the potential of existing gas network in transporting increasing percentages of hydrogen contributing to the decarbonisation of hard-to-abate sectors.

- **H_2-NG fuel compression station** (Snam, Backed Hughes): The initiative represented the world's first test for a "hybrid" hydrogen turbine designed for a gas network, paving the way to implement adoption of hydrogen blending in Snam's transmission network infrastructure.

- **HHV – Hydrogen Valley Valcamonica** (Snam, A2A, FNM): Snam involvement in this project, which aims to produce and store green hydrogen-to cover the local demand, will allow the transportation of hydrogen making it available for local mobility sector (local trains currently fed with diesel).

- **"Divina" project** (Snam, RINA, Bormioli): In this initiative, which proved the role that hydrogen could play for the decarbonisation of the glass industry, Snam confirmed the role that gas infrastructure will have in the next years, allowing hydrogen to be increasingly available for the hard-to-abate sectors.

- **"Prometeo" project**[19]: This project, which aims to reduce the production costs of green hydrogen (below 2 €/kg) thanks to a highly efficient technology that combines electricity from photovoltaic (or wind) with concentrated solar heat, is expecting to extend over a period of 42-months and it is mainly financed by the European Union.

- **"Puglia Green Hydrogen Valley"** (Edison, Snam, Saipem, Alboran): the project aims to accelerate the uptake of hydrogen in Italy with large-scale initiatives for the production and consequent transport of green hydrogen, injecting – or blending – into Snam's local gas network, enabling the connection of production and consumption centres.

19 https://prometeo-project.eu/

Picture courtesy of Snam

5.4.7 ROMANIA

The role of hydrogen and renewable gases in Romanian energy transition

According to the provisions of the National Integrated Energy and Climate Change Plan, in terms of renewable energy potential, Romania can opt for the use of hydrogen in industrial processes, as natural gas represents 34 % of the energy mix currently used in the industrial sector and replacing it with hydrogen from renewable or low-carbon sources is an important way to decarbonise.

The use of hydrogen and other gases can facilitate the transition to deep decarbonisation, thanks to the ability of the natural gas grid to integrate different architectures and scales of size and mixtures of hydrogen into the network. The gas transmission infrastructure development projects included in the National Gas Transmission System Development Plan for the period 2021–2030 respond to such new requirements and can ensure the transmission of natural gas mixtures with up to 10 % hydrogen without major additional investments.

In this respect, Transgaz is planning to implement in the coming period pilot projects on hydrogen injection in pipelines for the transmission of the natural gas-hydrogen mixture to facilitate the analysis of the infrastructure behaviour from a technical point of view, and to test a market model for hydrogen demand as well as the necessary regulatory framework.

5.4.8 SLOVAKIA

Slovakian strategy to support hydrogen uptake

In spring 2021 the Slovak Ministry of Economy presented the consultation draft of the document "National Hydrogen Strategy -Ready for the Future" (hereinafter as "NHS") approved by the Slovak Government in June 2021. The NHS confirms the aim to reach carbon neutrality by 2050, confirming the role that hydrogen will play in that respect, with the existing gas infrastructure that will enable such transformation to a carbon neutral economy of the Slovak Republic. Furthermore the NHS defines the conditions for the implementation of hydrogen technologies in accordance with the long-term strategic development plan, creating conditions for hydrogen production so that the Slovak economy could rely on its own production as much as possible in the future.

The development of markets for the use of hydrogen in the Slovakia requires the creation of innovative logistics solutions for its transmission, distribution and storage. In that respect, EUSTREAM, the Slovak gas transmission system operator, together with Slovakian institutions will also focus on the possibilities of the natural gas transmission network to be used for the transport of hydrogen, unless its capacity is fully used for the transport of natural gas. One solution is represented by bleding hydrogen into the national grid, which could be used for transport and distribution after having implemented the technical modifications needed (e. g. pipelines, pressure relief devices, fittings, flow measurement, etc.). The determination of the maximum safe level of

hydrogen blending will be preceded by a detailed research and testing of the impact of hydrogen on the materials and components of the gas equipment used.

Based on the existing use of hydrogen, it can be assumed that by 2030, 200 kt of hydrogen will be consumed annually, an amount that could increase up to 400–600 kt by 2050, out of which up to 90 % from low-carbon sources.

In this context EUSTREAM prepares its network for transporting renewable and low-carbon gases. The company is planning adjustments that will make its network technologically ready for blending up to 5 % of hydrogen into the transported natural gas, as early as at the end of 2023. With the current volumes of natural gas transmission, Slovakia will be soon technologically ready to transport theoretically more than 2 bcm of hydrogen per year and thus to accommodate expected gradual increase in hydrogen supply/demand.

Eustream projects

Category: Hydrogen (project promoter EUSTREAM, a.s.)

Modification of NP23 MW turboset to a hydrogen-ready low-emissions at CS04 (ETR-N-913)

The initiative is a part of a package of projects that will enable hydrogen transmission within the natural gas transmission system of Slovakia. The low-emissions system will cause a decrease of gaseous pollutants emitted from the turbo-set in order to comply with stricter environmental standards.. The project is expected to be commissioned in 2023.

Measures for achieving hydrogen blending readiness of the transmission system (ETR-N-916)

Achievement of hydrogen blending readiness in metering and leakage detection is part of a package of projects that will enable hydrogen transmission within the natural gas transmission system of Slovakia. Its focus is on raising protection of metering and leakage detection equipment against negative effects of hydrogen. The project is expected to be commissioned in 2024.

Measures for the reduction of methane emissions (ETR-N-920)

The project aims at the reduction of methane emissions that are created within the Slovak natural gas transmission system, in order to mitigate the impact on climate change. The project is expected to be commissioned in 2024.

Category: Sector coupling (project promoter Nafta, a.s.)

G2F – Gas to Future (ETR-N-315)

Project Gas to Future (G2F) aims to store renewable energy in form of the hydrogen in the mixture with natural gas using the existing Nafta´s gas storages. The project, which is consistent with goal to reduce CO_2 emissions, counts to install the electrolysis units to transform electricity to H_2, and to use the existing gas infrastructure for storing it in the reservoirs. More in detail the project is split in two phases. In the first phase H_2 will be stored with natural gas, continuously increasing its amount reaching 2 % of total capacity (by injecting in the reservoirs 1.32 GWh/d), with H_2 to be produced from P2G technologies for which it is expected to have 84 MW of installed capacity. Commissioning date for this first phase is expected to be 2025. In the second phase the amount of H_2 content stored will in while in the will increase to 10 %(by injecting in the reservoirs 6.6 GWh/d) and the installed capacity of P2G will increase to 332 MW. Commissioning date for the second phase is expected to be 2035.

P2G Velke Kapusany (ETR-A-312)

Project P2G Velke Kapusany aims to store renewable energy in form of H_2 in the mixture with natural gas using the new Naftas gas storage. The project, which aim to contribute to decrease the CO_2 emissions, counts to install the electrolysis units (78 MW) to transform the electricity to H_2. The H_2 produced hydrogen will be then injected into planned UGS Velke Kapusany at rate about 1,23 GWh/day. Compressor units as well as other infrastructure will be used from the UGS Velke Kapusany. The power of compressor unit should be around 8400 kW and the commissioning of the project is planned for 2023.

Green Transmission

EUSTREAM also plans to develop an own photovoltaic plant to produce green hydrogen in its premises and then use it for powering compressors. The first pilot project to decarbonise own operations is planned for the Veľké Kapušany compressor station, with expected hydrogen production in 2023.

5.4.9 SLOVENIA

Joint efforts for decarbonisation of Slovenian energy supply

Slovenian NG TSO Plinovodi, together with some other Slovenian energy companies, launched an initiative which aims to introduce first quantities of renewable gases in Slovenian national transmission system. The initiative is oriented toward achieving climate goals with sector coupling, which will require storage support to achieve maximal RES penetration in the electricity transmission system. The NG transmission system is able to accept large amounts of green gases and help to mitigate RES intermittency related issues in electricity transmission system.

One of the goals of this initiative is to pilot a domestic production site, which would produce green hydrogen for existing industrial consumers and for injection into the natural gas network, since some Slovenian industrial companies already expressed their interest in using green gases and CO_2 neutral alternatives. Such project would be a stepping-stone for further expansion of hydrogen production and consumption in Slovenia in various sectors, including heavy industry and transport, with the aim to to attract third party companies to produce hydrogen commercially and to attract larger industrial sites to begin using green hydrogen and synthetic gas.

Transition from NG transmission system towards CO_2 neutral transmission system

Mitigating technical gaps are also crucial for enabling step-by-step replacement of NG with renewable gases, especially technical gaps regarding hydrogen. Hydrogen's chemical and physical properties differ significantly compared to those of NG, therefore. Plinovodi aims to research possibilities of injecting hydrogen in the NG transmission system.

Plinovodi participated in the European Hydrogen Backbone initiative (described at the beginning of Chapter 5) by presenting Slovenian hydrogen transmission system plans for the development of the EHB. In case of sufficient hydrogen production and consumption, Slovenia plans to retrofit two existing pipelines and build two new hydrogen-ready pipelines. These four pipelines will form a Slovenian hydrogen backbone in the total length of 338 km and will enable to transport 100 % hydrogen between Italy, Austria, Hungary and Slovenia, as well as a connection to Croatia. Slovenian hydrogen backbone is planned to be operational in 2035. Until 2035, Plinovodi plans to upgrade (where necessary) the transmission system to enable hydrogen injections in allowable ranges, which will be included in the Network code for natural gas transmission system.

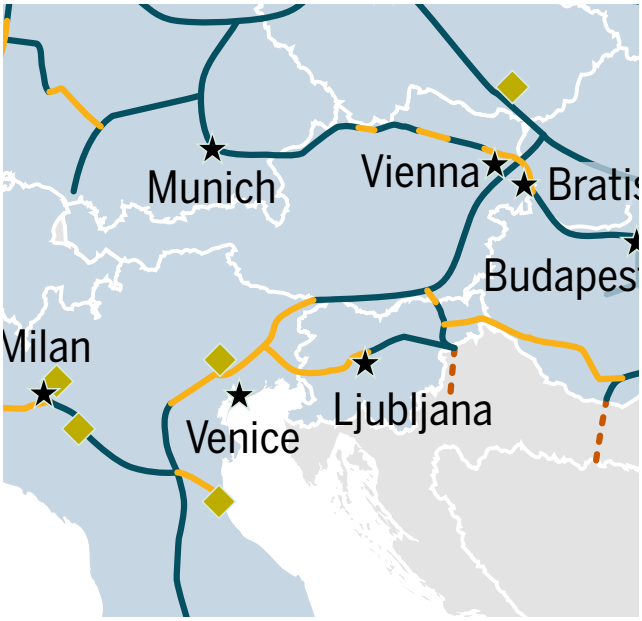


Figure 5.9: Slovenian section of European Hydrogen Backbone (Source: Guidehouse)

6 CONCLUSIONS

The present publication of the "Southern Corridor Gas Regional Investment Plan" (SC GRIP) is the fifth 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".

In line with previous editions the aim of this report was to offer a complete overview of the Region in terms of ongoing and planned projects, demand analysis and efforts taken at country level in order to enable energy transition.

The key outputs of this report can be summarised as following:

- Since 2020, with the commissioning of TAP the Southern Corridor successfully provides Europe with a new route securing natural gas supplies from the gas-rich Caspian Sea Basin, contributing to the diversification of the natural gas sources in the whole region. Infrastructure in the region is further developing (with the expansion of the main Azeri supply chain and important interconnections between countries) in order to connect the needs of customers and market participants, to stimulate the market activity and contribute to creating liquid and competitive gas markets.

- Historical trends in Southern Corridor Region suggests that in the last five years the gas consumption has increased by 116 TWh, determining a stable share of 25 % of the EU28 total gas consumption. Moreover, an increase in gas consumption is expected up to 2025, driven mainly by the increasing demand for power generation as gas will progressively substitute more pollutant fuels. Such consumption level is forecasted to be maintained approximately up to 2030. Afterwards a downward trend is expected due to the decrease of the conventional gas consumption, mainly in residential and tertiary sectors, determined by the achievement of energy efficiency and decarbonisation targets. This decrease is broadly counterbalanced by the deployment of sustainable gases (hydrogen, bio and synthetic gases) as unavoidable energy carrier for the adequacy and storability of the European energy system, highlighting the crucial role that gas infrastructure will continue to have in the next decades to provide the required flexibility to integrate the electricity system.

- In the frame of the energy-transition tasked by the European Union in terms of efficiency, decarbonisation and sustainability, the Southern Corridor Region and its gas infrastructures will represent for the next decades a bridge between further EU natural gas market integration and flexibility needs, being at the same time an enabler for the uptake of low-carbon and decarbonised gases required by the energy transition.

- Natural gas represent a fundamental energy carriers in the process of transition toward a net-zero energy system: it will allow for quick decarbonisation wins, enabling an immediate substitution effect leading to the reduction of GHG emissions in a Region which is still reliant on more carbon intensive fuels such as coal, lignite and oil, while intermittent renewable energy sources are still in a developing phase, although increasing fast. As highlighted in the report, this energy carrier represents an opportunity for immediate and significant emissions reduction, as it will enable the coal phase out process until 2025 by providing at the same time stability and flexibility to the energy systems.

- Furthermore, gas infrastructures are expected to be enablers of energy transition allowing for the uptake and scaling-up of new low-carbon and decarbonised gases, from natural gas itself with CCS to biomethane and hydrogen, as well as their potential blends. These represent efficient solutions for the decarbonisation of the energy systems, since they allow the exploitation of the opportunities that existing gas infrastructures and relevant market arrangements can already offer in this new context.

- For these reasons, and coherently with the recent developments in European climate policies, TSOs are developing new initiatives that confirm the role of gas infrastructure as an enabler of energy transition, allowing for the uptake of new low-carbon and decarbonised gases such as biomethane and hydrogen, that will be fundamental to achieve the decarbonisation targets.

The TSOs of the Region hope that stakeholders will consider that the present report as a valuable informative tool offering a comprehensive overview of the main gas infrastructure developments within the Southern Corridor Region.

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COUNRY CODES (ISO)

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

LEGAL DISCLAIMER

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The Southern Corridor GRIP contains TSOs' own assumptions and analysis are based upon this information.

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