european network
of transmission system operators
for gas

GAS REGIONAL INVESTMENT PLAN 2013–2022

GRIP South

MAIN REPORT

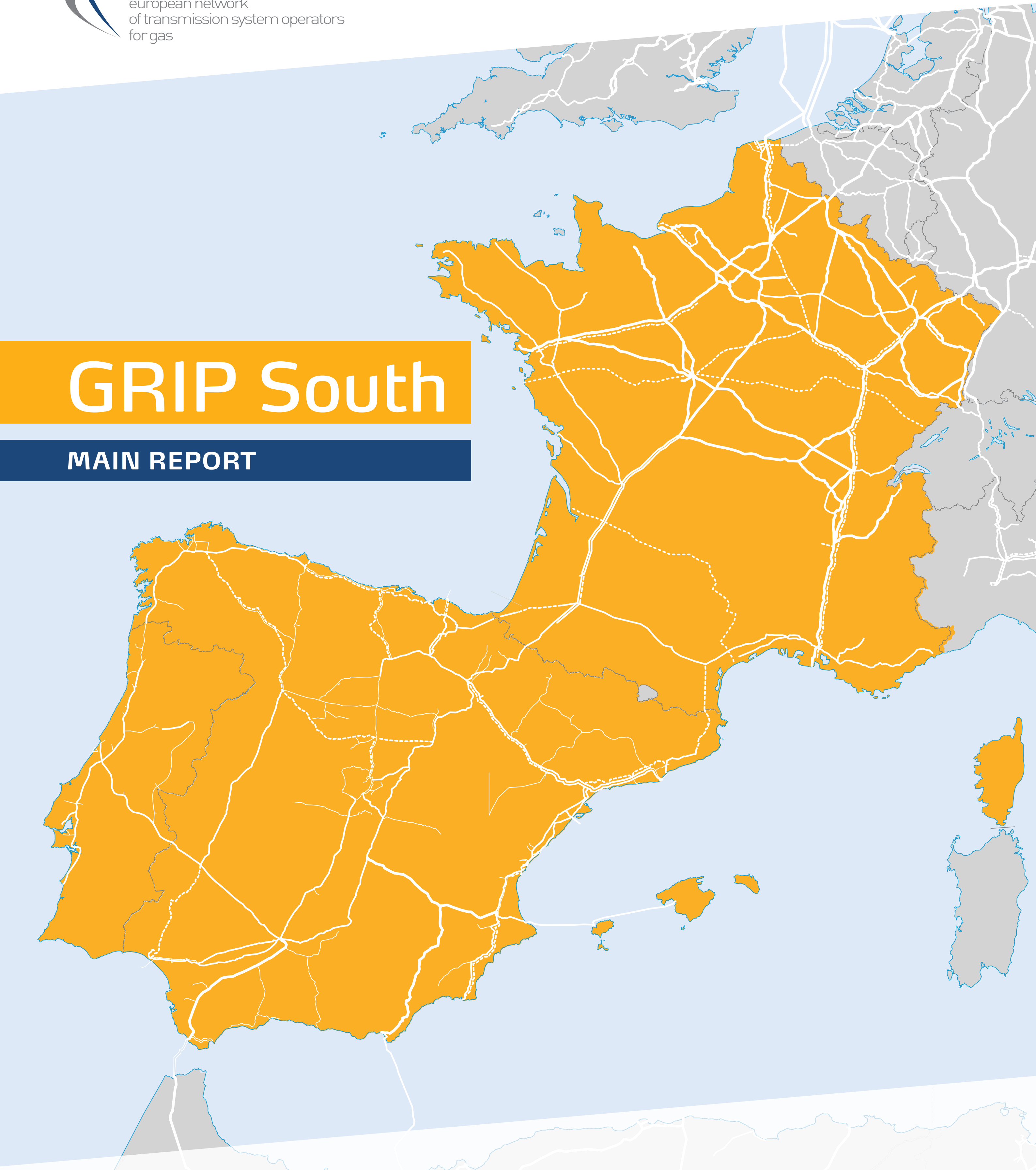


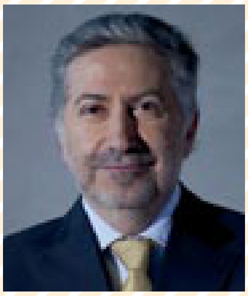
Table of Content

Foreword

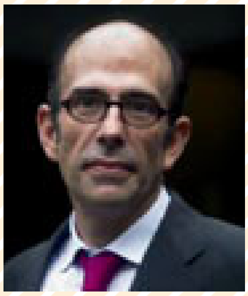
The second edition of the South European Gas Regional Investment Plan (GRIP South) builds on the previous edition of the GRIP South, published in 2011, and also complements the Ten Year Network Development Plan (TYNDP) 2013–2022 published by ENTSOG in February 2013.

This GRIP is the result of close cooperation between the Transmission System Operators (TSOs) in the three countries of this European Region: Spain, Portugal and France. This cooperation between the four TSOs involved, Enagás, REN, TIGF and GRTgaz, continues the fruitful cooperation established in the last years with significant developments of the interconnections between the different gas transmission systems. For this edition, the coordination of this report was facilitated by GRTgaz.

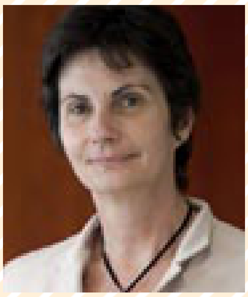
This report takes into account the feedbacks received since the first GRIP edition and stakeholders have been involved in the development of this GRIP through exchanges organized within the ENTSOG and the Gas Regional Initiative (GRI) platforms. TSOs of the region would like to thank the stakeholders involved in this process and welcome further comments from stakeholders, which could improve future editions of this report.



Rui Cartaxo
Chief Executive Officer REN



Marcelino Oreja
Chief Executive Officer Enagás



Monique Delamare
Managing Director TIGF

Thierry Trouvé
Chief Executive Officer GRTgaz

Executive Summary

Major efforts are needed to modernize and expand Europe's gas infrastructure and to interconnect network across borders to increase competitiveness, sustainability and security of supply into the Union creating the European Internal Gas Market.

The achievement of the desired level of these 3 Energy policy pillars is enabled through the achievement of the desired level of market integration which can be measured at commercial and physical level. This GRIP gives for the South Region a detailed assessment, in terms of level of physical market integration of the gas system for the next ten years.

The 2nd edition of the Gas Regional Investment Plan of the South Region (GRIP South) which covers France, Portugal and Spain, in closer consistency with EU-wide and national TYNDPs, provides complementary analysis of the gas system focus on Transmission, UGS and LNG Terminals projects. Compared to the European TYNDP, this GRIP provides, at regional level, updated forecasts on demand and projects, additional analysis and simulations of the gas system and of the infrastructures which remedy the various issues in the region.

The GRIP South describes the current gas market into the Region, showing the strong differences in both seasonal and daily gas demand modulation among the countries, stressing the main role played by LNG Terminals and UGS, and highlighting the potential of the South Region which could become a valuable source of supply for the rest of Europe, thanks to its LNG Terminals and its proximity to Algerian gas.

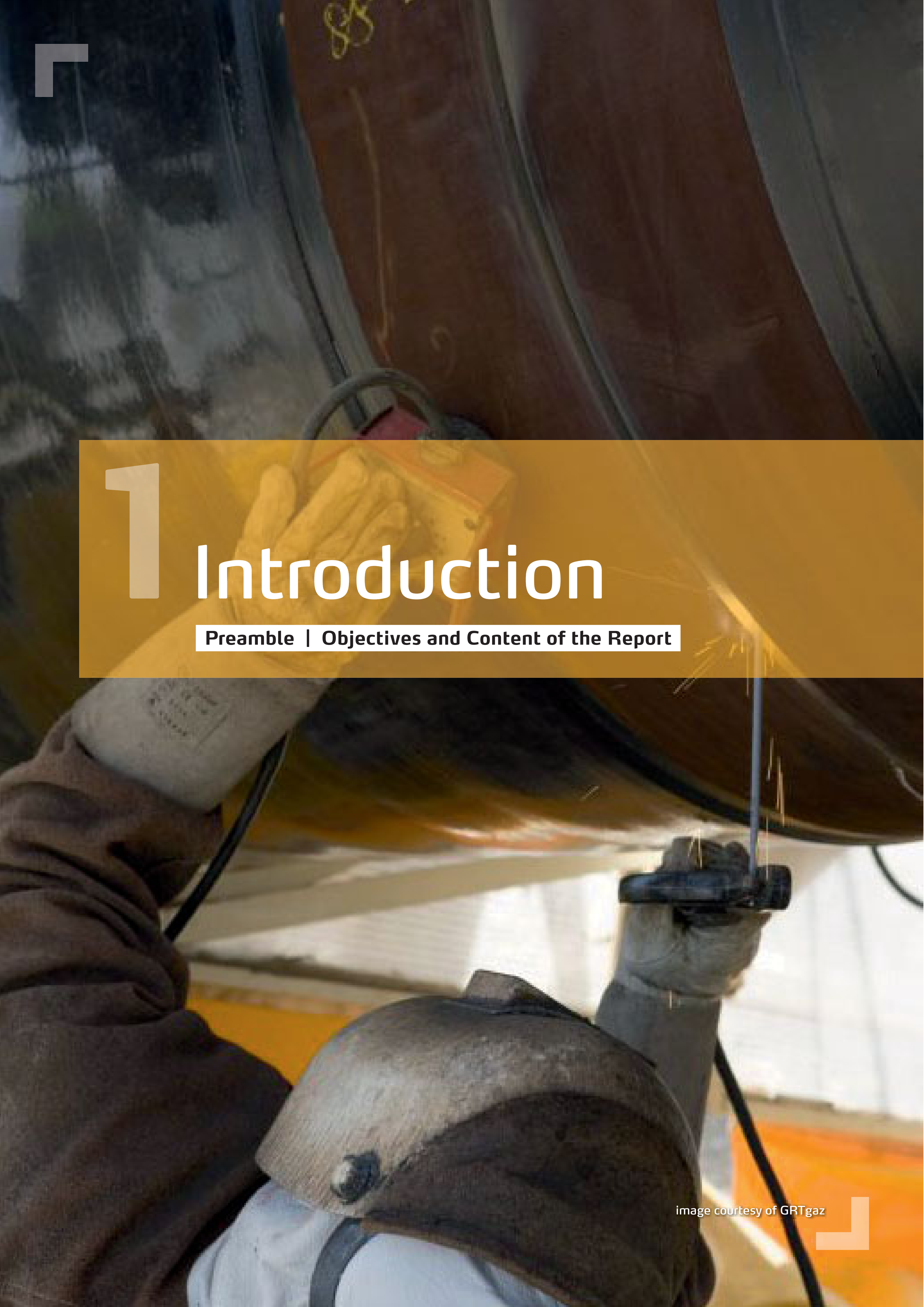
The assessment of the Network identifies the lack of ability of the existing and FID transmission projects in the Region to face very different supply mixes and to create price convergence as the main issues for the gas system in the South Region.

Main results of the analysis are the identification of the principal projects currently planned to remedy these issues: the projects of the new corridor, "Bidirectional flows between Portugal, Spain, France and Germany", as well as other FID transmission projects currently on going.

The report also shows how these projects have a positive impact on the network flexibility, enhancing as a result competitiveness for the industry and the rest of the end consumers of the gas system.

The investments needed in the South Region for achieving these goals are significant. A clear visibility over future market trends, the mitigation of the climate of uncertainty in Europe with a clear Energy Policy on the role of the natural gas on long term basis, as well as the support of the competent authorities, are needed in order to secure the cost-effectiveness of these investments.

Transmission System Operator of the South Region, having extended experience in working together since 2006, wish that the GRIP South provides useful information to all stakeholders and will support fruitful discussions when assessing the ability of investments to answer regional market needs.



1 Introduction

Preamble | Objectives and Content of the Report

image courtesy of GRTgaz

1.1 Preamble

Europe is importing gas in a very significant way and Transmissions Systems Operators have been cooperating for decades in order to enable cross border transmission. This cooperation is crucial for supporting market integration and developing the security of supply of all Member States. The need to promote regional cooperation is underlined by the European Directive 2009/73/EC in Article 7 and further detailed by the European Regulation No. 715/2009 in Article 12.

Pursuant to Article 12 (1) of the European Regulation, Transmission System Operators of the Region publish every two years, a regional investment plan, which contributes to the fulfilment of tasks listed in Article 8 (1–3), thereof the elaboration of the European Ten-Year Network Development Plan published by ENTSOG.

Transmission System Operators have worked together within ENTSOG in order to elaborate the European Ten-Year Network Development Plan (TYNDP 2013–2022) published on 21 February 2013 and available at:
www.entsog.eu/publications/tyndp

This is the second edition of the Gas Regional Investment Plan of the South Region (GRIP South) which covers France, Portugal and Spain. GRIP South, in closer consistency with EU-wide and national TYNDPs, provides complementary analysis of the gas system focus on Transmission, UGS and LNG Terminals projects. Compared to the European TYNDP, this GRIP provides, at regional level, updated forecasts on demand and projects, additional analysis of the gas system and of the infrastructures which remedy the various issues in the region.

This report takes into account feedbacks received from stakeholders since the publication of the 1st GRIP in 2011 and through exchanges organized within the ENTSOG and the South Gas Regional Initiative (SGRI) platforms. Based in part on these feedbacks, the main enhancements of this edition are:

- a more harmonized approach between the different GRIPs, thanks to more coordination with the other GRIPs within the ENTSOG,
- the interaction with stakeholders has been developed with exchanges and consultations organized with SGRI and ENTSOG,
- more information on open seasons or other market-based procedures realized in the last few years or planned in the following years, to trigger an investment decision,
- update of all the infrastructure projects of the Region from TSOs and non-TSOs,
- updates of gas demand forecasts in order to take into account the latest trends, in particular from the power generation sector,
- in depth analysis of the infrastructure needs identified for the region through inter alia National Plans, Open Seasons, the TYNDP 2013, and based on the analysis of Hubs price spread and capacity subscription and/or use,
- a detailed presentation of the remedies responding to the identified needs of the region,
- and a specific focus on the Projects of Common Interest (PCI).

Transmissions System Operators of the Region wish that this document will provide useful information to all stakeholders and will support fruitful discussions when assessing the ability of investment projects to answer the regional market needs.

1.2 Objectives and Content of the Report

The main objectives of the European energy policy are security of supply, competitiveness and sustainability. To achieve these goals, the European Council highlighted the need to create “an internal energy market that is integrated, interconnected and fully operational” in order to “benefit from more reliable and competitive prices, as well as more sustainable energy”. The challenge consists in diversifying sources and supply channels, facilitating arbitrage between the most competitive sources of natural gas supply, ensuring the circulation of gas is more fluid between the various markets, and increasing the flexibility of the network.

The European Commission notes that the development of new, flexible infrastructures is a “no regrets option” likely to support a number of orientations and estimates the investment requirement for 2020 at €70 billion for gas infrastructures.[1] To support this development, on 17 April 2013, the European Parliament and the Council adopted a regulation on “guidelines for trans-European energy infrastructure”.

In the field of natural gas, four priority gas corridors have been defined, considered to be strategic for Europe, among which the North-South corridor in western Europe being of direct interest for the Region. As mentioned by the European Commission: “The strategic concept of the North-South Corridor in Western Europe, that is to better interconnect the Mediterranean area and thus supplies from Africa and the Northern supply Corridor with supplies from Norway and Russia.”

The ENTSOG TYNDP assesses the physical layer of Market Integration through four assessments which are:

- the **Resilience of European gas network**,
- **Supply Source Dependence**,
- **Network Adaptability to Supply Evolution**,
- and **Capability for Supply Source Diversification**.

The added value of the GRIPs is to go further in terms of analysis and details on the assessment of the transmission system and the projects that remedy these needs. This plan investigates the role of these projects which improve the market integration in the Region and of the Region in Europe; the objective of this document is to explain in more depth their added value.

This GRIP begins with 3 chapters describing and analyzing, the supply, the demand and the projects identified in the Region. Like in the TYNDP, the horizon of the forecasts is the next 10 years.

The assessment chapter is a key chapter in order to explain the needs of the gas system. Assessments of the ENTSOG TYNDP are updated, extended and analysed in depth in this document. In parallel, simulations with updated data have been developed at European level using ENTSOG’s Nemo Tool. The main conclusions remain in line with TYNDP 2013 for the South Region here presented.

Additional analysis is made when relevant, in particular on prices and IP capacities. Additional chapter is focused on the projects which are remedy to the needs detected in the assessment chapter. Projects of Common Interest (PCI) in the Region are highlighted in this chapter.

1) "Energy Infrastructure. Priorities for 2020 and beyond - A Blueprint for an integrated European energy network", 17 October 2011

2 General Context

Worldwide Context | Trends for the European Gas Market

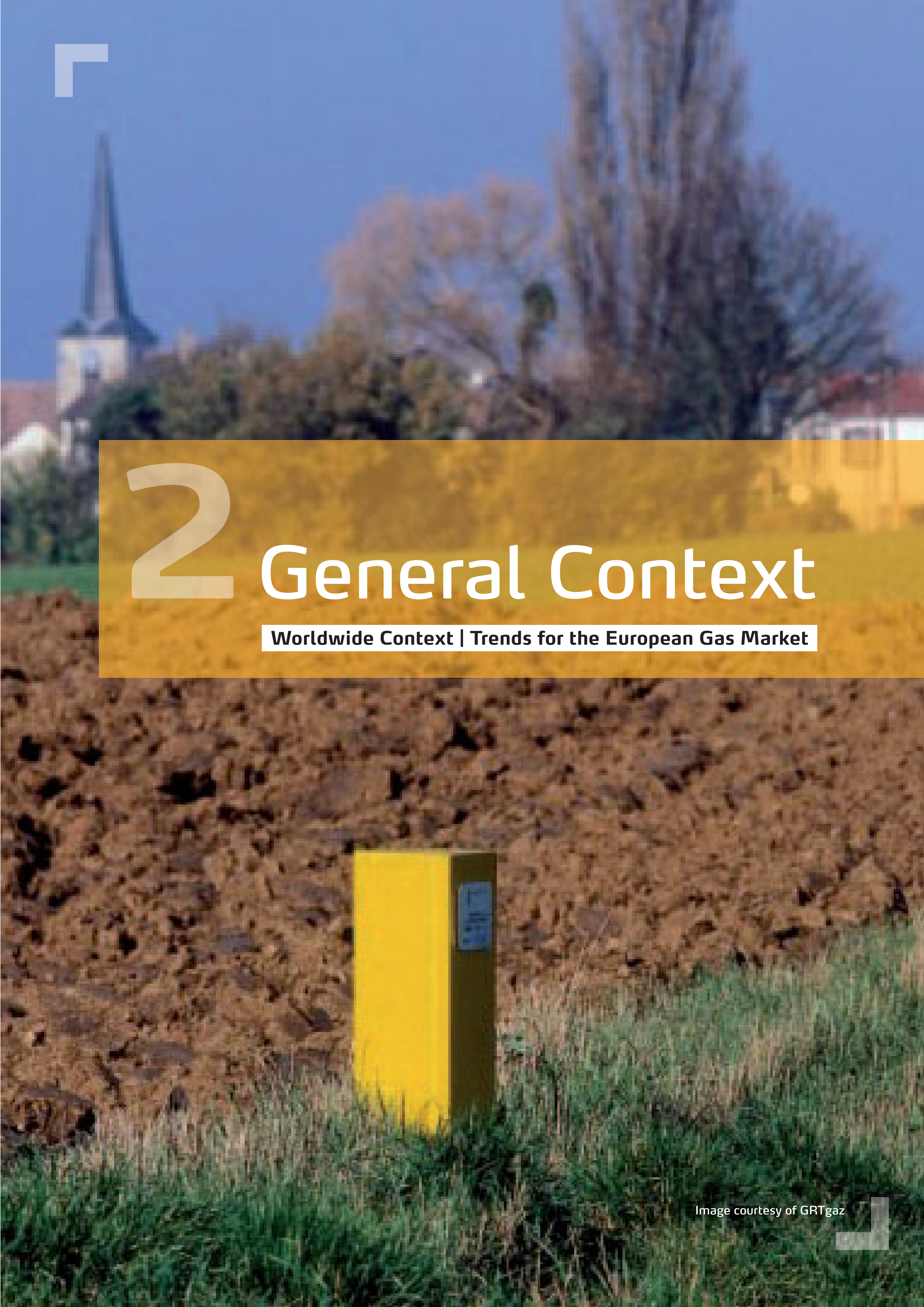


Image courtesy of GRTgaz

2.1 Worldwide context

The growing energy demand in Asia, enhanced by the nuclear accident of the 11 March 2011 in Fukushima, Japan, the new cheap shale gas in the United States and the decrease on consumption in Europe due to the economical crisis, have changed the global gas market creating big differences between gas prices all over the world.

As shown in Figure 2.1, the estimated LNG prices by July 2013 goes from 9.5 €/MWh in the United States to 38 €/MWh in Japan and Korea, reaching almost 43 €/MWh in certain countries of Latin America and being near 26 €/MWh in the South-west of Europe.

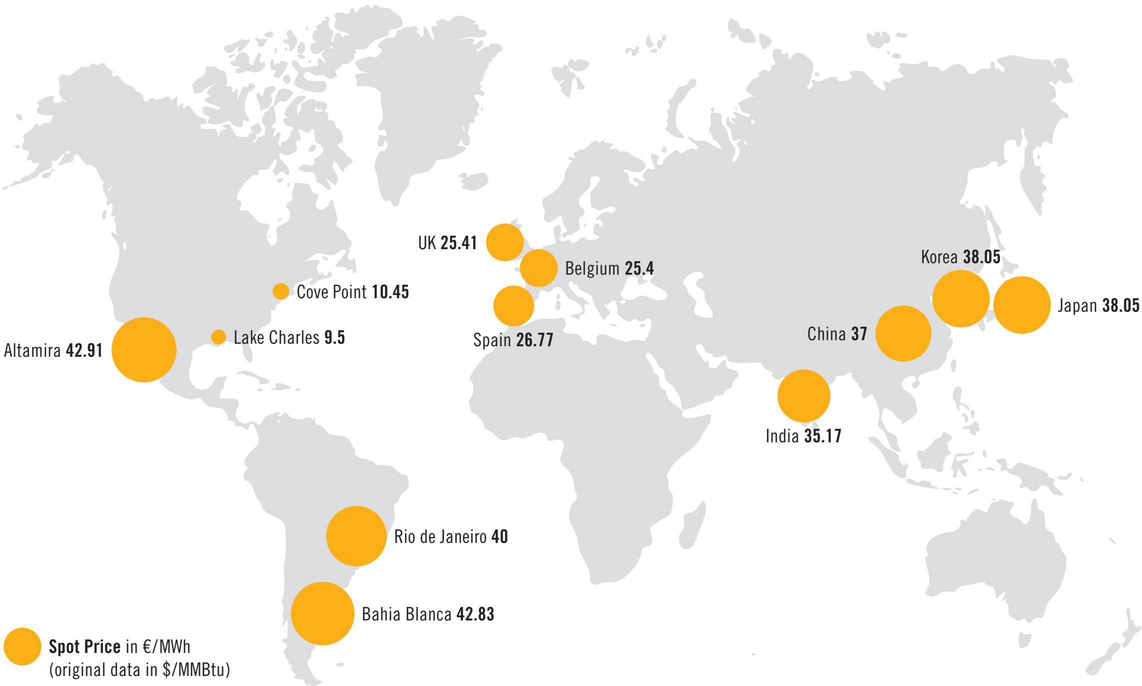


Figure 2.1: World LNG landed prices, est. July 2013
(Source: Waterborne Energy, June 7, 2013)

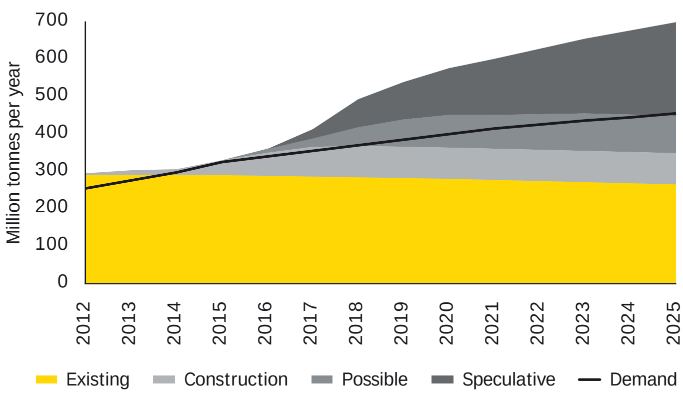


Figure 2.2: Global LNG capacity and demand in million tons per annum
(Source: Ernst & Young assessments of data from multiple sources)

This rupture in LNG prices is expected to remain as long as the development of new LNG Receiving Terminals, mainly in Asia, will increase more significantly than the new supplies expected, mainly from Australia, Africa and the United States.

2.2 Trends for the European Gas Market

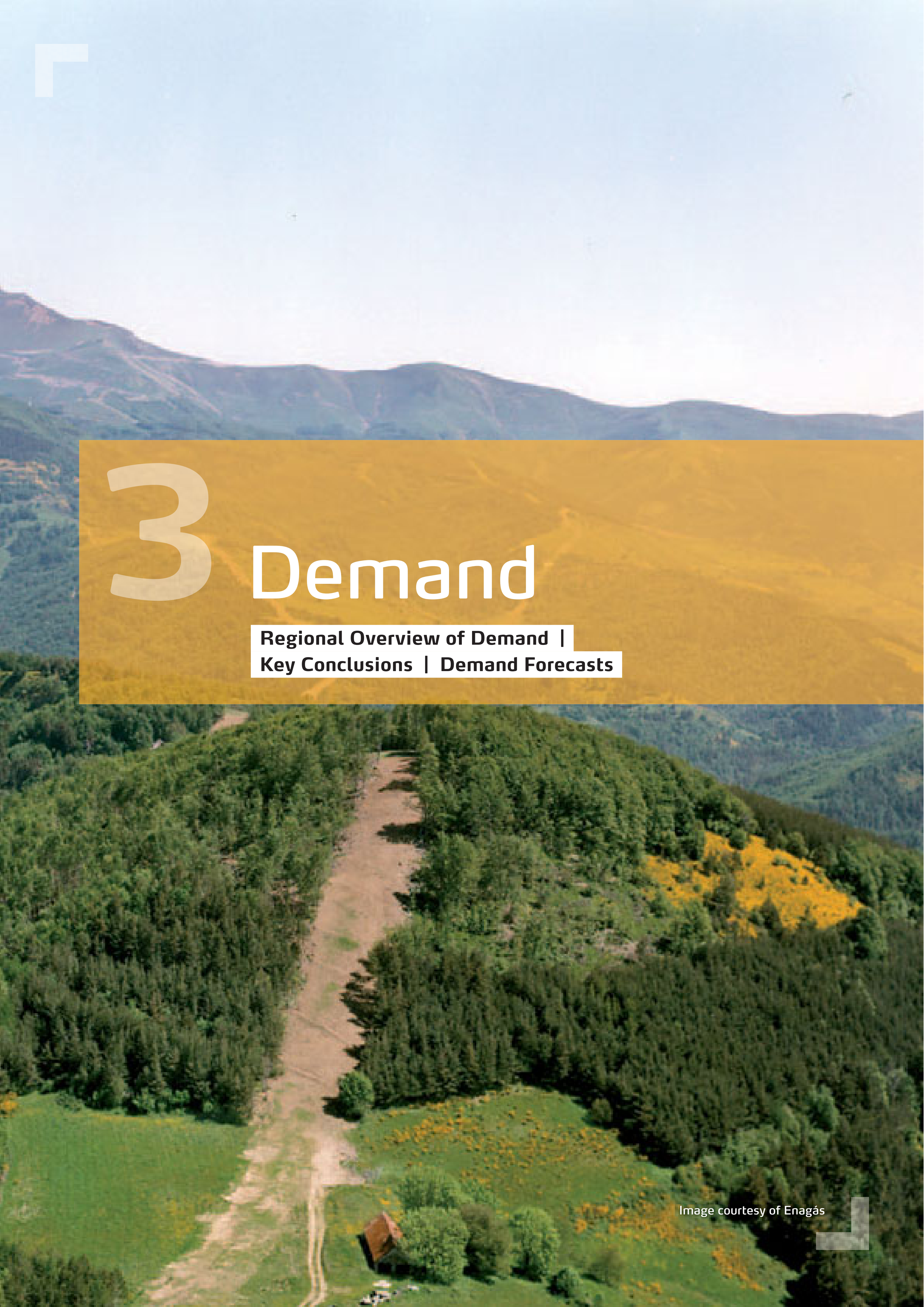
The current worldwide context, with high LNG demand in Asia and a lower offer, has made LNG spot prices rise significantly and increased LNG cargoes reroutes to Asia. At European level, it has made shippers prefer pipe gas instead of LNG, with price consequences in countries dependent on LNG supply, which is the case in the South Region.

Due to the combined impact of the economic crisis Europe is currently facing and the loss of competitiveness of gas because more coal is exported from the United States, gas consumption in Europe is declining. The implementation of the decisions adopted on energy efficiency and the development of renewable energies may limit the use of natural gas despite its undeniable advantages. In this context, consumption forecasts are in general lower than last year.

Nevertheless, due to the drop in European production, request for gas imports will remain high looking toward 2030. Furthermore, the major price spreads seen on global markets confirm the importance of diversifying supply sources and increasing the fluidity of exchanges within the European Union. The implementation of the market integration planned by the European Commission continues, with the finalisation of two network codes (capacity allocation and congestion – bottleneck – management) and the adoption of a regulation on "guidelines for trans-European energy infrastructures".

Aware of the major financial constraints and significant economic stakes energy issues present, the European Commission is encouraging project promoters to perform cost-benefit analyses to determine which projects are the most promising in particular in the framework of the process for "projects of common interest" (PCI's).

Image courtesy of GRTgaz



3 Demand

Regional Overview of Demand | Key Conclusions | Demand Forecasts

Image courtesy of Enagás

3.1 Regional Overview of Demand

In 2012 the primary energy consumption in the South Region was 413 MTOE (Million Tonnes of Oil Equivalent), 17 % of that being natural gas, shown in Figure 3.1.

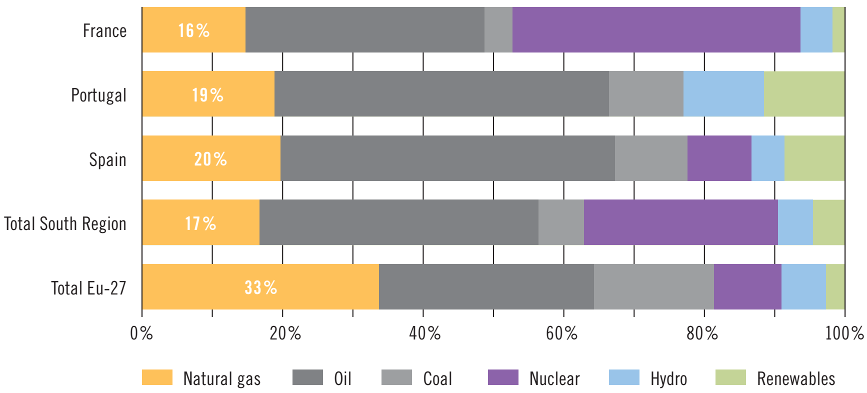


Figure 3.1: Primary energy breakdown by fuels in 2012 for South Region countries (Source: BP, 2013)

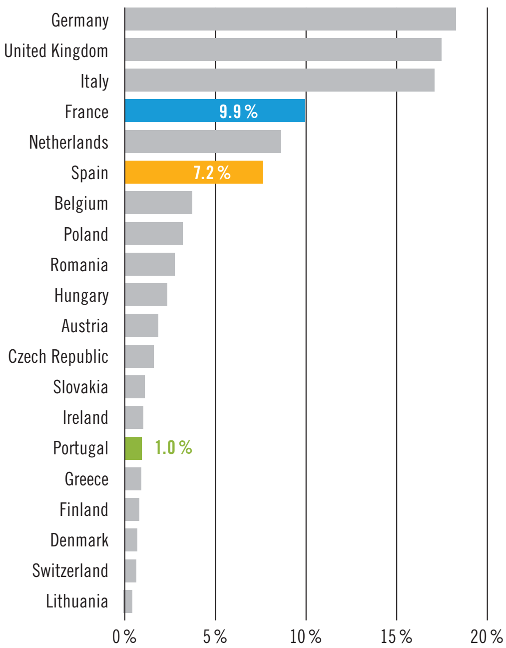


Figure 3.2

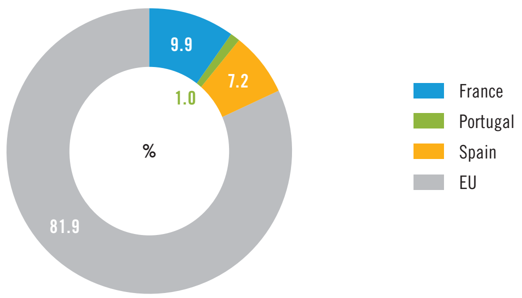


Figure 3.3

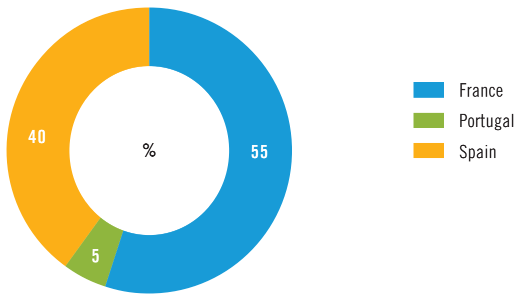


Figure 3.4

Share of each country in Europe's (3.2 and 3.3) and the South Region's (3.4) total gas demand (2012)
Those countries with a demand representing less than 0.5 % overall have been left off Figure 3.2.

The annual demand in the South Region represents approximately 18 % of the total European gas demand. When focusing on the South Region, it appears that France represents 55 % of the demand, Spain 40 % and Portugal 5 %, as shown in Figure 3.4.

The demand for natural gas can be broken down into two distinct sectors:

- The conventional sector includes demand for Industry, Commercial, Residential and Cogeneration (CHP);
- Gas for power generation: includes natural gas demand for power generation. In Portugal and in Spain this sector comprises combined cycle gas turbines (CCGT) and in France also combustion turbines (TAC).

These two sectors have specific characteristics. The conventional sector is, globally, much more linked to climatic conditions (for residential and commercial sector) while demand in the power sector is generally less linked to climate. In the South Region, the conventional sector (Residential + Commercial + Industrial) represented 87 % of the total gas demand in 2012. This breakdown of the demand varies from one country to another (Figure 3.5).

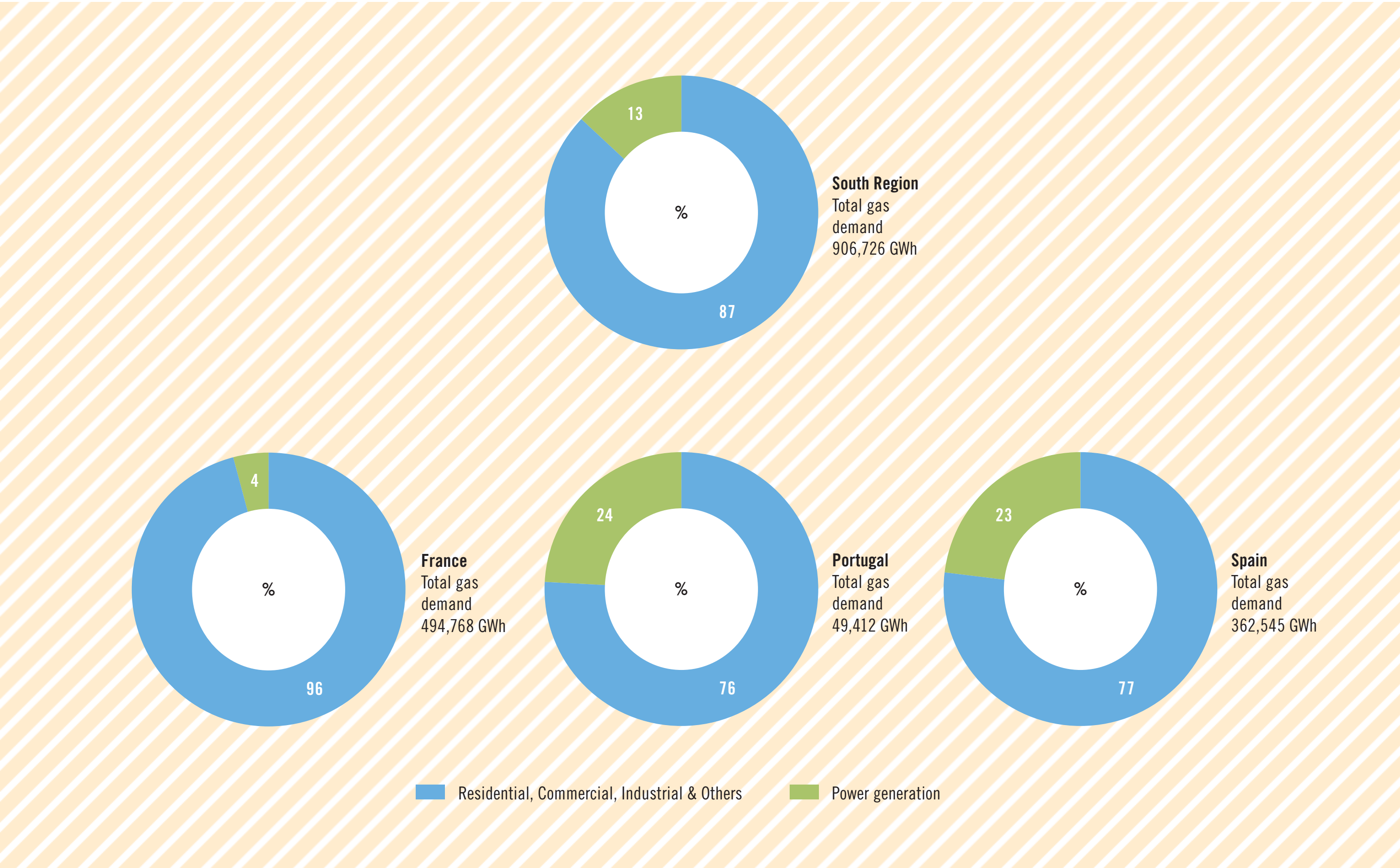


Figure 3.5: Breakdown of total gas demand in the South Region and for France, Portugal and Spain (2012)

The importance of the electricity generated by gas differs from each country of the South Region to another (Figure 3.6): for example in 2012, whereas in Portugal and Spain approximately a quarter of the total electricity production was generated using natural gas, in France this part represented only 4 % of the total electricity generation.

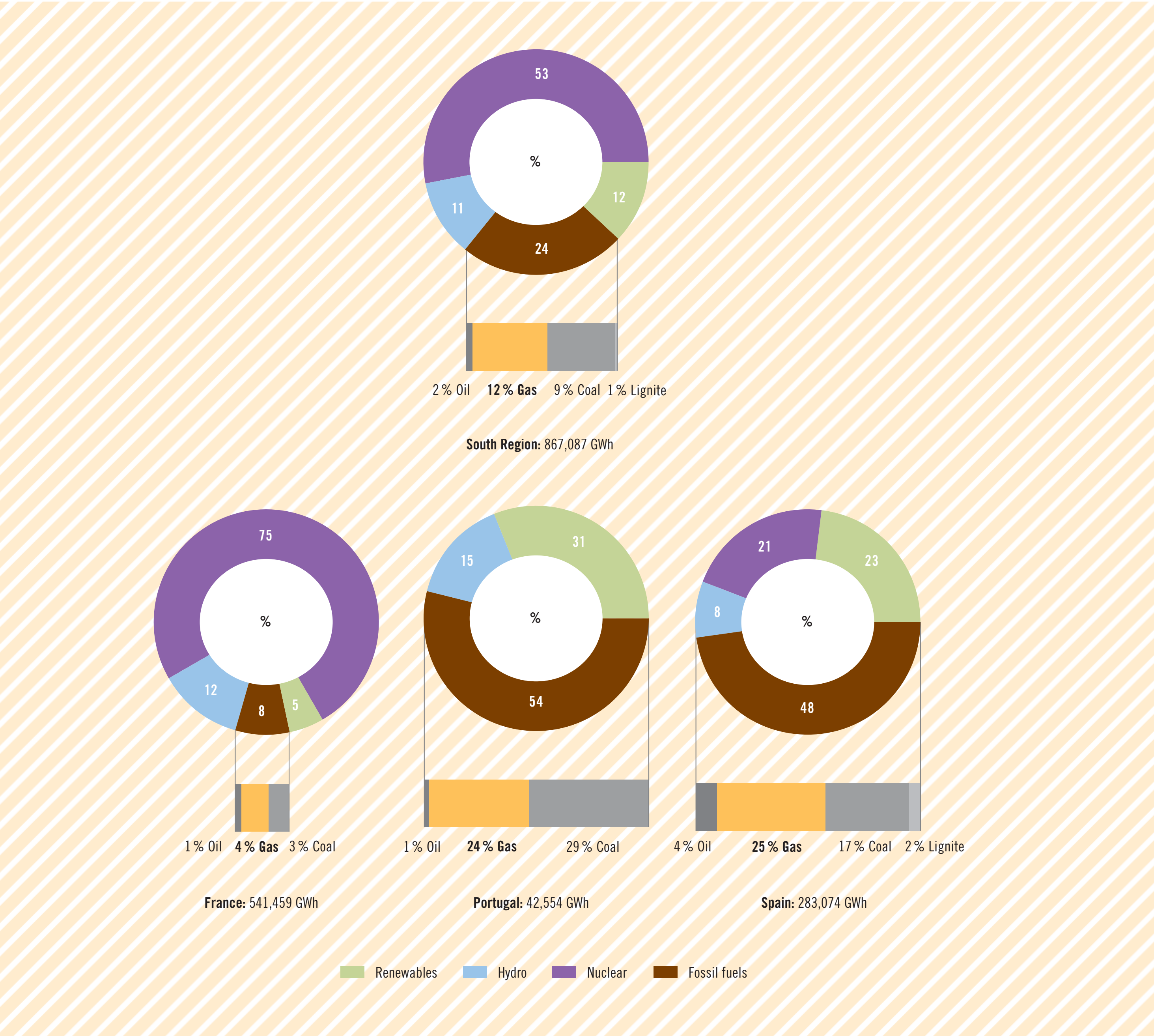


Figure 3.6: Yearly electricity generation by technology in 2012 (GWh) for The South Region, France, Portugal and Spain (Source: ENTSO-E)

Gas demand can vary through the year, the week and daily due to meteorological conditions, competing sources of energy, economical and residential activities. Therefore, demand fluctuations can be categorized by the period over which the variation in supply is required, in general in the year, the week, and the day.

Figure 3.7 shows the modulation in demand in the South Region with:

- fluctuations in the year mainly caused by the weather conditions when the gas is used for heating uses,
- weekly cycle due to the economical activity,
- and intra-daily factors linked to the economical and residential activities, and also fluctuations in other power generation in particular when CCGT are used as backup of intermittent renewable power generation (mainly wind).

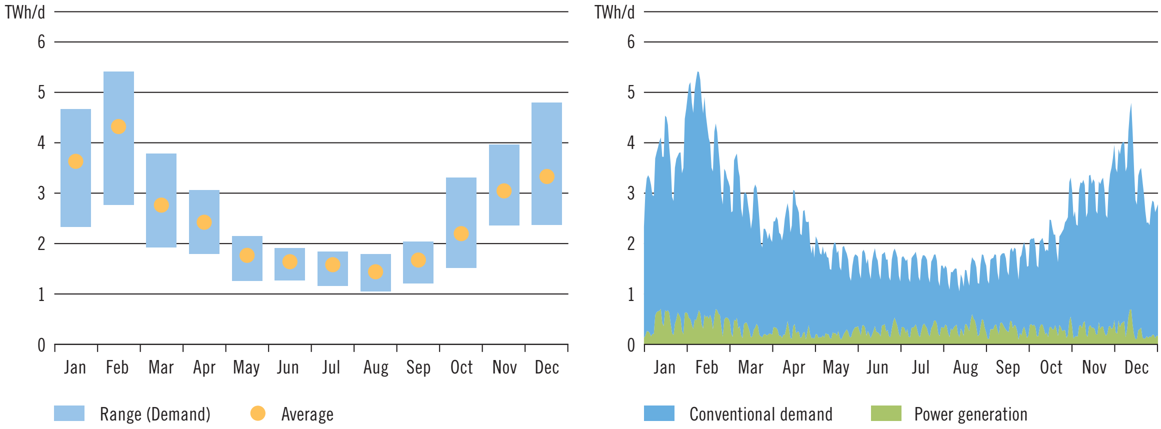


Figure 3.7: Total demand for gas in the South Region by sectors in 2012. The graph on the left shows seasonal variation

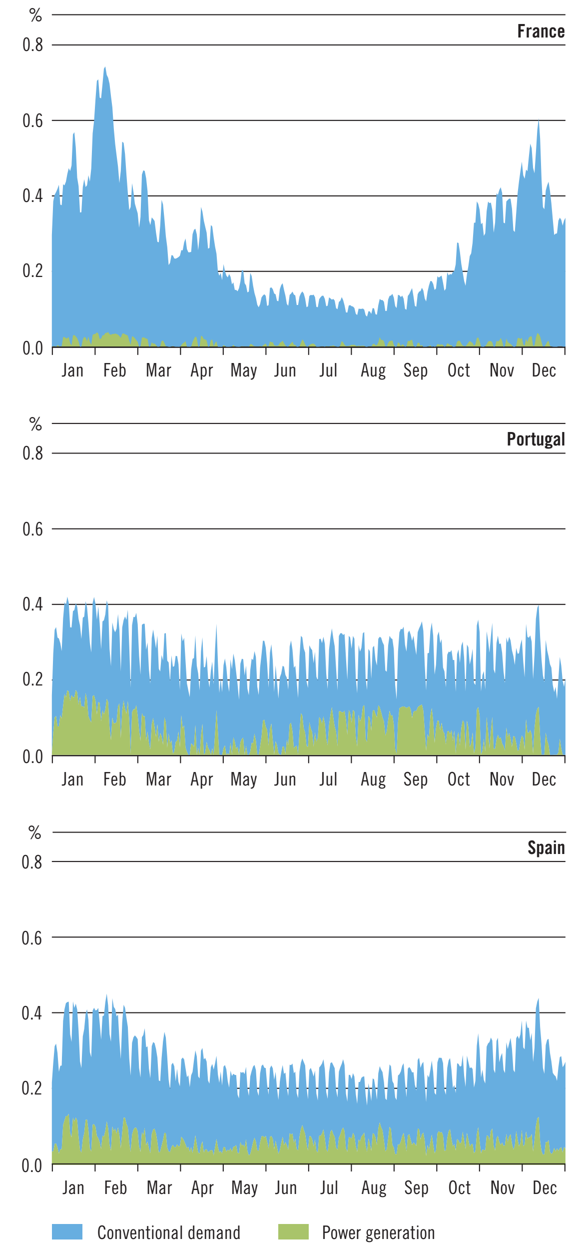


Figure 3.8: Modulation by country – ratio day/year in 2012

Demand behaviour isn't homogeneous across each of the South Region composite countries. Each country's profile is shown below in Figure 3.8 as a ratio between daily demand and total annual demand so that they can be compared on the same scale.

As can be seen, demand in France has a higher variation on a seasonal basis than in Portugal and in Spain which is mainly due to the higher share of the residential and commercial sector (which represents roughly half of the yearly demand in France), stressed by a more colder climate. On the other hand, the weekly modulation is higher in Spain and Portugal, which is mainly due to Spain and Portugal both using gas more for power generation and industry (for example, in 2011, 76% of conventional sector was mainly for the industrial sector).

The gas demand for power generation in 2012 is shown in Figure 3.9. It shows how the demand for power generation fluctuates a lot less with the seasons compared to the conventional demand. It also shows the huge range found in the demand values explained by the role played by gas for power generation in providing flexibility for the electrical system demand modulation, in particular to deal with the intermittency of some renewable power generation (mainly for wind and solar sources).

In the South Region the combined cycle gas turbines (CCGTs) are playing an important role as a support in the development of renewable energy production. Intermittency and unpredictability of renewable energy sources like wind require a flexible back-up. CCGTs can provide efficient flexibility and therefore makes the CCGT an enabler to introduce the development of renewable energies.

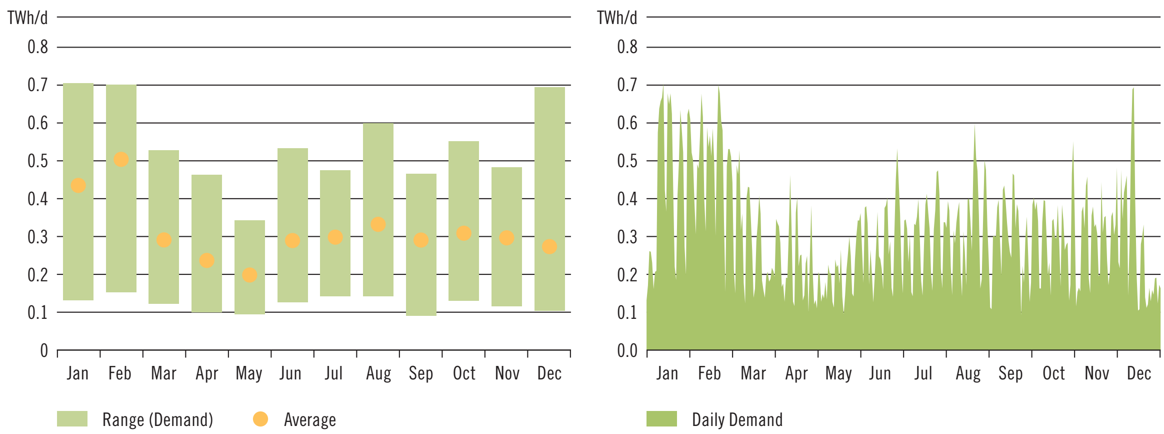


Figure 3.9: Gas demand for power generation in 2012 in the South Region

Nevertheless, gas for power generation is in competition with other sources of electricity, and the part played by gas in electricity generation can vary according to the hydrologic regime, the gas prices (compared to other sources of power and flexibility, such as coal), the electricity demand and prices and political decisions (price of CO_2 permits, subsidies on renewable energy, etc.).

The yearly modulation factor is defined as the daily average gas demand divided by the daily peak demand. A high yearly modulation factor means demand is relatively uniform. A low yearly modulation factor shows that a high demand is set; to service that peak demand, capacity is sitting idle for long periods.

As can be seen in Figure 3.10, France's total yearly modulation factor is lower compared to Portugal and Spain. This is mainly due to the seasonal modulation in France that is much less pronounced in Portugal and Spain. To cope with this seasonal modulation, France has developed important underground storage facilities.

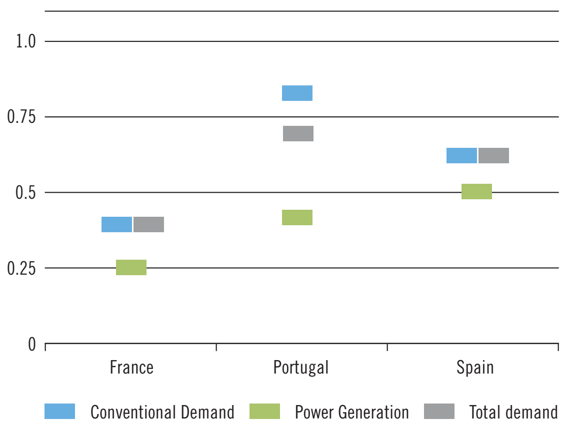


Figure 3.10: Yearly modulation factor for conventional demand, power generation demand and total demand, for France, Portugal and Spain

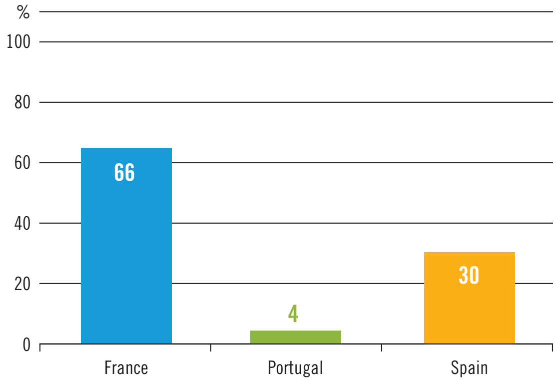


Figure 3.11: Percentage of each country (France, Portugal and Spain) in the peak demand of the South Region

3.2 Key Conclusions

- The key conclusions highlighted by this analysis include both seasonal and daily gas demand modulation and show strong differences among the three countries. In particular, demand presents a significant seasonal modulation in France which is non-apparent in Spain and Portugal,
- The share of gas used for power generation in the gas market is also different for each country: it represents in 2012 24 % of the demand in Portugal, 23 % in Spain but only 4 % in France
- These results are the consequence of the role of the gas for the electricity generation in each country with 24 % of the Power produced with gas in Portugal, 25 % in Spain and only 4 % in France
- The gas demand for CCGTs can have important intraday variations in particular when they are backup to intermittent renewable energy sources. As a consequence, gas fired power plants generally require a high level of flexibility from the gas system.
- In France, Spain and Portugal, the yearly modulation factor for the power generation sector is lower than the yearly modulation factor of the conventional demand. It means, the gas for power generation requires higher flexibility than the conventional sector.

Image courtesy of GRTgaz

3.3 Demand Forecasts

The objective of this section is to show the most updated trend of the long term demand scenarios for the South Region and to provide an analysis of deviations in comparison with the long term forecast included in the TYNDP 2013–2022.

3.3.1 YEARLY DEMAND

The macroeconomic scenarios underlying the natural gas demand projections of both studies, TYNDP 2013–2022 and GRIP, already incorporate the most recent expected trends for the economic activity.

For the South Region, total demand is set to increase over the next ten years, as shown in Figure 3.12.

Yearly demand

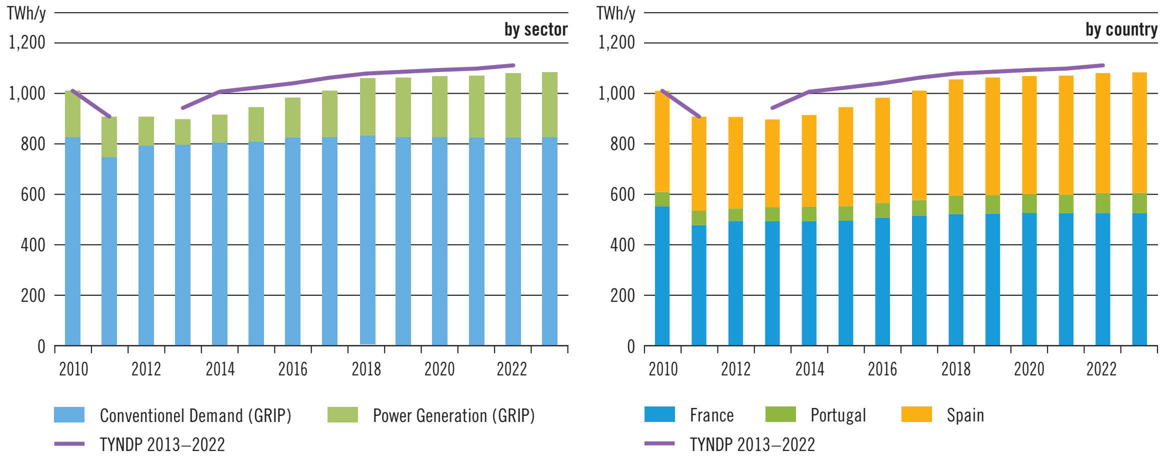


Figure 3.12: Yearly gas demand for the South Region – breakdown by country (right) and by sector (left)

Regarding the Conventional sector:

- GRTgaz is using a bottom-up approach to evaluate the evolution of the demand in the conventional sector (residential, commercial and industry). Type of building, segment of activities and energy uses considering competition with other energies are taken into account. In France, the conventional sector is down especially in the Industry and Commercial sector, due to the economic context in Western Europe and in France. Taking this into account, it leads to some slight differences between the current demand scenarios for the GRIP (established in July 2013) and those presented in the TYNDP 2013–2022 (established in July 2012).
- TIGF has not exactly the same approach as GRTgaz. However, as expected, the same trends appears in TIGF's area. There are also some differences between GRIP and TYNDP. As a result, Conventional demand in France in the current scenario is slightly lower than in the TYNDP because final values for 2012 have been lower than the forecasts with a stronger effect of the crisis.
- In Spain the figures published in the TYNDP 2013–2022 associated to this sector are maintained, since the forecasts are accurate for the actual situation.

- In the case of Portugal, the differences between the current demand scenarios and those presented in the TYNDP 2013–2022 are not significant in both conventional and power generation sector. In the Conventional sector, the current scenarios are slightly higher because of CHP. In this particular case new information about the specific consumption of cogenerations equipment has led to an upward revision in demand scenarios.

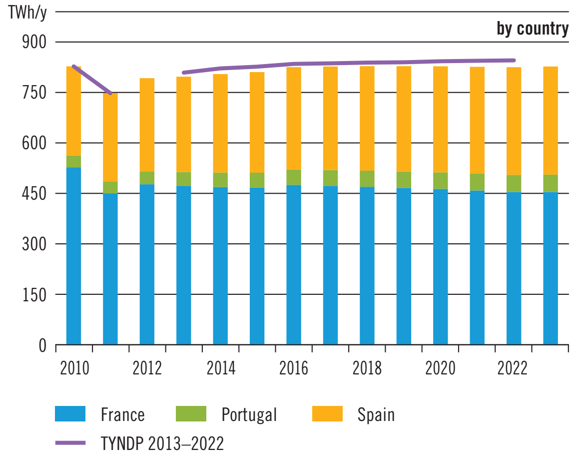


Figure 3.13: Yearly conventional demand by country – TYNDP 2013–2022 vs. GRIPs. France, Portugal, Spain and the South Region

Gas for power generation

Gas consumption for power generation has slowed down significantly in the South region for the second half of 2011.

There are some factors that affect the whole South Region that explain the significant drop of natural gas consumption for power generation:

1. LNG world prices:

The increase of LNG demand in the world causing high LNG prices, had also driven changes in the electricity generation. For example, shippers, operating in both electricity and gas markets and optimizing their global benefit, are reducing the gas-fired power plants production in Spain favouring alternatives fuels.

2. Increase of coal generation, due to several factors:

- Lower cost of generation with coal than with gas: The production of shale gas in the US is skyrocketing. Supply and demand balance of natural gas is eased significantly and the price sagged to one quarter of the last highest level recorded four years ago. Wider use of natural gas in power generation has been seen due to the drop in natural gas price. So substitution between natural gas and coal becomes significant when relative price of natural gas to coal is lower than a certain level. Under the current situation, the impact of shale gas revolution, the surplus coal substituted by natural gas in the US, is exported to Europe, that has increased coal power generation due to low coal price led by imported coal of US origin and low CO_2 price. Strong correlation between coal-gas in US and EU can be appreciated in Figure 3.14.
- Carbon dioxide emission price: CO_2 prices has fallen down to the lowest ever, mainly due to the decrease of the industry, which benefits coal production in Europe as well.

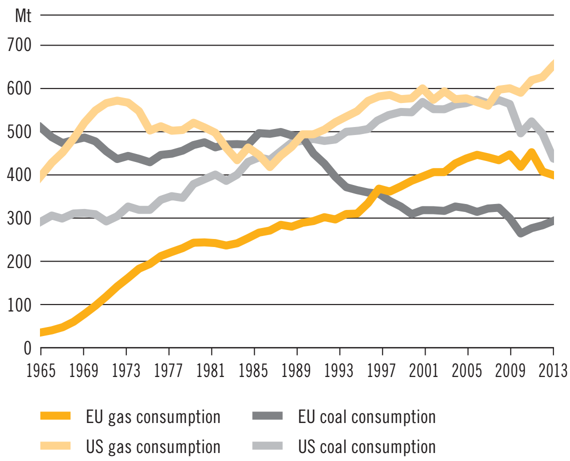


Figure 3.14: EU – USA gas coal correlation (in million tonnes oil equivalent)

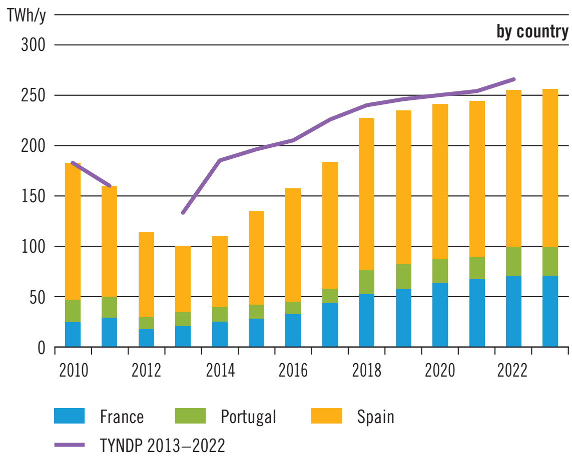


Figure 3.15: Yearly gas demand for power generation – TYNDP 2013–2022 and GRIPs. France, Portugal, Spain and the South Region

3. Increase of the renewable production:

Due to the European Energy policy objectives for 2020 and beyond, the RES installed capacity has increased significantly over the past years. Special relevance assumes the installed capacity in wind parks in the Iberian Peninsula. As a consequence, the share of the renewable production in the energy mix has increased significantly and the gas consumption for power generation has dropped accordingly.

The macroeconomic scenarios underlying the gas for power generation projections of both studies, TYNDP 2013–2022 and GRIP, incorporate the most recent expected trends for the economic activity.

FRANCE

Concerning gas demand for power generation, GRTgaz identifies each project. Comparing to the TYNDP scenario, schedule of new power plants has slightly changed. In the GRIP scenario, some projects have been postponed or cancelled, and some existing power generation capacities have been put on hold for a period starting in 2013 up to 2018. In the TIGF region, a first CCGT project is planned for 2017.

Concerning TIGF area none increase of demand is expected. This is principally due to the effect of the crisis and consequently a loss of economic dynamics. A smooth decrease is considered for TIGF forecast from 2013 to 2022 because of the anticipation of the energy efficiency regulation which will lower the energy consumption of buildings.

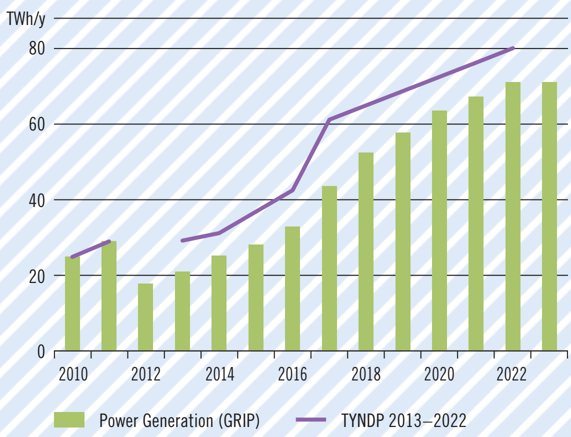


Figure 3.16: France – Yearly gas demand for power generation in the TYNDP 2013–2022 vs. GRIP

PORTUGAL

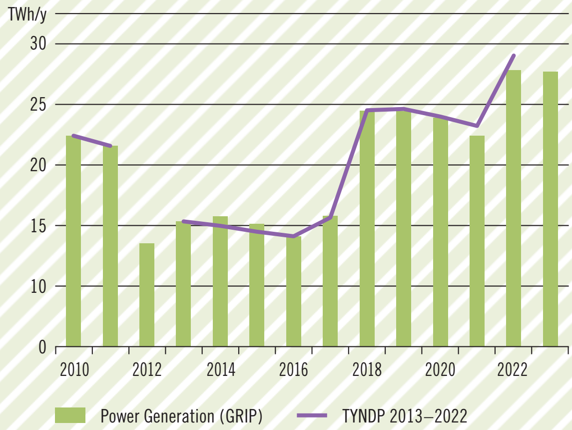


Figure 3.17: Portugal – Yearly gas demand for power generation in the TYNDP 2013–2022 vs. GRIP

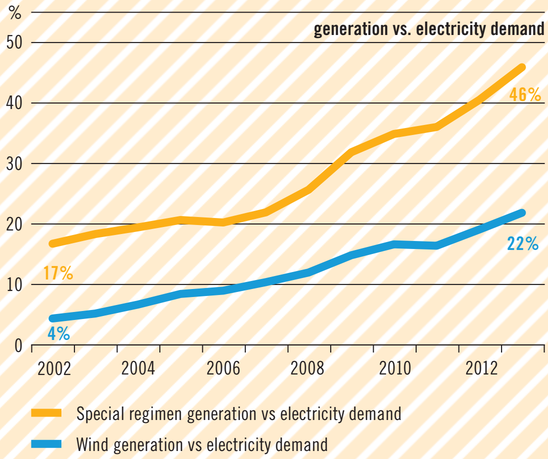
Concerning gas demand for power generation in Portugal, projected consumptions are based on the results of the national studies performed by REN for long term security of supply assessment purposes. With this regard, schedule of new CCGT power plants (as well as of decommissioning of old power plants) has not changed, which contributes to the maintenance of the similarity of both scenarios of gas consumption. This schedule explains the increase in gas consumption forecasted for the years 2017 and 2018, and from 2021 to 2022. On the other hand, the trend of increase forecasted for the renewable installed capacity (RES) and the net import/export balance in the interconnections with Spain explains the slight decrease in gas consumption for the years 2015, 2016, 2020 and 2021.

SPAIN

Taking into account the sharp drop of natural gas consumption for combined cycles in Spain, in the last two years, more pronounced in the current year, there has been a review of the Spanish figures of Natural gas to power generation published in the TYNDP 2013–2022.

Spanish background

The Spanish energy picture has changed due to several factors, among **which stands out the drop in electricity demand**, which neither has been recovered since 2008, nor expected to recover in the short term. (There has been an annual average decrease of around 1.5 % in electricity demand.)



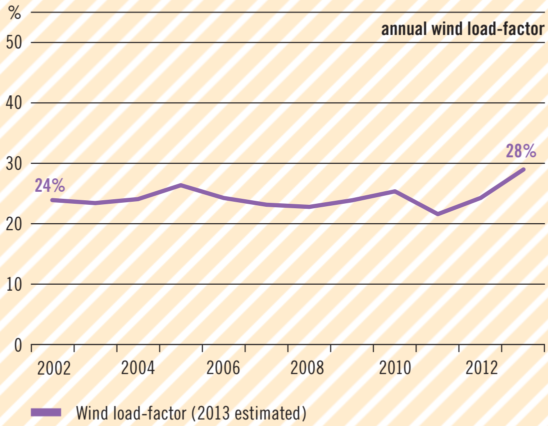


Figure 3.18: Spanish evolution of percentage of Special Regime generation vs. total electricity demand and annual wind load-factor Special Regime: Those technologies under a system of incentives, to place them in a position of competition in a free market. Currently, the main technologies under the special regime are: wind, solar, CHP.

In addition to the factors affecting the whole South Region, other factors to highlight that have influenced the change structure of the Spanish energy mix and as a consequence, have derived in the significant drop of natural gas consumption for Spanish CCGT's are the following:

1. Increase of the renewable contribution to the energy mix:
   To meet the EU 2020 target. In the case of Spain, wind generation has experienced a huge increase in the last years, not only in installed capacities and contribution to the energy mix, but also its load factor that, for example, is growing by 3 points this year.

2. National regulation introduced in 2011 domestic coal production subsides, giving it preferential access to the power market.

These factors together, imply a need of reviewing the figures of gas for power generation published in TYNDP 2013–2022, to gather the actual situation. So let´s see more in detail, the behaviour of the Spanish Energy market, as well as the variables affecting the natural gas for power generation, and the methodology implemented for the analysis.

Long term estimations methodology

The first groups of combined cycles gas turbines started operating in the spring of 2002 and now, in 2013, we find 67 groups already in commercial operation. In the early years of generation with this technology, high load factors were registered, around 42% reaching a maximum of 48% in 2008. The average growth rate of installed capacity for this technology, in the first five years, was 48%. Based on this historical behaviour long-term estimations were made in terms of installed capacity and future projects, taking into account the factors previously mentioned, as well as the level of maturity in the market, the methodology to estimate the gas for power generation has evolved.

The new methodology takes into account the big amount of variables influencing the generation mix (wind, hydro, solar…), and the need to deepen on the Spanish electricity market behaviour, to outline the role occupied by natural gas in that energy market, by using the technique of scenario simulation.[1)]

This methodology carries out an analysis based on three different assumptions depending on electricity demand, development of renewable energy and cost of fuels.

Thus, for a correct analysis of the generation mix, it would be needed to have a thorough understanding of each of the variables that are part of it, highlighting:

- Electricity demand
- Wind generation
- Nuclear generation
- International flows
- Hydro generation
- Rest (rest of renewables, fuel, auto consumptions, etc.)
- Thermal generation: natural gas + coal (Thermal gap)

The thermal generation (thermal gap) represents the last resort in the Spanish generation mix to cover electricity demand. It should be noticed that this thermal gap is impacted by the variability of renewables and level of electricity demand. The thermal gap will be split according to the cost of production associated with each fuel (natural gas and coal). These costs are marked mainly by:

- International coal prices
- International spot market Price of natural gas
- CO_2 emission price

To develop the new scenarios for the GRIP, in all of them the level of the nuclear generation has been maintained, as the installed capacities for this technology do not change in the period under study. Concerning hydro power an average hydro-year has been considered, as installed capacity neither changes.

Two different assumptions of electricity demand growth and special regime growth (high and low) have been set up, giving a total of **four scenarios built with all the possible combinations between demand growth (high and low) and Special Regime growth (mainly wind and solar, high and low)**. For each of the four scenarios, there are 3 alternatives to distribute the thermal gap, depending on the relative prices of coal and gas (price equilibrium, competitive coal price related to gas price and competitive gas price related to coal). So, four different scenarios with 3 possibilities each, give a range of 12 scenarios.

1) It is not just one or several predictive models, but explicit knowledge of the sector and its significant variability: deductive models, generating scenarios based on the different variables influencing and their respective uncertainties.

The assumptions carried out for the review analysis, has considered as the main driver for generating the final scenarios, the economic recovery, that implies different electricity demand growth rates and different development of the Renewable sources.

It has been considered two more reasonable alternatives:

- First one is considering a slow progression of the economy, that implies slow electricity demand evolution and low Special Regime (wind and solar) development,
- Second one is considering an accelerate recovery of the economy: that implies high electricity demand evolution and high Special Regime (wind and solar) development.

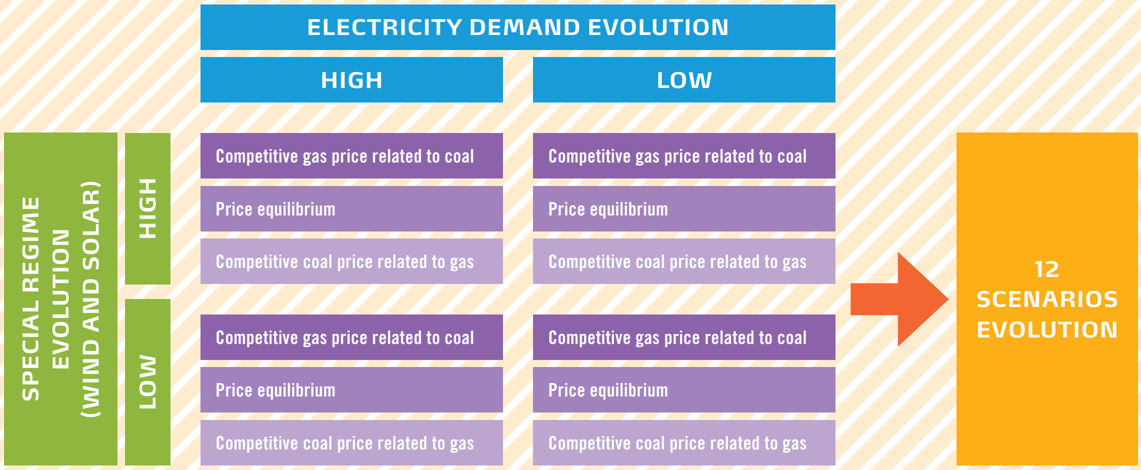


Figure 3.19: Spain – Gas for power generation yearly scenarios

It should be highlighted that gas demand for power generation for the next 10 year period will be a combination of these scenarios. In order to determine a new trend of annual gas for power generation evolution, the final proposal contemplates a scenario that:

- in the short term (2014–2015), a slow progression of the economy that implies LOW electricity demand growth and LOW wind and solar development.
- from 2016, the economy starts a moderate recovery, to achieve in 2020 an accelerated evolution that implies HIGH electricity demand growth and High wind and solar development to meet the EU 2020 target.

Comparing both projections, it is shown that in the first years of the horizon, the current projections are lower than the ones of TYNDP 2013–2022, but from 2018, considering competitive gas price, and an accelerated progression of the economy, we achieve the figures set up on TYNDP 2013–2022.

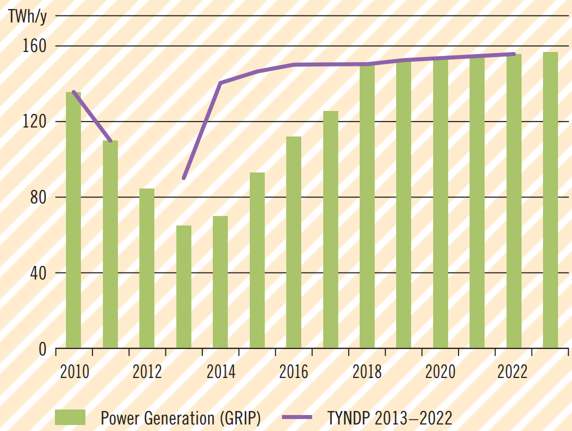


Figure 3.20: Spain – Yearly gas demand for power generation in the TYNDP 2013–2022 vs. GRIP

3.3.2 HIGH DAILY DEMAND

Design case

European TSOs estimate each country's national peak demand for the design and the planning of their national gas networks, because the gas systems must be able to cope with this high daily demand. In TYNDP 2013–2022, following a bottom-up approach, the 1-day Design Case Situation is calculated as the aggregation of the national peak demands (design demands). The 1-day Design Case Situation is the most stressful situation, in terms of demand, to be covered by the capacity of the entries to the gas transmission system.

The 1-day Design Case Situation for the South Region is calculated as the aggregation of the national design demands of France, Portugal and Spain. The level of risk used in each country of the South Region to calculate the Design Case is different: in France it is used a 1-in-50 level of risk and in Portugal and Spain the level of risk is 1-in-20. Consequently, the level of risk of the South Region is higher than 1-in-20.

The forecast of the 1-day Design Case Situation of the South Region is shown in Figure 3.21. It is expected a steadily increase along the 2013–2022 period, mainly due to the increase of the percentage of power generation in the 1-day Design Case Situation.

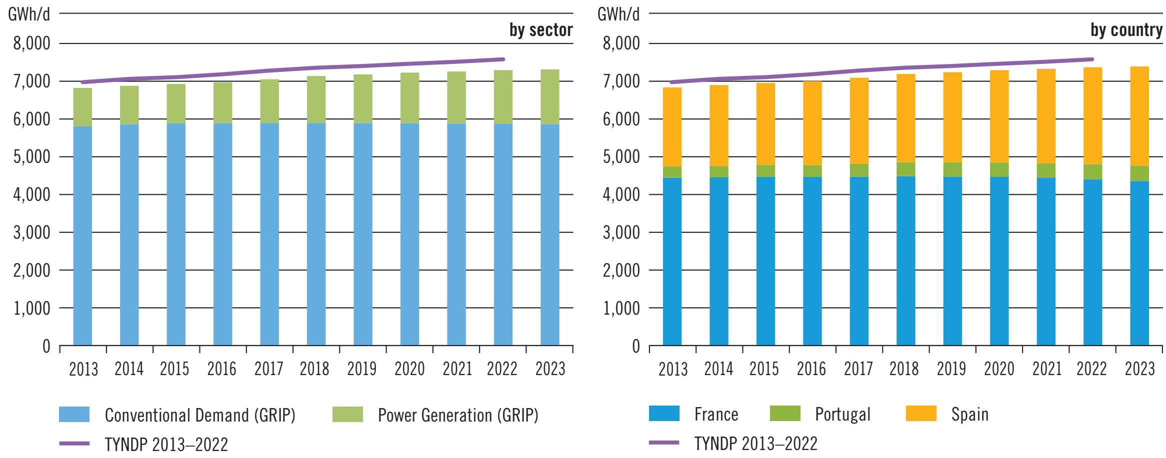


Figure 3.21: High daily demand: design case
1-day Design Case Situation for the South Region – breakdown by country (right) and by sector (left)

FRANCE

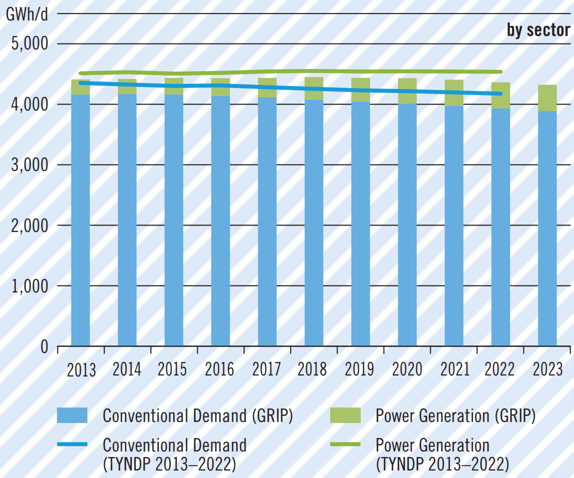


Figure 3.22: High daily demand: design case
France – HDD Design Case TYNDP 2013–2022 vs. GRIPs

The French legislation defines a specific standard for the level of risk to be adopted for gas transport, distribution and supply. At national level: the high daily peak demand corresponds to a day of exceptionally high gas demand occurring with a statistical probability of one in 50 years.

Thus, for the determination of the high daily demand the same methodology used in the previous TYNDP 2013–2022 study has been implemented.

As presented in Figure 3.22, a global stagnation is now observed. A smooth decrease is taken into account for the industrial and commercial sectors due to the economic crisis in Western Europe and in France. CHP sector has been strongly impacted for the past couple of years by the decommissioning of several facilities at the end of their specific contracts. Impact of the environmental regulation on the residential and commercial sectors is not stronger in the GRIP scenario compared to the TYNDP 2013–2022.

PORTUGAL

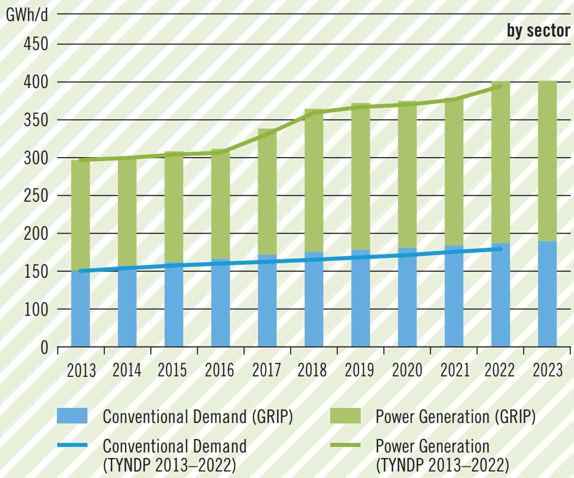


Figure 3.23: High daily demand: design case
Portugal – HDD Design Case TYNDP 2013–2022 vs. GRIPs

Portuguese legislation doesn't define a specific standard for the level of risk to be adopted beyond the requirements imposed by Regulation (EU) No. 994/2010 on security of gas supply. Hence, for this purposes, REN is adopting Article 6 – Infrastructures standard as the reference to be adopted at national level: the high daily peak demand corresponds to a day of exceptionally high gas demand occurring with a statistical probability of one in 20 years.

Thus, for the determination of the high daily demand the same methodology used in the previous TYNDP 2013–2022 study has been implemented. As presented in Figure 3.23, the results of both studies are very similar.

SPAIN

For the calculation of the high daily demand, the same methodology used for the yearly demand forecast has been implemented, with the only difference that it has been only considered the scenario of competitive natural gas Price related to coal.

This is mainly due to the fact that the design of infrastructures should be enough to face up to the most critical situation, so the highest possible scenario has to be taken into account.

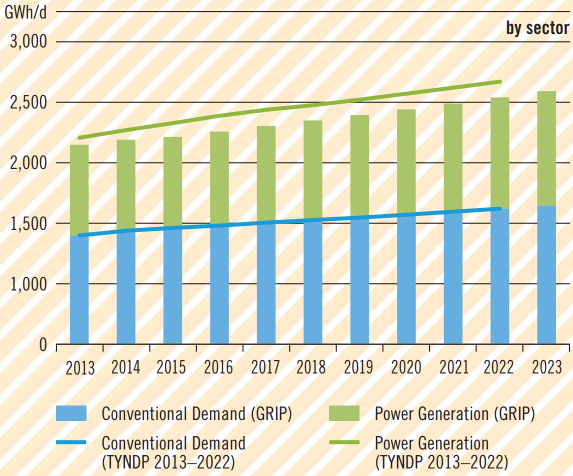


Figure 3.24: High daily demand: design case
Spain – HDD Design Case TYNDP 2013–2022 vs. GRIPs

Demand under Uniform Risk Situation (1-day, 14-days)

In addition to the 1-day Design Case Situation, another high daily demand was defined in TYNDP 2013–2022: the Demand under 1-day of Uniform Risk Situation. To define this demand a temperature database (coming from the European Commission) was used, with the effective daily temperature of each country, from January 1975 to December 2011. Using this database, the yearly minimum effective temperature was calculated for each country. It was also defined a harmonized Risk Situation of 1-in-20 climatic (temperature) condition. The 1-day Uniform Risk Temperature is defined by the percentile 0.05 (1/20) of the yearly minimum effective temperature, for each country. For the calculation of the Uniform Risk Situation, the gas demand is supposed to have a direct link with the temperature. Accordingly, the Demand of 1-day Uniform Risk Situation is the gas demand corresponding to the 1-day Uniform Risk Temperature. The Demand of 1-day Uniform Risk Situation for the EU-27 is calculated as the aggregation of the national 1-day Uniform Risk Situations.

On the other hand, as the gas demand for power generation has not a direct link with the temperature, this methodology is only suitable for the conventional gas demand (Industrial + Residential + Commercial).

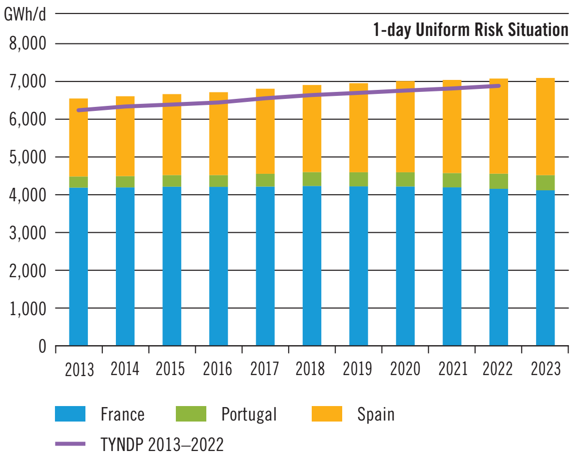
It is not only the level of demand, but also the availability of supply sources in the entry points as well as the transmission capacity which challenge system operation. The availability or lack of availability of supply is usually impacted by the duration for which high levels of gas consumptions are sustained. On this basis, ENTSOG TYNDP 2013–2022 has also estimated a 14-day period as significant for the definition of a long period of high demand testing the resilience needs of the system.

The objective of the calculation of these different demands is to carry out an assessment of the gas network under different level of demand associated to different levels of supply.

The 14-days Uniform Risk Situation was calculated using the same statistical approach defined for the 1-day Uniform Risk Situation, but taking the average of 14 consecutive days of effective temperature instead of the daily effective temperature. The EU-27 14-days Uniform Risk Situation was calculated as the aggregation of the national 14-days Uniform Risk Situations.

When comparing the high demands of the South Region (1-day Design Case, 1-day Uniform Risk Situation and 14-days Uniform Risk Situation) it can be seen that:

- The highest values correspond to 1-day Design Case Situation, that is, the most stressful demand for the gas network.
- Along the 2013–2022 period the difference between1-day Design Case Situation and 1-day Uniform Risk Situation remains stable. This difference is mainly due to the difference level of risk considered in each country for the estimation of the Design Case.



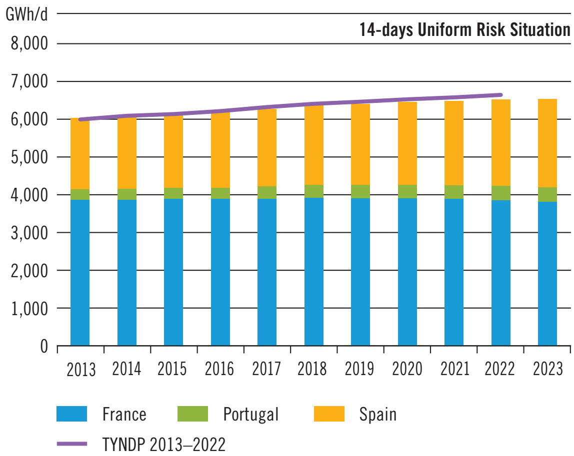


Figure 3.25: High daily demand by country
Demand under Uniform Risk Situations for the South Region (breakdown by country)

3.3.3 YEARLY MODULATION FACTOR

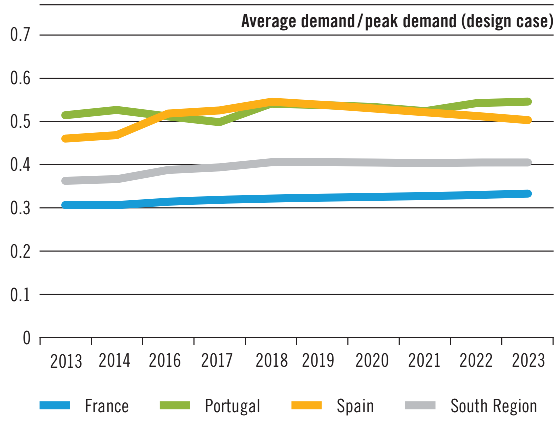


Figure 3.26: Evolution of the yearly modulation factor, for the South Region, France, Portugal and Spain (Source: own calculation, using data for GRIPs)

Figure 3.26 shows the evolution of the yearly modulation factor, calculated as the relation between the average demand and the peak demand (design case) and for the South Region, France, Portugal and Spain. The yearly modulation factor of the South Region is expected to remain stable after a decrease in 2014.

In France, the demand of the conventional sector is foreseen to slightly decrease, due to the residential and commercial sector (heating uses) and the results of the environmental regulation (buildings isolation, etc.), even if the gas demand of the industrial sector is foreseen to increase. The forecast of the power generation sector is more optimistic with new projects of combined gas cycle turbine power plants (CCGTs). The modulation factor of the residential and commercial sector is far lower than the modulation factor of the industrial and power generation sectors; consequently, the global evolution of the load factor for France is an increase.

In Portugal, the demand of the conventional sector will continue to increase at higher rates that the rest of the economy of the country due to a still ongoing natural gas penetration in the energy mix of the country, both in terms of natural gas consumption per capita and natural gas intensity in GDP, but also due to new industrial gas consumers. The yearly modulation factor is expected to increase, although changes in this pattern can happen due to the volatility of the natural gas demand for power generation.

The estimated yearly modulation factor decreases in Spain after 2018 due to the increase of residential and commercial sector, and also due to the expected increase in the power generation sector in the coming years.

We can see in Figure 3.26 that, in spite of the evolutions of the national yearly modulation factors, the Regional yearly modulation factor remains stable after 2018. This fact indicates possible positive synergies in terms of system flexibility in the Region, which could be facilitated with more integration between the different systems.

4 Supply

Regional Overview | Pipeline Imports | The LNG Market in the South Region | Key Conclusions on the Regional Overview of the Supply

Image courtesy of Enagás

4.1 Regional Overview

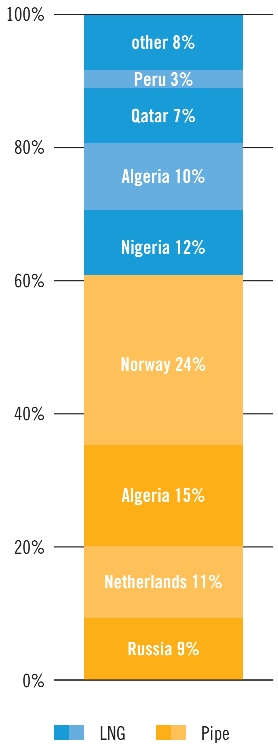


Figure 4.1: Breakdown of supply to the South Region in 2012 (Source: BP 2013)

The South Region is highly dependent on natural gas imports. Gas production is currently negligible in both Spain and Portugal and only accounting for 1 % of the natural gas consumption in France.

From a global point of view, in 2012, 39 % of the natural gas imports in the South Region has been delivered as Liquefied Natural Gas (LNG), while the remaining 61 % was imported through pipelines. These figures are not homogeneously distributed among the three countries of the South Region, as shown in Figure 4.1.

Nevertheless, in all the countries of the South Region the share of LNG imports is far higher than the European average (14 %)

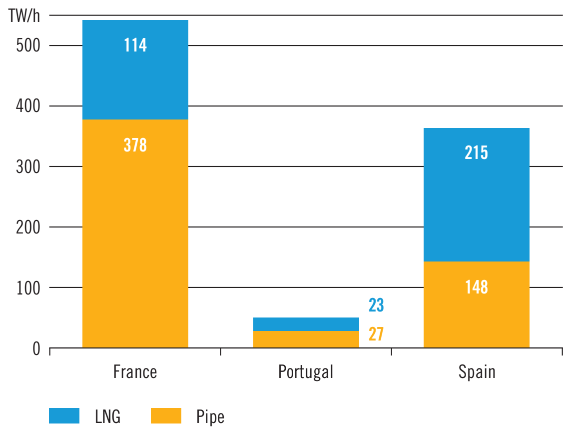
As a consequence of the important use of LNG in the Region, the South Region is characterized by a highly diversified supply portfolio with imports from 14 different origins. The diversification of supply differs from one country to another and between pipeline and LNG entries. If we focus on pipeline imports only, the diversification of supply is far less positive, as shown in Figure 4.1.

It can be interesting to split gas supply into two different types of source – pipeline supply and LNG supply, which provides diversification and is more connected to the world gas market. Currently, in the South Region, pipeline imports only come from four countries while LNG has 8 different sources.

Pipeline supply is, by its very nature, less flexible when compared to LNG, which is connected to a much wider world market. In other words, building an LNG Terminal grants you access to any number of LNG exporting countries whereas building a pipe (generally) only gives you access to the supplies of one country. LNG also has the benefit of being easily diverted if prices are high in other parts of the world.

Most of the supply in the South Region is from outside the EU (Figure 4.1). With the decline of the European production, imports from non-EU sources will continue to rise over the coming years.

There is also possibility to develop unconventional sources of gas such as shale gas and biogas; however, the data included in the ENTSOG-TYNDP is only preliminary due to the current high uncertainty levels in their development. At medium/long term, they will probably diminish gas imports from non EU countries.



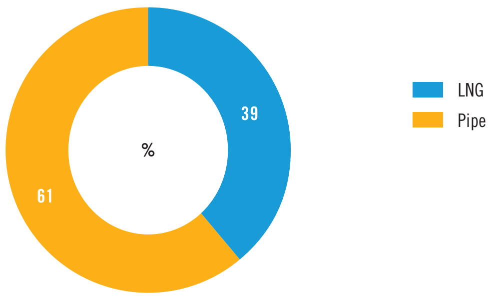


Figure 4.2: Share between pipeline and LNG in the South Region in 2012 (Source: Eurogas).

4.2 Pipeline Imports

The pipeline gas portfolio is composed of four different origins, Norway, Algeria, Netherlands (internal production) and Russia, as seen below. There are three countries supplying France, two supplying Spain and just one supplying Portugal.

It is evident that pipeline supply is an area that could benefit a lot from diversification. As it stands at the moment, it would be beneficial to increase diversification of supply throughout the Southern Region by extending the supply of Russian gas southward towards Spain and by extending the supply of Algerian gas northwards towards the rest of Europe.

The reserves held by each of these countries could have an effect on their ability to supply. Gas production in the Netherlands is set to decrease over the next ten years; hence L-gas imports in the North East of France will decrease accordingly.

As seen in Figure 4.5, Russian supply is significantly vaster compared to the reserves of the other countries, however, Russia is a very vast country itself, so not all this supply is available for Europe. This becomes important, especially when we compare much closer sources such as Norway and Algeria, as a much larger percentage of their reserves will be actually available to the South Region.

Norwegian gas production activity is mature, with significant infrastructure in areas of the North Sea where the geology is often well known, therefore large new discoveries are less likely than before in these areas. It is also well integrated with the European market hence the availability of supply from Norway is very high.

The supply potential from Norway is set to remain fairly constant over the coming years, according to ENTSOG, and so it should be expected that South Region imports of Norwegian gas will remain fairly constant over the next ten years accordingly.

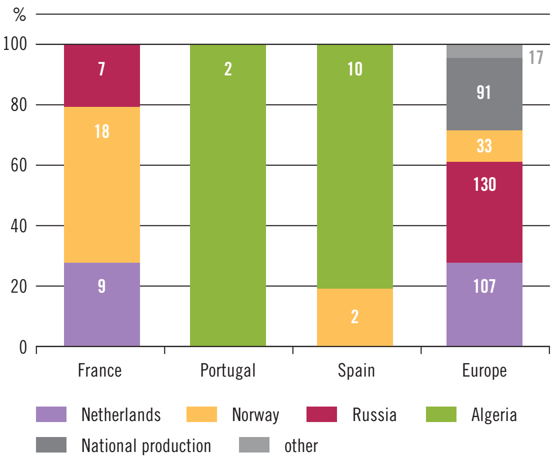


Figure 4.3: Origins of gas imported via pipeline to the South Region in 2012 (values in bcm) (Source: BP 2013)

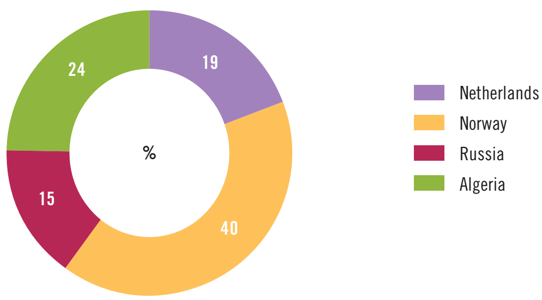


Figure 4.4: Breakdown of pipeline supply to the South Region in 2012 (Source: BP 2013)

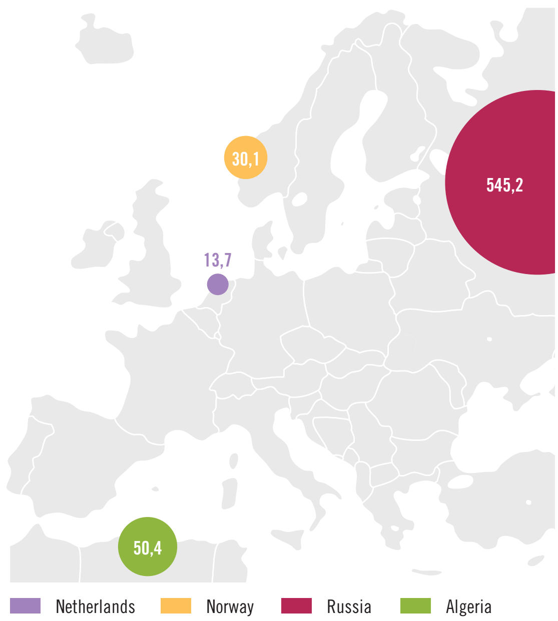


Figure 4.5: Proven reserves of each pipeline supply country, with the relative areas of the bubbles representing total reserves in 2012, 10^3 TWh

Figure 4.6: Supply potential forecasts to the EU-27 for the major pipeline suppliers to the South Region in TWh/year

The supply potential of Russia, however, is set to steadily increase over the next ten years. The development of gas Corridors along Europe opens up the path to gas flows that could be made available to the more southern regions of the South Region, i.e. Portugal and Spain, diversifying their pipeline imports. This would increase the liquidity in the gas market opening possibilities of arbitrage between the different European gas sources.

The proximity and the level of reserves of Algeria may encourage investment in pipelines from Algeria with the aim of increasing diversification to Europe. Long term supply visibility from Algeria would be promoted by partners' agreements as well as it has been the case of gas with Norway which, thanks to EEC free trade agreements, shows long term stability.

4.3 The LNG Market in the South Region

The level of LNG supplies that will reach the European market in the future will depend on many factors, including:

- The potential for significantly increased global liquefaction capacity going forward, for example the facilities under construction in Australia, proposals to export US gas as LNG and possible new LNG from Africa (Mozambique) and Russia.
- Higher global LNG demand, particularly in the Far East.
- Inter-regional price variations. In some instances traded LNG would flow towards higher priced markets.
- In the short term, uncertainty regarding LNG demand in Japan due to the level of nuclear generation returning.

It should be highlighted that one of the major effects in the evolution of LNG supplies will be the changing US supply-demand position. Only a few years ago, with domestic gas production in decline, the US was predicted to be a significant importer of LNG in the future. Now, with developments in hydraulic fracturing and horizontal drilling, shale gas production has increased so significantly that the US could potentially become a significant exporter of LNG over the next decade and beyond.

In 2012 the world LNG trade amounted to 522 million cubic meters of gas in liquid form, 2 % less than 2011 (532 million m³). Of this total amount, 20 % was destined for Europe with over 48 % of this amount going to the southern region.

12 % of the LNG traded during 2012 was destined for the South Region, most of which comes from the Atlantic Basin, who are highly reliant on the South Region as a place to export to, with over 31 % of their exports destined for the South Region. 5% of exports from the Middle East and just 2 % of exports from the Pacific Basin were destined for the South Region.

Use of LNG is a reliable way to increase the diversification of supply sources. It also allows for greater seasonality of demand as it is generally available in both long term and short term contracts. This short term supply provides greater flexibility in the supply of natural gas. These short term contracts represented 12 % of overall LNG trade in the South Region in 2012.

The short-term contracts allow operators to avoid committing to one area of supply for long durations and can also offer more attractive prices than long term contracts, hence their popularity throughout Europe and the South Region. The diversification of supply in the South Region, largely coming from LNG, is illustrated well in Figure 4.8.

World Market in LNG in 2012	World	EU-27	South Region
ATLANTIC BASIN			
Algeria	5 %	3 %	3 %
Egypt	2 %	1 %	0 %
Equatorial Guinea	2 %	0 %	0 %
Libya	0 %	0 %	0 %
Nigeria	8 %	3 %	3 %
Norway	1 %	1 %	1 %
Trinidad & Tobago	6 %	1 %	1 %
Atlantic Basin Total	**24 %**	**9 %**	**8 %**
MIDDLE EAST			
Abu Dhabi	2 %	0 %	0 %
Oman	3 %	0 %	0 %
Qatar	32 %	9 %	2 %
Yemen	2 %	0 %	0 %
Middle East Total	**40 %**	**9 %**	**2 %**
PACIFIC BASIN			
Australia	9 %	0 %	0 %
Brunei	3 %	0 %	0 %
USA	0 %	0 %	0 %
Indonesia	8 %	0 %	0 %
Malaysia	10 %	0 %	0 %
Peru	2 %	1 %	1 %
Russia	5 %	0 %	0 %
Pacific Basin Total	**36 %**	**1 %**	**1 %**
World Market Total	**100 %**	**19 %**	**10 %**

Table 4.1: Share of each country as a supplier in trade for the World, EU-27 and South Region (Source: GIIGNL 2012)

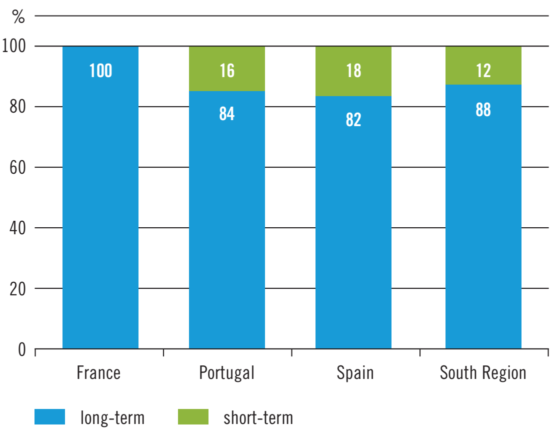


Figure 4.7: Long term vs. Short term contracts in LNG destined for the South Region in 2012 with the total for the South Region shown (Source: GIIGNL, 2012)

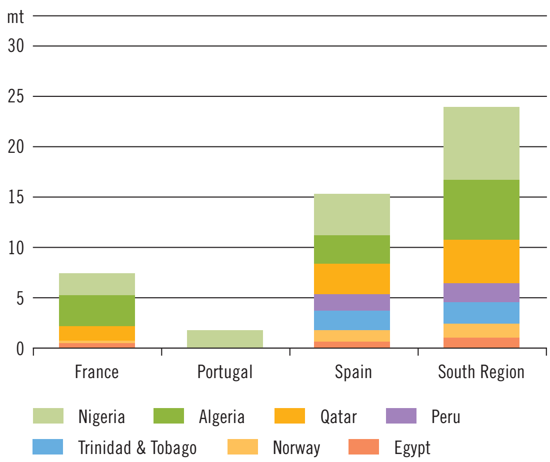


Figure 4.8 : Sources of LNG imported into the South Region in 2012 by country (Source: GIIGNL, 2012)

The LNG supply chain to the South Region is highly diverse, with imports coming from 7 different countries in 2012. This diversification is set to increase with increasing supplies from some countries and new sources entering the market, such as the USA's strengthening position or Australian ongoing developments. These facts combined with the responsiveness to price of LNG make it an appealing source of diversification for gas imports.

4.4 Key Conclusions on the Regional Overview of the Supply

The South Region is highly dependent on imports of natural gas with less than 0.7 % of gas consumed being produced by the country itself. This high dependence on gas imports outlines a few key important factors when choosing supply sources, for example the diversification and flexibility of supplies to prevent over dependence on just one source.

There is a roughly equal split between the import of gas as LNG and via pipelines in the South Region, however it is not homogeneous on each country showing a higher share in Spain and Portugal. LNG imports are highly developed, providing a lot of the diversification of the South Region's import basket.

Being highly diverse, the import portfolio in the South Region has gas coming from 13 different countries, not including trade between countries in the South Region itself.

The TYNDP 2013–2022 potential supply appears to show that there will generally be significant supply flexibility in the future. However, some uncertainties exist: it could take a long time to develop these potential supplies and the associated infrastructures; moreover, supply potential for Europe will also depend on the demand situation throughout the rest of world, which attract a greater and greater proportion of the gas market.

5 Infrastructure Projects

Overall | Update on Infrastructure Projects | Market Consultation and Other Means to Identify Market Needs in the South Region | List of Projects | Interconnection Capacities in the South Region

Image courtesy of GRTgaz

5.1 Overall

The South Region is located in the west end of Europe and it consists of Portugal, Spain and France. At Europe level, it is connected via LNG facilities and cross-border interconnections with Africa, Norway and Central Europe.

Over the next decade, huge energy infrastructures are needed in the European Union to achieve its goals for the energy market: security of supply, competitiveness and sustainability.

5.2 Update on Infrastructure Projects

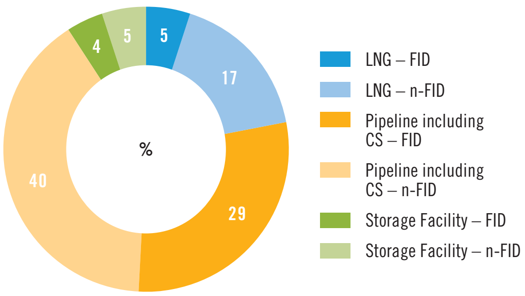


Figure 5.1: Breakdown of projects

The infrastructure projects here presented have been updated during summer 2013 by ENTSOG.

The South Region is one of the most attractive and dynamic region in Europe concerning the gas infrastructure projects, as it counts 78 projects, around 26 % of the projects identified by ENTSOG TYNDP. A final investment decision has been taken for 30 of these projects.

5.3 Market Consultation and Other Means to Identify Market Needs in the South Region

The infrastructure projects here presented have been updated during summer 2013 by ENTSOG.

In the South Region, many market consultations have been organized to develop cross border capacities for the past few years. Since 2005, TSOs of the South Region have launched consultations and binding requests for additional capacities with each neighbouring TSO:

- The first one, in 2005, led to the creation of new entry capacity from Germany, growing from 120 GWh/d in 2008 to 620 GWh/d in 2009.
- After two consultations organized in 2009 and 2010, cross border capacities with Spain will be enhanced in 2013 at Larrau and in 2015 at Biriatou, in both directions as described in Figure 5.2.
- In order to consolidate the integration of the French, Belgian and North European markets, Fluxys Belgium and GRTgaz have completed two consultations together, one in 2010 and the other in 2011. Both TSOs will develop their transmission networks accordingly:
  - capacity from Belgium to France will be increased in 2013 at Taisnières,
  - and a new interconnection point will be created in 2015 at Veurne to provide non-odorised gas from the new Dunkirk LNG Terminal to the Belgian border.
- The consultation conducted jointly by GRTgaz and FluxSwiss in 2012 to increase capacity out of Switzerland towards France by 2016–2018 didn't enable to develop entry capacity to France. GRTgaz and FluxSwiss are now working on a new product that would require less investment and would better fit market need. This new capacity could be commissioned at the earliest in 2017, provided this requirement is confirmed in 2014.
- The consultation conducted jointly in 2012 and 2013 by GRTgaz and CREOS Luxembourg in order to increase France's interconnection capacity towards Luxembourg failed to confirm the interest of market operators in the capacity proposed. However, the project could go ahead if Luxembourg confirmed its interest with a view to securing its supply.
- Having been requested by several shippers in the past, the increase in exit capacity out of France into Italy via Switzerland is subject to the feasibility of increasing capacity in Switzerland. In light of the uncertainties concerning the latter point and the period from contract to delivery of such works, the date of commissioning of such capacity is planned for the end of the ten year plan.

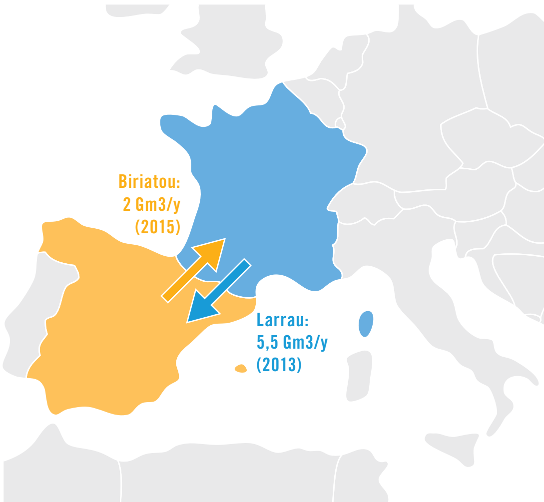


Figure 5.2: Capacity between France and Spain after developing the FID projects

In addition to these market consultations, many projects including core network developments are initiated by large import projects, in particular LNG Terminals, by large storage projects, or by the evolution of the French market design such as the expected merger of gas hubs.

In Portugal, the NG projects are approved by the Portuguese Government after the consultation of the NRA (ERSE). In spite of not being mandatory to have a market consultation, during the year of 2013, the National Plan (TYNDP) for the period 2014–2023 was put under a public consultation process for a period of 30 days. With this procedure, the market has the opportunity to comment on all relevant projects included in the National Plan (TYNDP), both the core network development projects and also the cross-border interconnection projects.

5.4 List of Projects

On the following maps are given the location of all the projects in the South Region, identified by their ENTSOG TYNDP code.

Details on each project can be found in Tables 5.1, 5.2 and 5.3.

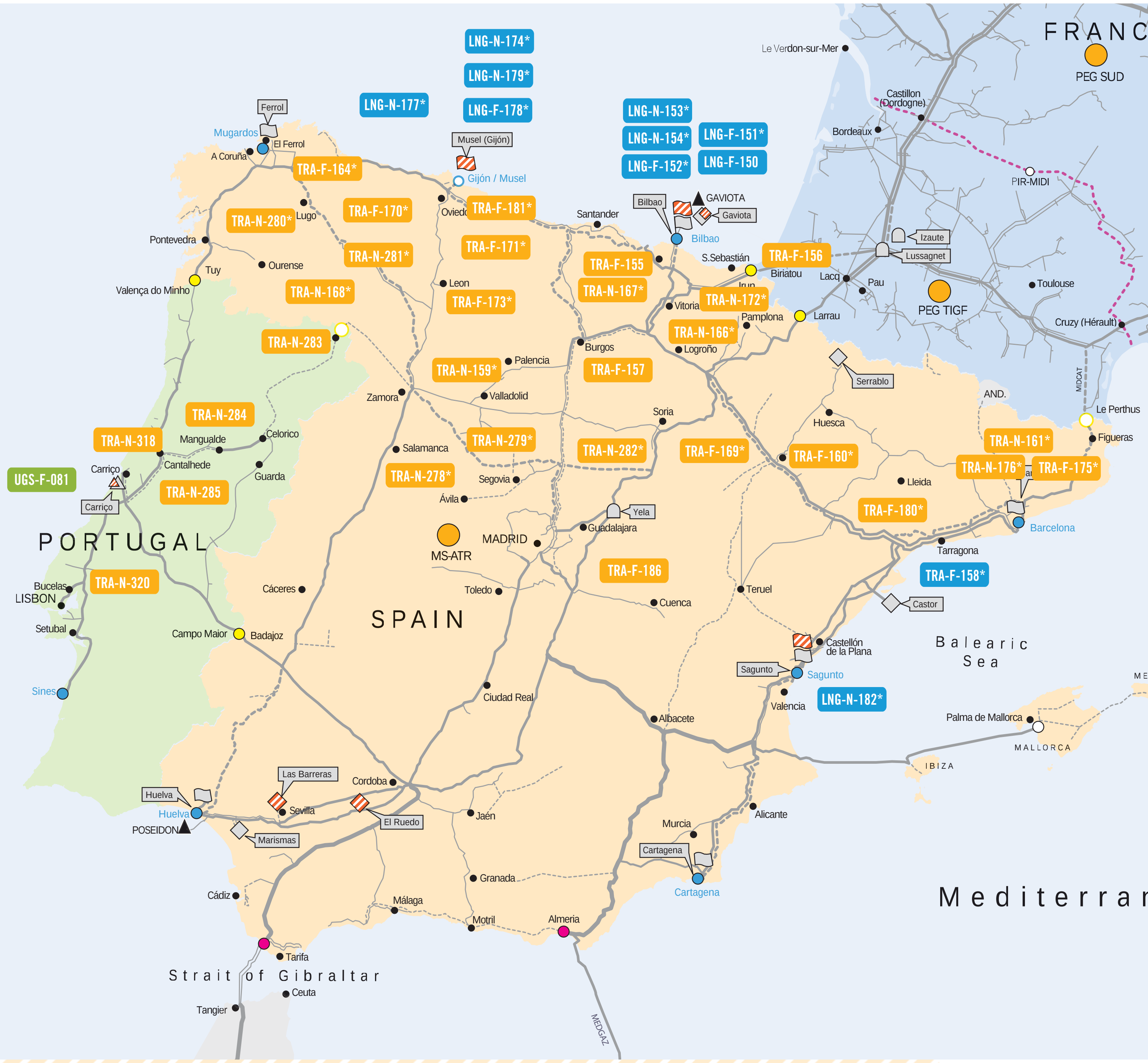


Figure 5.3: Portugal and Spain – Location of projects, identified by their ENTSOG TYNDP code

* Spanish core network projects postponed/mothballed until a new planning document is approved by the government according to Spanish Royal Decree-Law 13/2012. No changes at Cross-border Interconnection Points Capacity

Figure 5.4: France – Location of projects, identified by their ENTSOG TYNDP code

Promoter	Code	Project	FID	Commision-ing Year[1]
PIPELINES, INCLUDING COMPRESSION				
Enagás S.A	TRA-F-156	CS Border at Biriatou	FID	2015
	TRA-F-181	Musel Terminal – Llanera	FID	2014
	TRA-F-175	Martorell – Figueras	FID	–
	TRA-F-180	Nuevo Tivissa – Arbós	FID	–
	TRA-F-170	Loop Llanera – Otero	FID	2014
	TRA-F-171	Loop Treto – Llanera	FID	–
	TRA-F-173	Loop Villapresente – Burgos	FID	–
	TRA-F-166	Loop Bermeo – Lemona	FID	–
	TRA-F-169	Loop Castelnou – Villar de Arnedo	FID	–
	TRA-F-158	New Utilities CS Tivissa	FID	–
	TRA-F-160	CS Zaragoza power increase	FID	–
	TRA-F-164	Guitiriz-Lugo	FID	–
	TRA-F-157	Power increase CS Haro	FID	–
	TRA-F-186	Zarza de Tajo-Yela	FID	2013
	TRA-N-176	Iberian-French corridor: Eastern Axis-Midcat Project (CS Martorell)	n-FID	2021
	TRA-N-281	Villafranca del Bierzo-Castropodame	n-FID	–
	TRA-N-282	Zamora – Barbolla – Adradas	n-FID	–
	TRA-N-278	Castropodame – Zamora	n-FID	–
	TRA-N-279	CS La Barbolla	n-FID	–
	TRA-N-280	Lugo – Villafranca del Bierzo	n-FID	–
	TRA-N-172	Loop Vergara – Lemona	n-FID	–
	TRA-N-168	Interconnection ES – PT (3rd IP)	n-FID	–
	TRA-N-159	CS Zamora power increase	n-FID	–
	TRA-N-161	Iberian-French corridor: Eastern Axis – Midcat Project (Pipeline Figueras – French border)	n-FID	2021
	TRA-N-167	Loop Arrigorriaga – Lemona	n-FID	–
ETN (Enagás Transporte del Norte)	TRA-F-155	Bilbao Terminal – Treto	FID	2014
GRTgaz	TRA-F-037	Entry capacity increase from Belgium to France	FID	2013
	TRA-F-039	Iberian-French corridor: Western Axis (CS Chazelles)	FID	2013
	TRA-F-038	Transmission system developments for the Dunkerque LNG new terminal	FID	2015
	TRA-F-040	Reverse capacity from France to Belgium at Veurne	FID	2015
	TRA-F-036	Arc de Dierrey	FID	2016
GRTgaz	TRA-F-041	Eridan	FID	2017
	TRA-N-045	Reverse capacity from CH to FR at Oltingue	n-FID	2017
	TRA-N-042	New interconnection IT – FR to connect Corsica	n-FID	2018
	TRA-N-043	Val de Saône project	n-FID	2018
	TRA-N-044	New interconnection to Luxembourg	n-FID	2018
	TRA-N-048	Transmission system developments for Montoir LNG Terminal expansion at 12,5 bcm – 1	n-FID	2018
	TRA-N-253	Arc Lyonnais pipeline	n-FID	2019
	TRA-N-254	Connection of the Fos faster LNG new terminal	n-FID	2019
	TRA-N-255	Fos Tonkin LNG expansion	n-FID	2019
	TRA-N-047	Reverse capacity from France to Germany at Obergailbach	n-FID	2020
	TRA-N-269	Transmission system developments for Fosmax (Cavaou) LNG expansion	n-FID	2020
	TRA-N-256	Iberian-French corridor: Eastern Axis – Midcat Project (CS Montpellier and CS Saint Martin de Crau)	n-FID	2021
	TRA-N-257	New line Between Chemery and Dierrey	n-FID	2021
	TRA-N-258	Transmission system developments for Montoir LNG Terminal expansion at 16,5 bcm – 2	n-FID	2021
	TRA-N-046	Exit capacity increase to CH at Oltingue	n-FID	2022
REN – Gasodutos, S.A.	TRA-N-283	PT – ES Interconnector Pipeline Spanish Border – Celorico	n-FID	2017[2]
	TRA-N-284	PT – ES Interconnector Cantanhede Compressor Station	n-FID	2019[2]
	TRA-N-285	PT – ES Interconnector Pipeline Cantanhede – Mangualde	n-FID	2021[2]
	TRA-N-320	Carregado Compressor Station	n-FID	2017[2]
	TRA-N-318	Pipeline Carriço – Cantanhede	n-FID	2021[2]
TIGF	TRA-F-250	Girland – Artère de Guyenne Phase B	FID	2013
	TRA-F-251	Artère de l'Adour (former Euskadour) (FR – ES interconnection)	FID	2015
	TRA-N-252	Iberian-French corridor: Eastern Axis – Midcat Project	n-FID	2021

Table 5.1: Pipelines, including compression

1) Spanish core network projects without specific date of commissioning have been postponed / mothballed until a new planning document is approved by the government according to Spanish Royal Decree-Law 13 / 2012. No changes at FID Cross-border Interconnection Points Capacity.
2) The dates indicated for the projects of the promoters REN – Gasodutos, REN – Armazenagem and Transgás Armazenagem should be considered indicative as the approval process of the Portuguese National TYNDP is still on-going.

Promoter	Code	Project	FID	Commisioning Year[1]
LNG TERMINALS				
EdF	LNG-F-210	Dunkerque LNG Terminal	FID	2015
Elengy	LNG-N-225	Montoir LNG Terminal Expansion	Non-FID	2019
	LNG-N-226	Fos Tonkin LNG Terminal Expansion	Non-FID	2019
	LNG-N-227	Fos Cavaou LNG Terminal Expansion	Non-FID	2020
Fos Faster LNG	LNG-N-223	Fos Faster LNG Terminal	Non-FID	2019
BBG	LNG-F-150	Bilbao's 3rd LNG Storage Tank	FID	2014
	LNG-F-152	Bilbao Send-Out increase 1000000	FID	–
	LNG-N-151	Bilbao's 4th LNG Storage Tank	Non-FID	–
	LNG-N-154	Bilbao Send-Out increase 1200000	Non-FID	–
	LNG-N-153	Bilbao Send-Out increase 1400000	Non-FID	–
Enagás S.A.	LNG-N-174	Musel's 3th LNG Storage Tank	Non-FID	–
	LNG-N-177	Musel's 4th LNG Storage Tank	Non-FID	–
	LNG-N-179	Musel Send-Out increase	Non-FID	–
	LNG-F-178	Musel LNG Terminal	FID	2022

Table 5.2: LNG Terminals

Promoter	Code	Project	FID	Commisioning Year
STORAGE FACILITIES				
Storengy	UGS-F-004	Hauterives Storage Project – Stage 1	FID	2014
	UGS-F-265	Hauterives – Stage 2	n-FID	2015
	UGS-N-003	Etrez	FID	2015
	UGS-N-002	Alsace Sud	n-FID	2022
	UGS-N-264	Etrez – Stage 2	n-FID	2022
REN – Gasodutos, S.A. and Transgás Armazenagem	UGS-F-081	Carriço UGS development	FID	2014

Table 5.3: Storage Facilities

1) Spanish core network projects without specific date of commissioning have been postponed / mothballed until a new planning document is approved by the government according to Spanish Royal Decree-Law 13 / 2012. No changes at FID Cross-border Interconnection Points Capacity.

5.5 Interconnection Capacities in the South Region

5.5.1 EXISTING CAPACITIES IN 2014

At the far western side of Europe, the South Region is a privileged gateway for LNG into Europe with up to 43 % of the total European LNG send-out capacity (2695 GWh/d).

It is located at a crossroad for various supplies by pipelines with direct sourcing from Norway and Algeria, and connections with Belgium, Germany and Switzerland.

France, Spain and Portugal have also developed through the years several infrastructures creating internal interconnection points allowing gas to circulate from North to South and reverse into the Region.

In 2013, Spanish-French IP capacity has been increased at Larrau IP capacity from 100 to 165 GWh/d thanks to the joint efforts of Enagás and TIGF in order to enhance a larger interconnection capacity at Western Axis.

At PIR MIDI, the IP between French balancing zones, capacity has been increased on both direction thanks to the joint efforts of TIGF and GRTgaz in order to enhancer a better interconnection capacity between balancing zones. Capacities have grown from 325 to 395 GWh from GRTgaz South to TIGF, and from 80 to 255 GWh in the opposite direction.

5.5.2 PROJECTED CAPACITIES TO 2022

FID+nFID Developments at IP's within the South Region

To create the European internal gas market essentially means linking the gas sources or facilities in one country (or region) to another country (or region) through interconnection projects. The effects of this are:

- Firstly, consumers have access to a larger number of suppliers, and the suppliers have a wider choice of supply sources. This increases competition to the benefit of the end consumer.
- Secondly, in the event of disruptions to the international supply chains, a greater number of alternative remedies are available to the affected suppliers. As a result, the supply security for consumers in highly interconnected areas is greatly improved.

Nationals Plans developed by TSOs as well as ENTSOG TYNDP 2013–2022 include a detailed description of the infrastructures projects planned in the South Region (FID and n-FID)

TSOs, cooperating in developing this GRIP, understand the role of creating transmission projects which can contribute to develop the internal European Market as well as to reach the European Commission energy policies.

This chapter we will focus on the development of internal Region IPs capacities and IPs with other regions in order to provide a clear vision of the current and ongoing development.

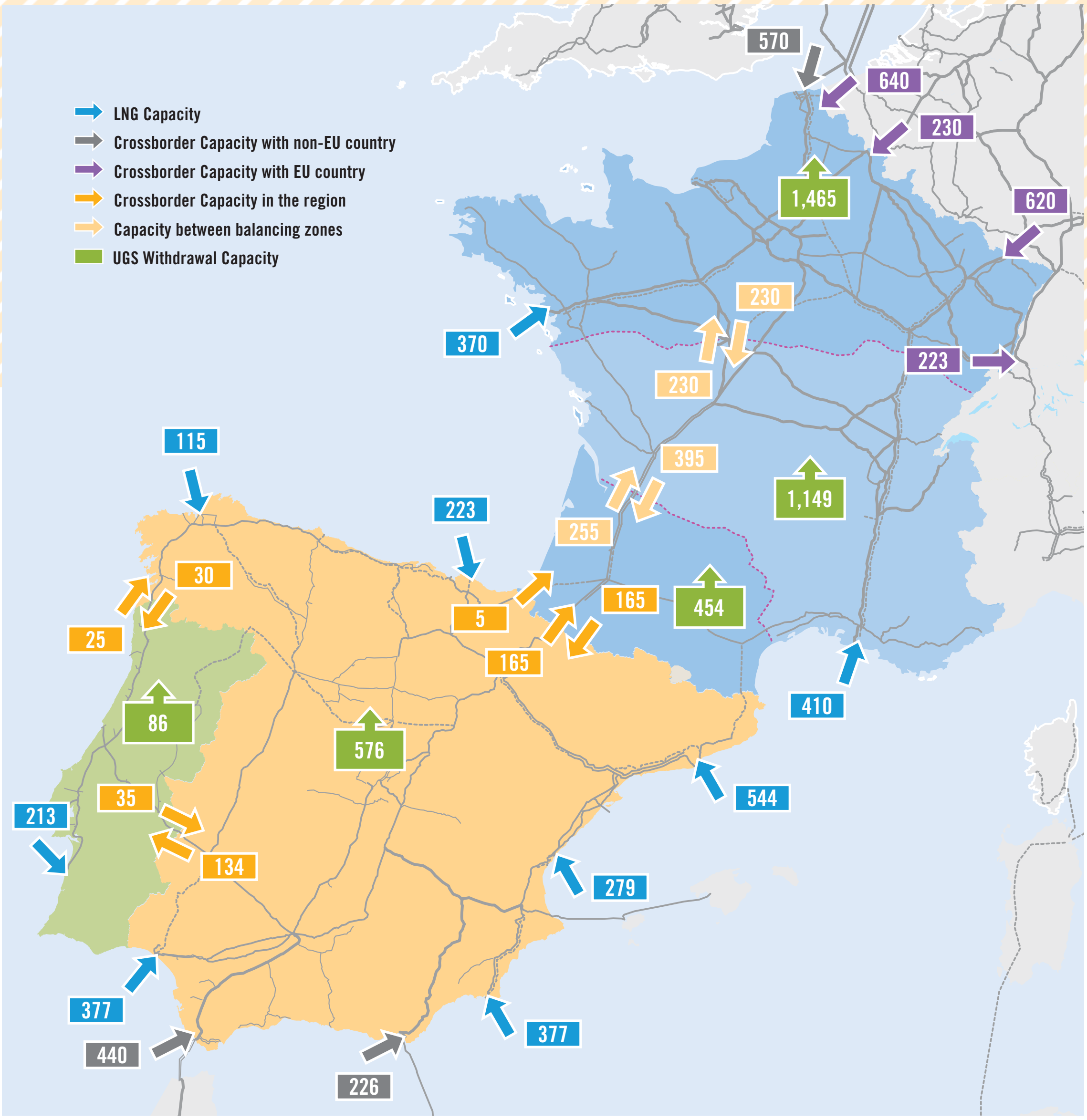


Figure 5.5: South Region Regional Overview (2014 existing Capacity)

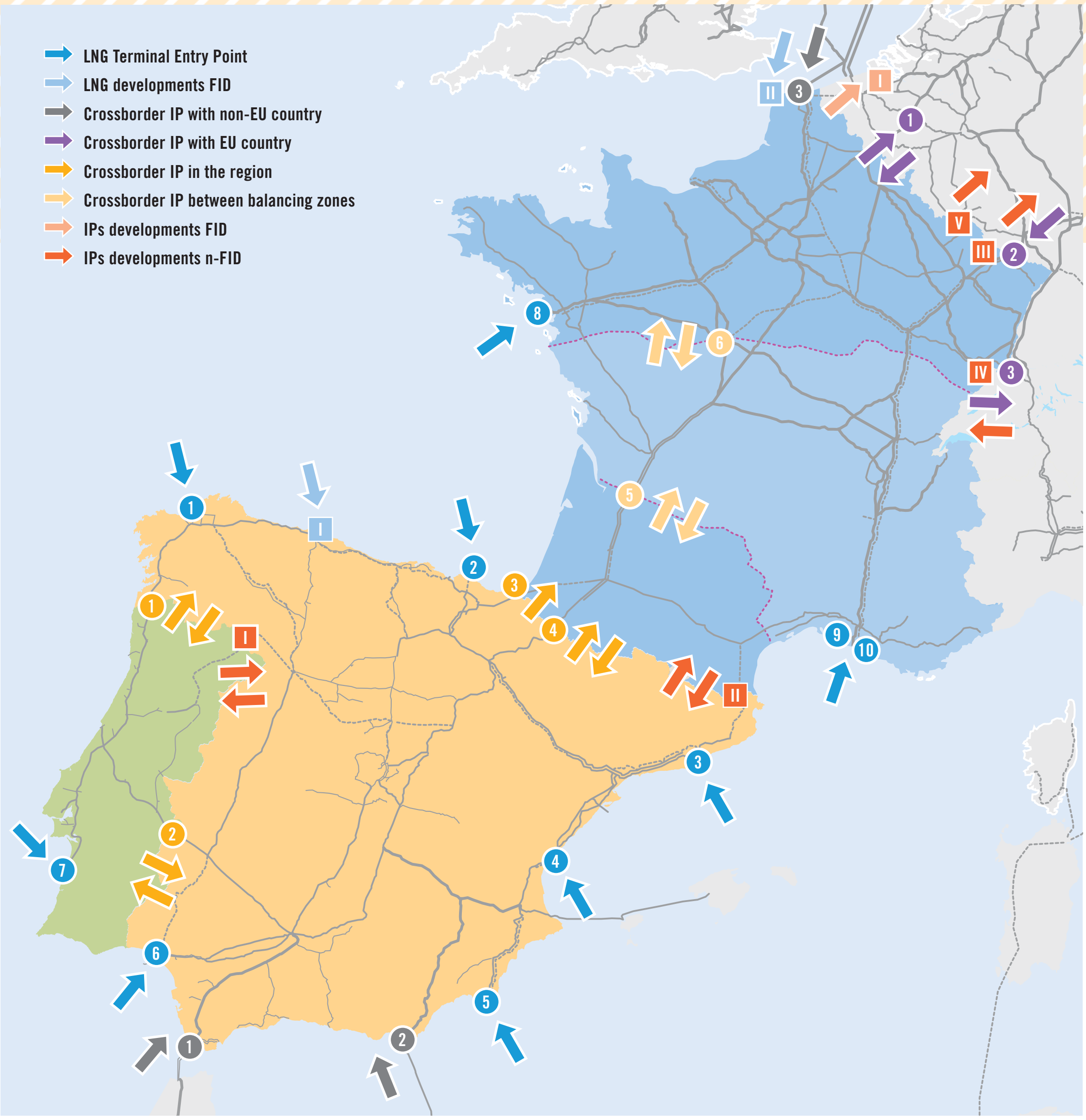


Figure 5.6: South Region Regional Entry/Exist Points (presently and future developments)

Infrastructure		Flow Direction
CROSS-BORDER INTERCONNECTION POINT WITH NON-EUROPEAN COUNTRY (IMPORT)		
1	Tarifa	DZ > SP (via MEG)
2	Almeria	DZ > SP (via Medgaz)
3	Dunkerque	NO > FR
CROSS-BORDER INTERCONNECTION POINT WITH EUROPEAN COUNTRY		
1	Blarégnies (BE) / Taisnières (H) (FR)	FR > BE
		BE > FR
2	Medelsheim (DE) / Obergailbach (FR)	DE > FR
3	Oltingue (FR) / Rodersdorf (CH)	FR > CH

Table 5.4: Cross-border interconnection points from / to the Region

Infrastructure		Flow Direction
LNG TERMINALS' ENTRY POINT INTRO TRANSMISSION SYSTEM		
1	Ferrol LNG Terminal	Entry to Spain
2	Bilbao LNG Terminal	Entry to Spain
3	Barcelona LNG Terminal	Entry to Spain
4	Sagunto LNG Terminal	Entry to Spain
5	Cartagena LNG Terminal	Entry to Spain
6	Huelva LNG Terminal	Entry to Spain
7	Sines LNG Terminal	Entry to Portugal
8	Montoir LNG Terminal	Entry to France
9	Fos Tonkin LNG Terminal	Entry to France
10	Fos Cavaou LNG Terminal	Entry to France

Table 5.6: LNG entry points

Infrastructure		Flow Direction
CROSS-BORDER INTERCONNECTION POINT BETWEEN SPAIN AND PORTUGAL		
1	Valença do Minho (PT) / Tuy (SP)	SP > PT
		PT > SP
2	Badajoz (SP) / Campo Maior (PT)	SP > PT
		PT > SP
CROSS-BORDER INTERCONNECTION POINT BETWEEN SPAIN AND FRANCE		
3	Biriatou (FR) / Irun (SP)	SP > FR(TIGF)
4	Larrau	SP > FR(TIGF)
		FR(TIGF) > SP
CROSS-BORDER INTERCONNECTION AT FRANCE		
5	PIR MIDI	FR (TIGF) > FR (GRTgaz South)
		FR (GRTgaz South) > FR (TIGF)
6	Liaison North South	FR (GRTgaz South) > FR (GRTgaz North)
		FR (GRTgaz North) > FR (GRTgaz South)

Table 5.5: Cross-border interconnection points into the South Region

Infrastructure		Flow Direction
CROSS-BORDER INTERCONNECTION BETWEEN FRANCE AND REST EU		
I	New IP Alveringe (FR) – Maldegem (BE)	FR > BE

Table 5.7: FID cross-border interconnection point development

Infrastructure		Flow Direction
CROSS-BORDER INTERCONNECTION POINT BETWEEN SPAIN AND PORTUGAL		
I	Mangualde (PT) / Zamora (ES) (3rd Spain / Portugal IP)	SP > PT
		PT > SP
CROSS-BORDER INTERCONNECTION POINT BETWEEN SPAIN AND FRANCE		
II	Le Perthus (MidCat)	SP > FR
		FR > SP
CROSS-BORDER INTERCONNECTION BETWEEN FRANCE AND REST EU		
III	Medelsheim (DE) / Obergailbach (FR)	FR > DE
IV	Oltingue (FR) / Rodersdorf (CH)	CH > FR
V	New IP France – Luxembourg	FR > LU

Table 5.8: n-FID cross-border interconnection points developments

Between Portugal and Spain

Both existing cross-border interconnection points between Portugal and Spain are totally developed. There will be an increase of capacity in Campo Maior / Badajoz IP (PT –> ES) due to a core network development on the Portuguese system, Carregado Compressor Station. There is projected a n-FID development in order to create a new interconnection between Portugal and Spain by 2018.

	Infrastructure	Flow Direction	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
1	Valença do Minho (PT) / Tuy (SP)	SP > PT	30	30	30	30	30	30	30	30	30	30
		PT > SP	25	25	25	25	25	25	25	25	25	25
2	Badajoz (SP) / Campo Maior (PT)	SP > PT	134	134	134	134	134	134	134	134	134	134
		PT > SP	35	35	35	35	35	70	70	70	70	70
I	Mangualde (PT) / Zamora (ES) (3rd Spain / Portugal IP)	SP > PT						75	75	107	107	142
		PT > SP						50	50	97	97	142

n-FID capacity at existing IP   n-FID capacity at future IP development

Table 5.9: FID capacities between Portugal and Spain (GWh / d)

Between Spain and France

Cross-border interconnection point between Spain and France creating the Western Axis will increase its firm capacity thanks to the joint efforts of Enagás and TIGF in order to enhance a larger interconnection capacity between Spanish and French gas markets at Larrau IP and Biriatou / Irun IP. A new IP (Le Perthus) on the eastern side of the border is projected by 2022 as n-FID capacity development (commonly known as MidCat Project)

	Infrastructure	Flow Direction	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
3	Biriatou (FR) / Irun (ES)	SP > FR (TIGF)	5	5	5	60	60	60	60	60	60	60
		FR (TIGF) > SP										
4	Larrau	SP > FR (TIGF)	100	165	165	165	165	165	165	165	165	165
		FR (TIGF) > SP	100	165	165	165	165	165	165	165	165	165
II	Le Perthus	SP > FR (TIGF)										230
		FR (TIGF) > SP										80

n-FID capacity at future IP development

Table 5.10: FID capacities between Spain and France (GWh / d)

In France

Thanks to the reinforcements at TIGF area, capacity at PIR MIDI have increased on both flow directions. The French National Regulatory Authority aims to create a single gas market in France. To achie ve this goal, GRTgaz South Hub and TIGF hub would first come closer. A merger between France PEG North Hub and PEG South Hub based on investments is also under study, with a cost benefits analysis.

	Infrastructure	Flow Direction	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
5	PIR MIDI	FR (TIGF) > FR (GRTgaz South)	80	255	255	255	255	255	255	255	255	485
		FR (GRTgaz South) > FR (TIGF)	325	395	395	395	395	395	395	395	395	475
6	Liaison Nord Sud	FR (GRTgaz South) > FR (GRTgaz North)	230	230	230	230	230	230	merger	merger	merger	merger
		FR (GRTgaz North) > FR (GRTgaz South)	230	230	230	230	230	230	merger	merger	merger	merger

n-FID capacity   commercial merger

Table 5.11: FID capacities in France (GWh / d)

Import capacities

There aren't any expected developments of the importation pipelines.

	Infrastructure	Flow Direction	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
1	Tarifa	Algeria > SP	444	444	444	444	444	444	444	444	444	444
2	Almeria	Algeria > SP	266	266	266	266	266	266	266	266	266	266
3	Dunkerque	Norway > SP	585	585	585	585	585	585	585	585	585	585

Table 5.12: FID capacities Import with non-European third country (GWh / d)

LNG Capacities

A new LNG Terminal will be commissioned in Dunkerque in 2015, whereas capacities at Fos, Sines and Bilbao will grow.

	Infrastructure	Flow Direction	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
1	Mugardos	Spain Hub	115	115	115	115	115	115	115	115	115	115
2	Bilbao	Spain Hub	223	223	223	223	223	223	223	223	223	223
3	Barcelona	Spain Hub	544	544	544	544	544	544	544	544	544	544
4	Sagunto	Spain Hub	279	279	279	279	279	279	279	279	279	279
5	Cartagena	Spain Hub	377	377	377	377	377	377	377	377	377	377
6	Huelva	Spain Hub	377	377	377	377	377	377	377	377	377	377
7	Sines	Portugal Hub	213	217	223	229	229	321	321	321	321	321
8	Montoir de Bretagne	France PEG > North Hub	370	370	370	370	370	370	425	425	425	425
9	Fos	France PEG > South Hub	410	410	410	450	450	450	450	785	1112	1112
I	Musel	Spain Hub										223
II	Dunkerque LNG	France Dunkerque cross border area				502	502	502	502	502	502	502
		France PEG > North Hub				250	250	250	250	250	250	250

n-FID capacity at existing LNG Terminal

Table 5.13: FID capacities LNG (GWh / d)

IP with other countries

Capacities with Belgium at Taisnières will grow as a result of the Open Season conducted by GRTgaz and Fluxys in 2010 and 2011. A new IP will be created from France to Belgium in 2016.

There are plans to develop capacities with Switzerland and Italy (reverse flow and enhancement of exit capacities) and to develop a reverse flow with Germany.

	Infrastructure	Flow Direction	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
2 III	Medelsheim (DE)/ Obergailbach (FR)	DE > FR	620	620	620	620	620	620	620	620	620	620
		FR > DE							100	100	100	100
3 IV	Oltingue (FR)/ Rodersdorf (CH)	FR > CH	223	223	223	223	223	223	223	223	223	230
		CH > FR					100	100	100	100	100	100
1	Blarégnies (BE)/ Taisnières (H) (FR)	BE > FR	570	640	640	640	640	640	640	640	640	640
		BE > FR	230	230	230	230	230	230	230	230	230	230
I	New IP Alveringe (FR) – Maldegem (BE)	FR > BE				270	270	270	270	270	270	270
V	New IP France – Luxembourg	FR > LU							40	40	40	40

n-FID capacity at existing IP   n-FID capacity at future IP development

Table 5.14: FID capacity (GWh/d) IP with European country

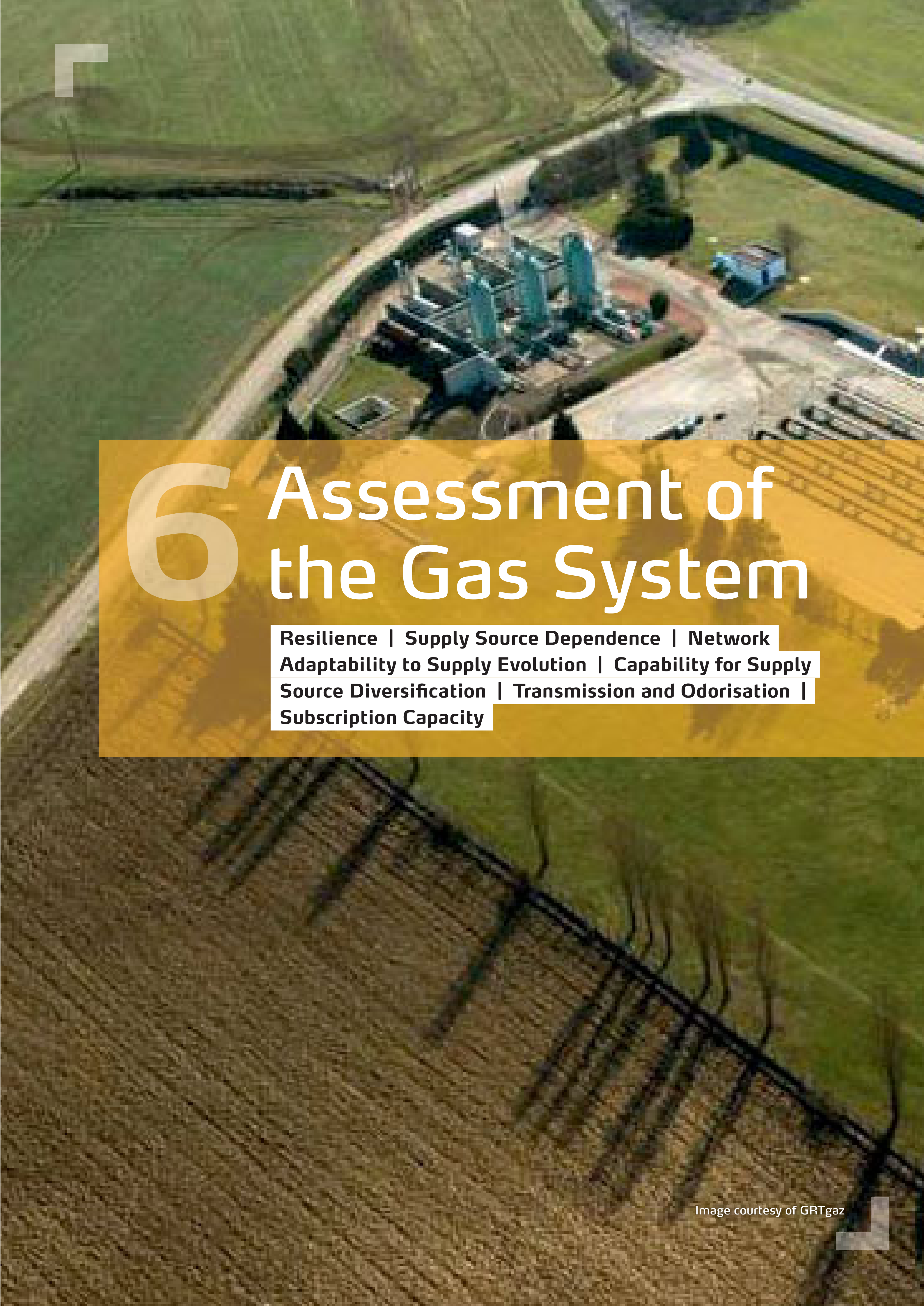
UGS

Developments of underground storages are decided in Portugal, Spain and France. Further developments are under consideration in France.

Capacity (GWh/d)	Flow Direction	2013	2014	2015	2016	2017	2018	2019	2020
France PEG North	FR (GRTgaz North) > UGS	847	847	847	847	847	847	847	847
	UGS > FR (GRTgaz North)	1,465	1,465	1,465	1,465	1,465	1,465	1,465	1,465
France PEG South	FR (GRTgaz South) > UGS	311	311	385	394	394	394	394	394
	UGS > FR (GRTgaz South)	1,149	1,149	1,441	1,476	1,476	1,476	1,476	1,604
France TIGF	FR (TIGF) > UGS	277	277	277	277	277	277	277	277
	UGS > FR (TIGF)	454	454	454	454	454	454	454	454
Spain	SP > UGS	295	310	321	341	346	350	350	350
	UGS > SP	400	576	602	625	640	649	660	671
Portugal	PT > UGS	24	24	36	36	36	36	36	36
	UGS > PT	86	86	129	129	129	129	129	129

n-FID capacity

Table 5.15: FID capacity (GWh/d) in France



6 Assessment of the Gas System

Resilience | Supply Source Dependence | Network Adaptability to Supply Evolution | Capability for Supply Source Diversification | Transmission and Odorisation | Subscription Capacity

Image courtesy of GRTgaz

South Gas Regional Investment Plan 2013–2022 deeply analyses the main results regarding the South Region obtained in the Network assessment chapter from the ENTSOG TYNDP 2013–2022.[1]

The results of the ENTSOG TYNDP assessment give an overall indication of the level of infrastructure-related Market Integration. For the purpose of the report, Market Integration is defined as a physical situation of the interconnected network which, under optimum operation of the system, provides sufficient flexibility to accommodate variable flow patterns that result from varying market situations.

The achievement of the desired level of Competition, Security of Supply and Sustainability is enabled through the achievement of desired level of market integration. Market integration can be measured at two levels:

- Commercial
  (determined by the market behaviour and business rules applicable on the respective market)
- Physical
  (determined by level of physical interconnection between the different infrastructures systems of the respective market).

The TYNDP assessed the physical layer of Market Integration through 4 assessments which analyse the way infrastructure can sustain the supply-demand balance under various supply-demand situation and infrastructure configuration.

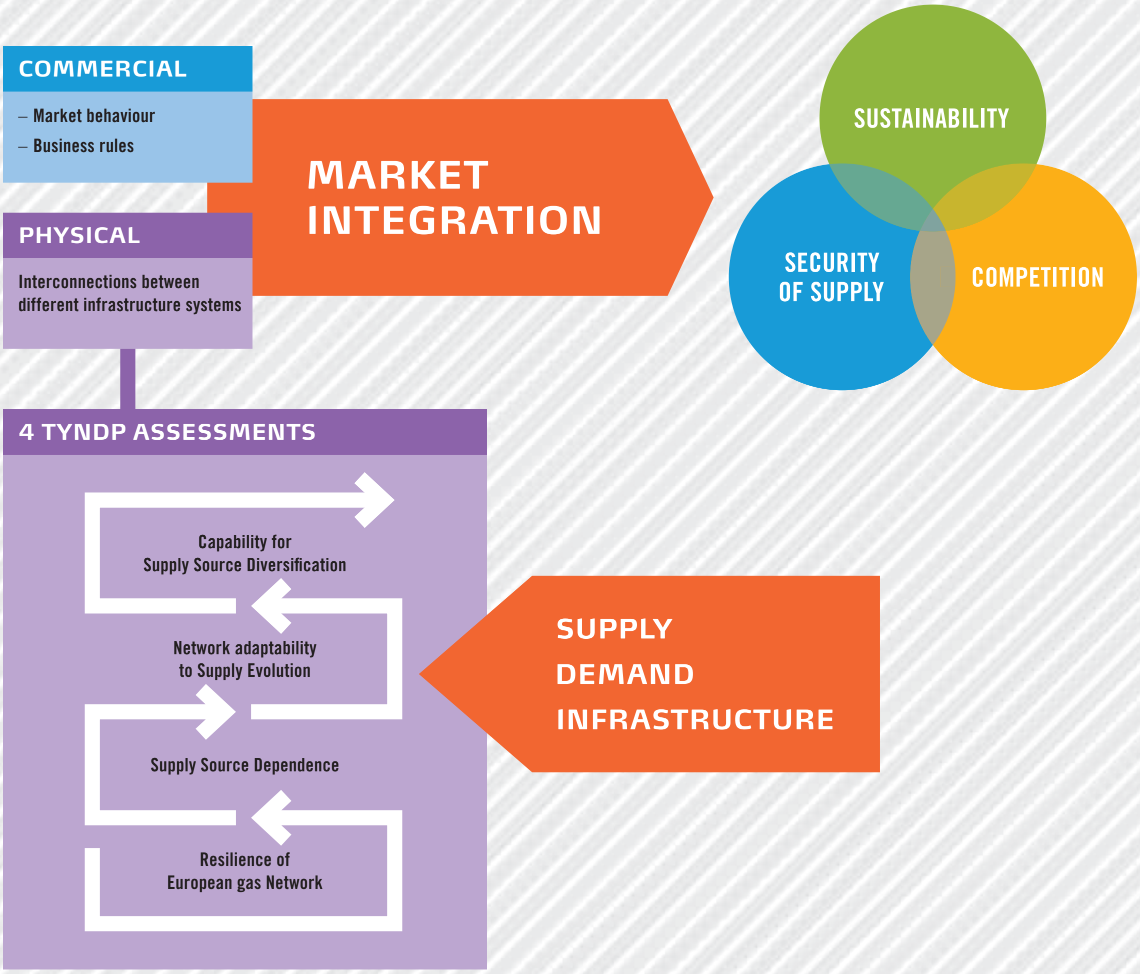


Figure 6.1: Market Integration concept

1) In parallel, simulations with updated data have been developed at European level using ENTSOG's Nemo Tool. The main conclusions remain in line with TYNDP 2013 for the South Region here presented.

6.1 Resilience of the European Gas Network

The Infrastructure Resilience assessment examines the ability of the infrastructure to transport large quantities of gas under high daily conditions (Supply Stress). This assessment is used for identification of investment gaps and potential remedies.

DEMAND

1-day Design Case
14-day High Risk Situation

SUPPLY

– Reference
– Complete Disruption of Norway to France
– Partial Disruption of Norway to United Kingdom (Langeled failure)
– Complete Disruption of Russia through Belarus
– Complete Disruption of Russia through Ukraine
– Complete Disruption of Algeria to Italy (Transmed failure)
– Partial Disruption of Algeria to Spain (MEG failure)
– Complete Disruption of Libya to Italy
– Extreme LNG Minimisation: European Resilience to low LNG deliverability

$$RFlex = 1 - \frac{\sum EnteringFlows}{\sum EnteryCapacity}$$

Remaining flexibility (RFlex) indicator at Zone level to identify **investment gaps** when **RFlex < 5 % (Ref. Case)** or **< 1 % (Supply Stress Cases)**

Use of LNG and UGS as last resort supply

European resilience to low LNG deliverability to identify Zones requiring a LNG minimum **Send-Out > 20 %**

Figure 6.2: Resilience of European Gas Network Methodology

Image courtesy of REN – Gasodutos

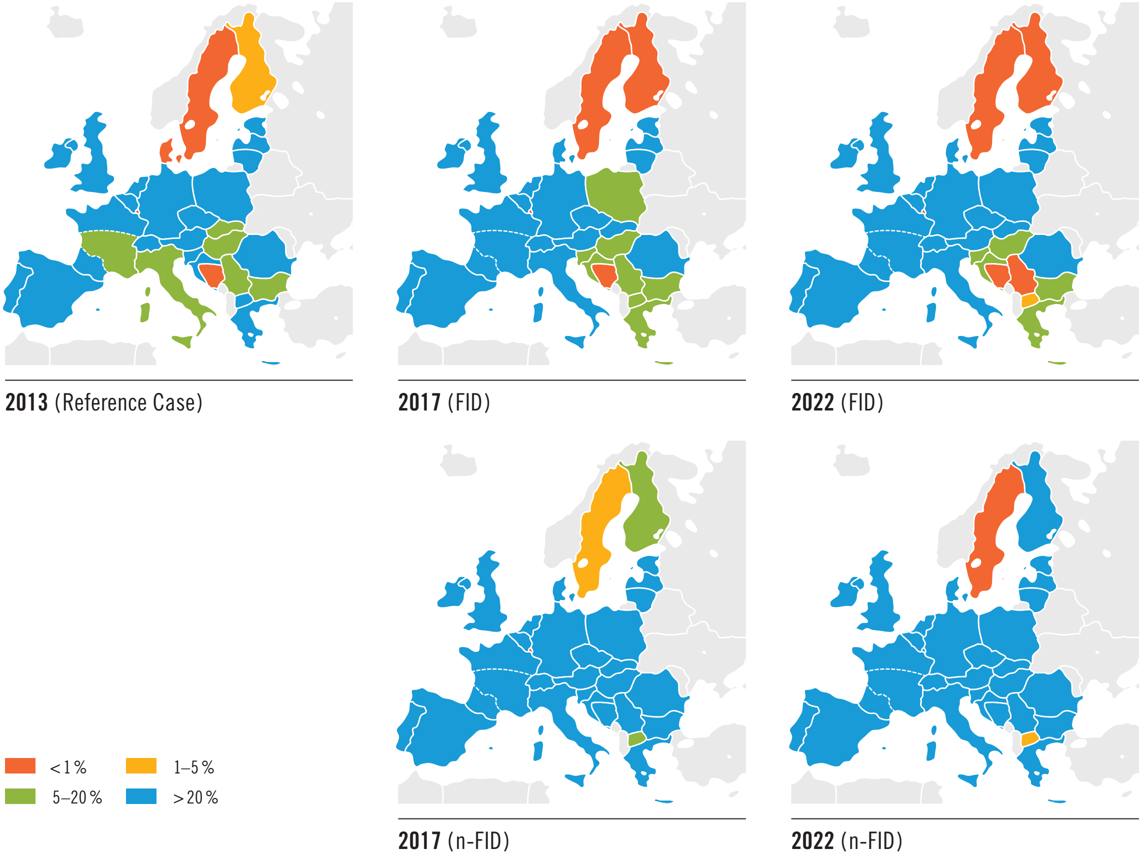


Figure 6.3 (a): Remaining Flexibility – Demand 1-day Design Case

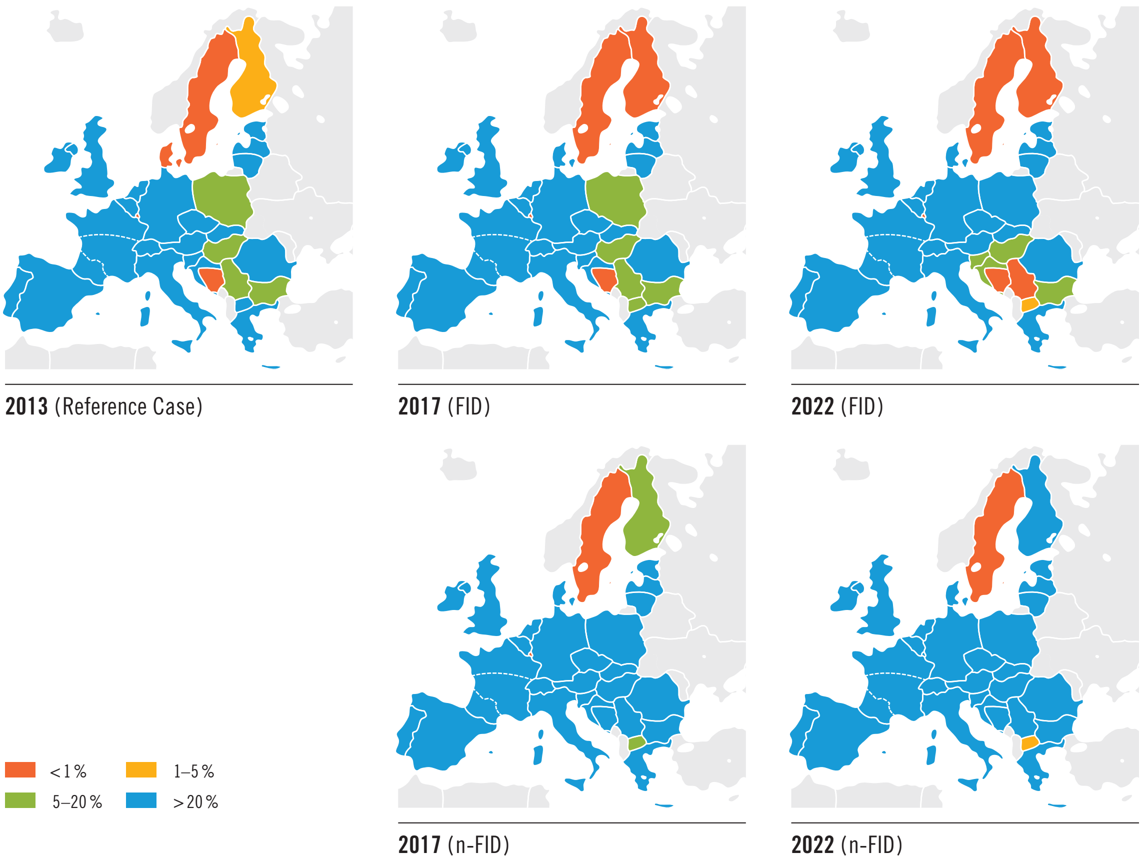


Figure 6.3 (b): Remaining Flexibility – Demand 14-day High Risk Situation

6.1.1 REMAINING FLEXIBILITY

The results of the ENTSOG simulations (Figures 6.3 a+b) show a good level of Remaining Flexibility in the South Region as well as in the rest of the countries included the North-South Corridor in Western Europe considering a Reference supply situation. The key conclusion from the modelling is that the gas system in the South Region will have sufficient capacity to achieve a full supply-demand balance under the scenarios analysed.

Additionally, no impact in the South Region has been detected in the analysed supply disruptions. For the simulations, the missing gas supply derived from the Supply Stress is managed by rerouting supply of the interrupted sources through alternative routes (if any) and, finally, by additional gas from UGS and LNG.

6.1.2 UGS AND LNG TERMINALS USE: THE MAIN ROLE OF THESE FACILITIES

The UGS and LNG Terminals play an important role contributing to cover demand fluctuations, seasonal modulation as well as daily peaks. Although pipeline also contributes to demand fluctuations, the storage dimension makes UGS and LNG Terminals especially appropriate to increase or decrease their level of emission into the network. Taking into account these aspect, the simulations done considering the use of these facilities “as last resort”, try to capture their feature providing short term flexibility and security of demand.

As it is mentioned before, the availability of gas in the facilities to be used as a “last resort” could have a high impact in the South Region Remaining Flexibility.

In the results of the analysis developed in the ENTSOG-TYNDP highlighted in the Figure 6.3 it is implicitly assumed that there is enough gas in the LNG tanks to increase the Send-out up to the capacity level; as well as the withdrawal from the UGS is not limited by the available Working Gas Volume when the high demand even occurs. These hypotheses must be taken into account in the interpretation of the results for the South Region where the role of the LNG Terminals and UGS are very important. For this reason, this report includes specific analysis of these facilities.

Image courtesy of Enagás

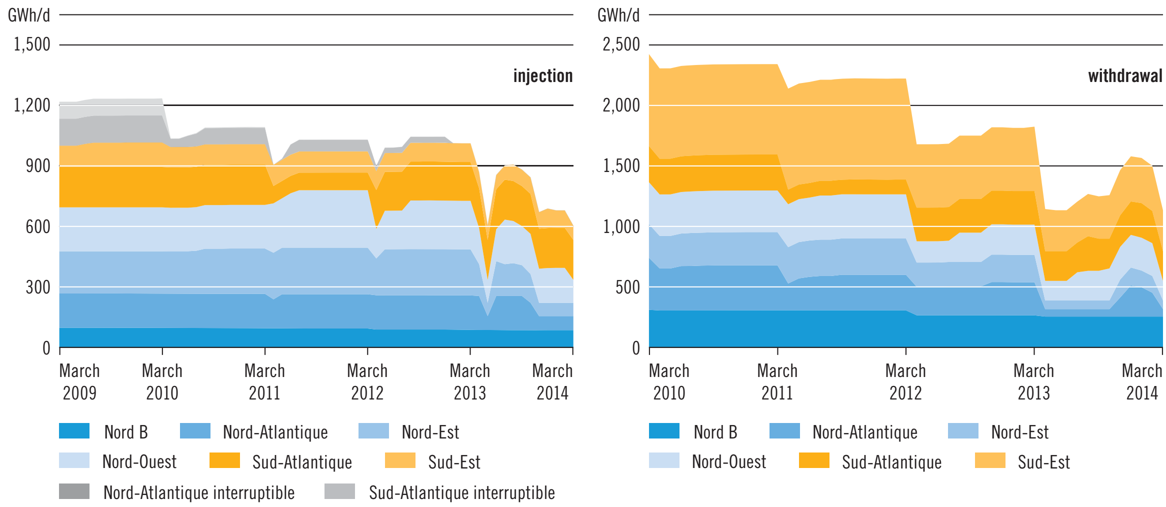


Figure 6.4: Evolution of the storage subscriptions in France

Use of the UGS in France: Last historical trend

As it is mentioned before, the availability of gas in the UGS could have a high impact in the South Region Remaining Flexibility.

In order to provide a clear picture of the current situation, we have developed specific analysis focus on the last historical trend in the use of UGS in France.

Storage capacities are marketed every year by storage operators. The corresponding injection and withdrawal capacity on the transmission network is allocated automatically on the basis of the result of the allocation of storage capacity.

In 2013, a sharp drop was recorded in the subscriptions. This situation was worrying because it limited the availability of these sources in particular in case of cold winter. For example in France, they only reached 45 % in May 2013 as opposed to 83 % in May 2011, as operators seem to have chosen other modulation sources, such as spot markets: winter/summer spreads dropped and therefore competed with storage facilities. Additional capacities were later subscribed.

At the beginning of the winter 2012–2013, the cumulative stocks in Storengy and TIGF UGSs were inferior to the previous years. This is associated with the fact that bookings showed a lower trend that was confirmed in April 2013, and due to a high level of withdrawal in the first half of 2012 as a consequence of lower temperatures than average during these months. As a result, shippers operated more and longer withdrawals, thus delaying the injection process. Driven by the rise in consumption of the residential sectors and of the combined cycle power plants during the cold weather peak, the quantities withdrawn increased by 38 %, in part to offset the drop in LNG deliveries.

The role of the LNG Terminals in the South Region during the cold snap in 2012

As example illustrating the contribution of the LNG Terminals in the South Region, we have analysed in more detail the cold snap that took place during the first half of February 2012, affecting most countries in Europe. This cold snap was characterized not only by its sharpness, but especially for its duration.

Even when it can be said that it was a global phenomenon affecting the continent, neither the severe weather conditions nor the high levels of gas consumption were homogeneous across Europe. In the Figure 6.5 we can observe the different impact in each country from the South Region: Portugal and Spain were much lower affected than France by the severe weather conditions and consequently by the increase of the level of gas consumption.

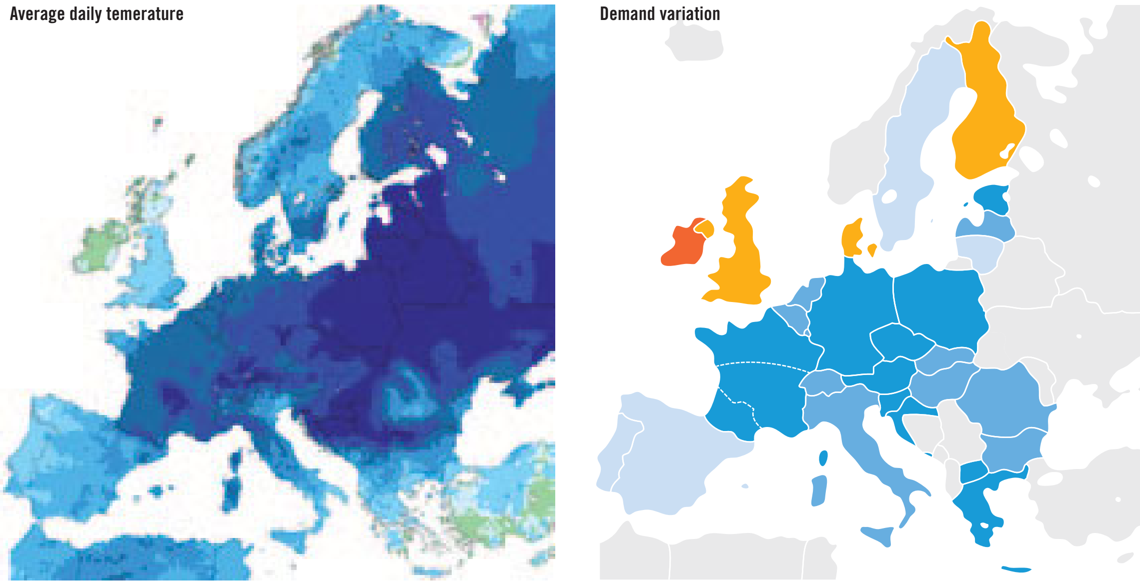


Figure 6.5: Cold snap during February 2012 – temperatures vs. demand (Source: left: JRC; right: ENTSOG)

In France, where the increase in gas demand during the cold snap was significant, there was a higher use of UGS. That was possible thanks to the high stock level available in the storages, coming from the low demand experienced during the first months of the winter, and the relative role of UGS in the entry capacity in this country. In Spain the increase of gas demand during the cold snap was moderated, and almost negligible in Portugal. In Spain, most of the flexibility required was provided by LNG Terminals, while in Portugal the deliveries from UGS even decreased from the January's average level.

LNG Terminals contributed to the cold snap providing short term flexibility by increasing the level of utilization as well as facilitating reloading and/or diversion of cargoes where they were most needed.

Figure 6.6 illustrates the contribution of the LNG Terminals in the South Region. During the cold snap was proved the substantial role of the LNG stored in tanks providing transitional mitigation of hourly/daily fluctuations.

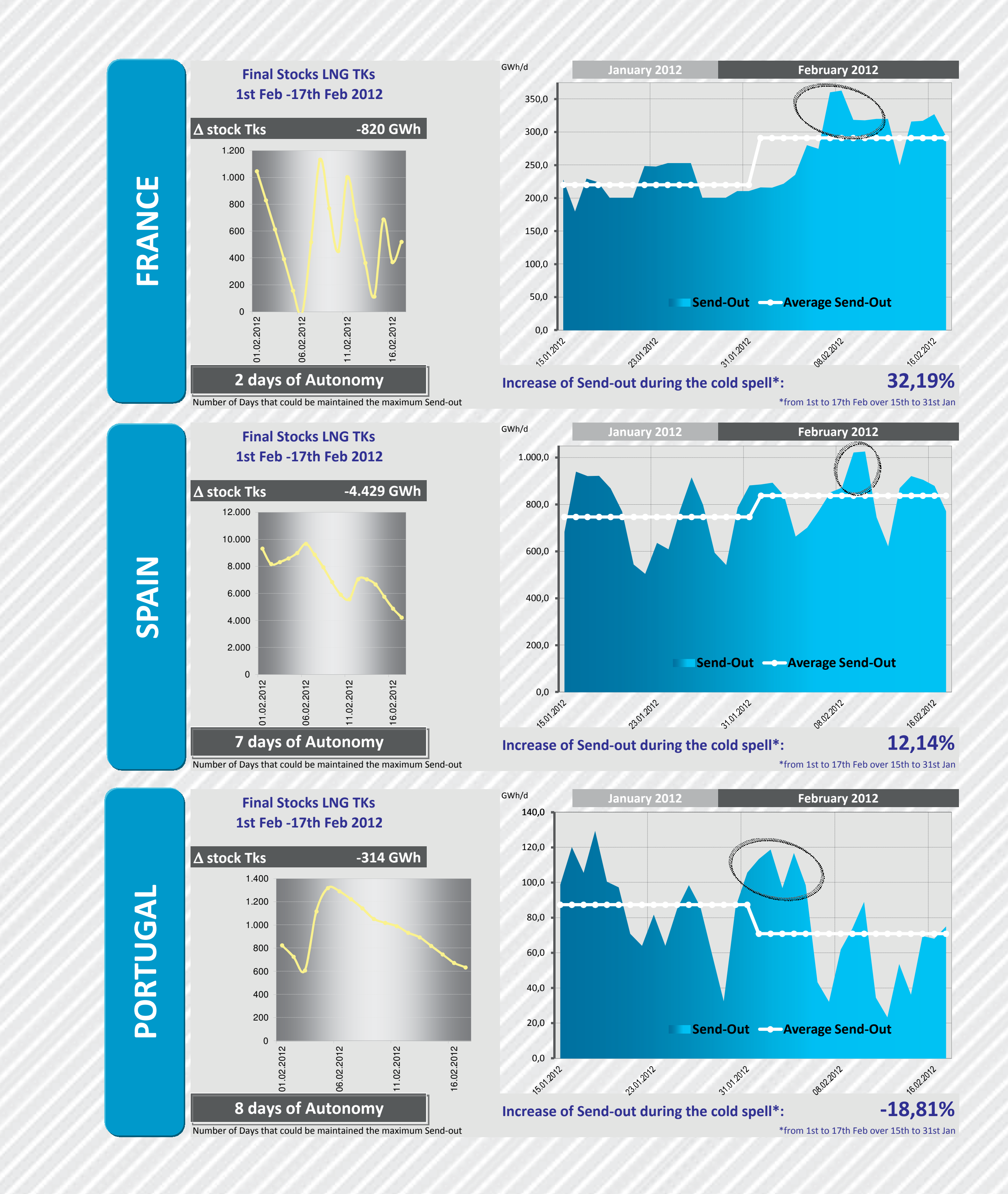


Figure 6.6: Contribution of the LNG Terminals to security of demand (Source: Internal development and GLE)

UGS and LNG Terminals providing short term flexibility the next ten year period

The graphs below (Figure 6.7) include the results of the simulations done by ENTSOG for the TYNDP for a High daily demand (design case) under normal operational conditions (Reference). The amount of gas needed from UGS and LNG Terminals as is considered in the methodology "uses of last resort supply" covers around 60 % of the High daily demand in the South Region: 35 % by UGS and 25 % by LNG Terminals Send-Out.

This point indicates the important role of UGS and LNG Terminals for the South Region. However, each kind of facility plays a different role in each country: in France, the role of the UGS covering the High Daily demand is significant, representing around 50 %, while in the Iberian Peninsula similar percentage is covered by LNG Terminals Send-Out used as last resort.

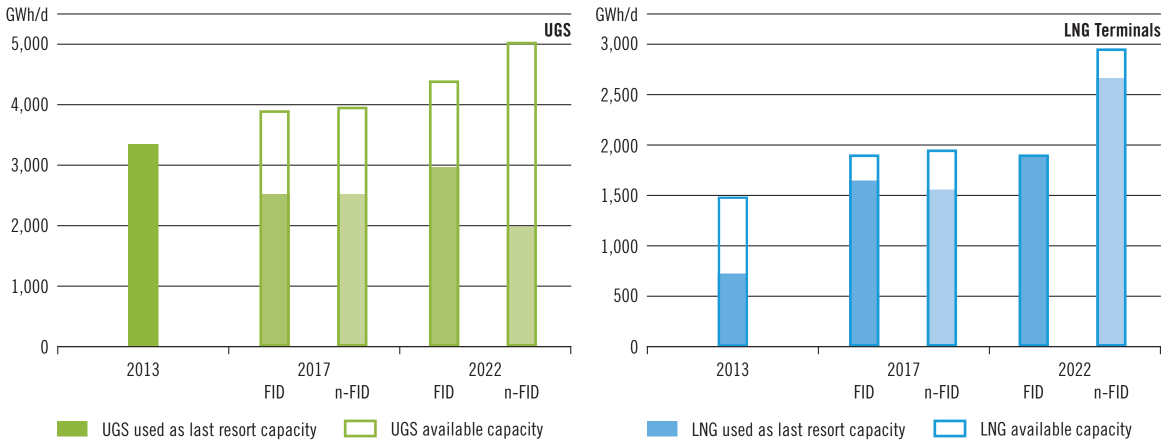


Figure 6.7: Amount of gas needed from the supply of last resort under Design-Case situation (UGS left and LNG Terminals right)

Considering the use from LNG Terminals named "last resort supply", more than 75 % of the High daily demand in the South Region could be covered by these facilities.

6.1.3 SOUTH REGION RESILIENCE TO LOW LNG DELIVERABILITY

The ENTSOG TYNDP 2013–2022 has detected a lack of resilience to low LNG deliverability in the Iberian Peninsula. The maps included in the ENTSOG TYNDP show that the Iberian Peninsula requires a minimum level of gas flow from LNG Terminals, [40 %; 60 %] of the LNG Terminals Send-Out capacity, during high daily demand (design case situation). These results indicate a potential vulnerability in the Iberian Peninsula to events, as for instance climatic conditions impacting LNG delivery from the Terminals, and/or local events as the technical disruption of the single LNG Terminal of a country impacting the send-out. This aspect has been further analysed.

The lack of resilience to low LNG deliverability in the Iberian Peninsula has been improved in the past years by the following measures already in place:

- by increasing cross border capacity between the Iberian Peninsula and France and between Portugal and Spain, as well the appropriated reinforcements in the French core network,
- through strategic UGS providing the amount of gas to substitute the lack of LNG, and also …
- through LNG Tanks providing autonomy to the LNG Terminals: adequate LNG tanks capacity and the requirement of some minimum LNG stock level in them, in order to maintain a certain level of Send-Out during a period of time,
- and by improving the diversification of LNG supply sources.

Resilience to low LNG delivery: Infrastructure perspective

Figure 6.8 shows the results of the simulations done for the TYNDP analysing the resilience to low LNG deliverability, for a 14-day High Risk Situation.

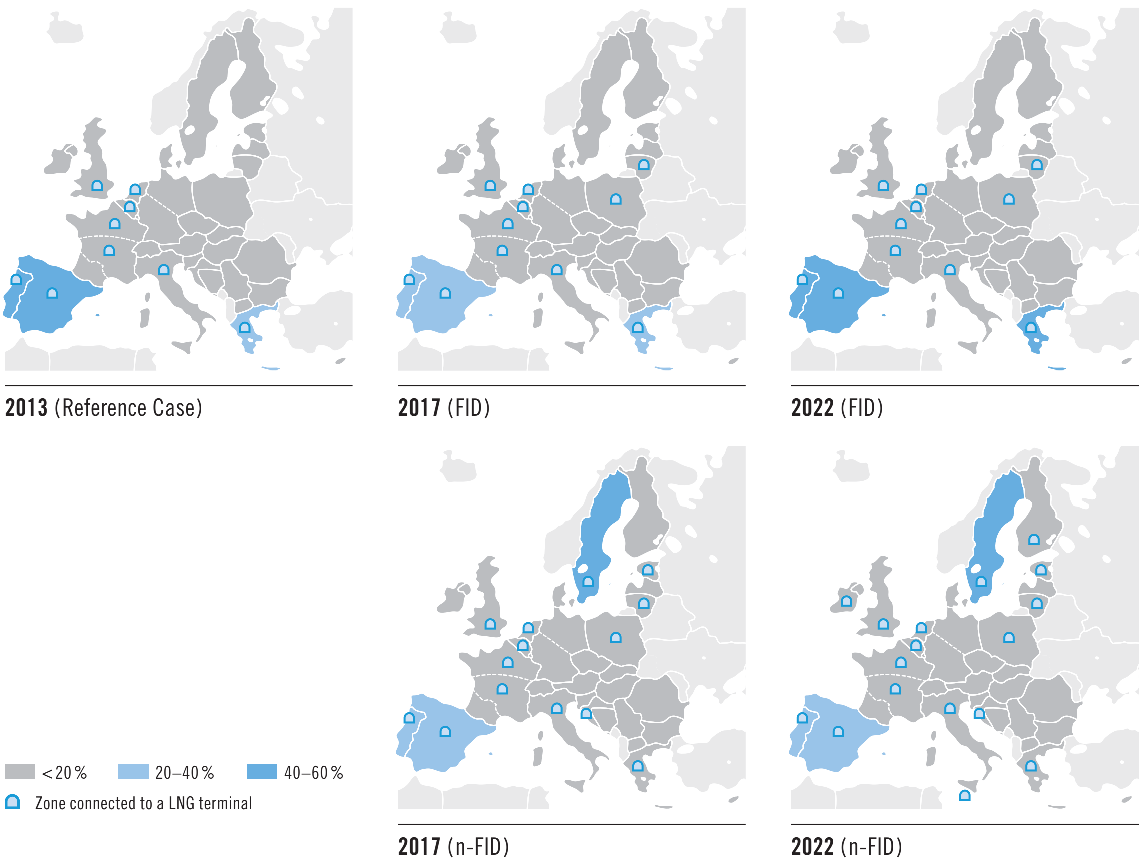


Figure 6.8: Resilience to low LNG delivery – Demand 14-day High Risk Situation

Further analysis of the results of the simulations indicates:

- Figure 6.8 highlights the role played by the infrastructure cross border projects creating new capacity between Spain and France reducing the lack of resilience to low LNG delivery in the Iberian Peninsula:
  - The on-going developments of the interconnection points related to the Western Axis (Larrau, Biriatou and Guyenne subprojects) reduce the requirements of the minimum LNG Terminal Send-out delivery.
  - Regarding n-FID projects, the lack of resilience to low LNG delivery in Spain would be improved by MidCat project as well the reinforcement in the French core network in the Eastern Axis. The reduction of the lack of resilience to low LNG delivery in Portugal needs additionally the development of the 3rd IP Portugal- Spain.
- Regarding France, Figure 6.8 shows the ability to deal with less than 20% of LNG Terminal Send-Out capacity under a 14-day uniform risk situation (and also Design case situation as presented in the TYNDP) due to the other sources: interconnection points and UGS. Additionally, the figure shows the French network capability to cover the demand under maritime conditions impacting all facilities of a given Zone (e.g. Fos Cavaou and Fos Tonkin located in GRTgaz South Zone) using others entries.
- Another important conclusion shown in the Figure 6.8 is that Send-Out from LNG Terminals in France as well as the others ones in the North-South Corridor in Western Europe could be reduced down to the minimum level without any congestion in the European network. The European network in the North-South Corridor in Western Europe, except the Iberian Peninsula, have the capability to react to an LNG disruption replacing lack of LNG by additional entries, by UGS, import pipelines and incremental flows through interconnection cross border.

Resilience to low LNG delivery: LNG Supply perspective

For the results of the Figure 6.8, the LNG supply is considered as one source. However, the LNG supply is by nature diversified.

In order to further analyse the potential risk for the Iberian Peninsula due to a lack of resilience to low LNG deliverability, we have analysed both countries Portugal and Spain separately focusing on the LNG basket.

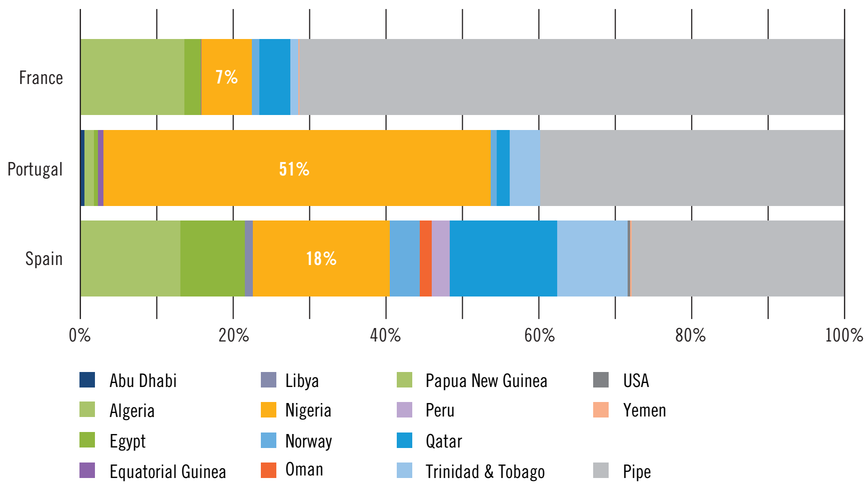


Figure 6.9: Share of imports by pipe and by LNG (Average period 2009–2011 by country origin)

Taking into account the historical data for the 2009–2011, Portugal receives around 60 % of gas imports by LNG of which 84 % comes from Nigeria. This means that 51 % of Portugal imports come from Nigeria.

Spain receives around 72 % of gas imports by LNG. Despite Spanish LNG basket is highly diversified, 25 % of the total LNG also comes from Nigeria, meaning around 18 % of the gas Spanish imports.

LNG from Nigeria represents also around 7 % of the total French imports.

Considering the current supply basket, a lack of LNG from Nigeria due to Upstream events like natural disasters, technical accidents, fires, terrorist attacks, or other force majeure causes could be a potential risk for the Iberian Peninsula, especially for Portugal.

Results of the simulations comparing the LNG send out required in the situations "14 days period under normal operational conditions" (Reference) with the "14 days period under low LNG delivery " we can conclude:

- The Spanish gas system vulnerability to a lack of LNG from Nigeria is mitigated with the development of the Western Axis; the entry capacity from France to Spain, as well as the LNG stored in tanks would allow replacing the Nigerian LNG supply lacked without have impact in the coverage of the demand.Therefore, we can conclude that the lack of resilience to low LNG deliverability is not de facto a risk of security of supply for Spain due to the high level of LNG diversification by country of origin, as well as the LNG Tanks capacity providing autonomy to the Spanish LNG Terminals.
- Due to the LNG from Nigeria represents more than a half of the total annual supply in Portugal, the vulnerability risk in the Portuguese gas system is highly dependent on the total amount of LNG lack from this country origin. Based on the analysis developed, a partial lack of LNG from Nigeria representing more than 35 % of the total supply could affect the Portuguese High daily demand coverage.Therefore, we can conclude that the lack of resilience to low LNG deliverability in Portugal could be clearly improved promoting the LNG diversification as well as the LNG Tanks capacity providing autonomy to the Sines LNG Terminal (if needed).

Specific Analysis on the vulnerability of the Portuguese gas system (additional to the TYNDP assessments)

The Portugal gas system vulnerability has been also highlighted by the Portuguese Competent Authority in the Risk Assessment (RA) and in the Preventive Action Plan (PAP), where a deeply analysis was done under the requirements of the Regulation No. 994/2010.

As it is concluded by the Portuguese Competent Authority, www.dgeg.pt, under the analysis done in the Risk Assessment (RA) and in the Preventive Action Plan (PAP) already published and adopted, without the increase of the withdrawal capacity of the Carriço UGS and without the 3rd Interconnection Portugal-Spain, the actual available capacity in the Portuguese network is not enough to guarantee the fulfilment of the national N-1 criterion under the disruption of the Sines LNG Terminal in a day of exceptionally high gas demand (1 in 20 years). This means that the technical capacity of the gas infrastructure is unable to satisfy the total gas demand in Portugal, under such an event.

6.1.4 KEY CONCLUSIONS

Key conclusions obtained in the Resilience Assessment for the South Region are:

- According to the TYNDP, the gas system in the South Region will have sufficient capacity to achieve a full supply-demand balance with the FID projects.
- No impact in the South Region has been detected in the supply disruptions analysed in the TYNDP, due to the flexibility in the network to rerouting supply of the interrupted sources through alternative routes, and by additional gas from UGS and LNG Terminals.
- UGS and LNG Terminals play a significant role in the South Region providing short term flexibility and security of demand. The LNG stored in the LNG tanks enables the increment of Send-Out from LNG Terminals, as well as the withdrawal from the UGS when adequate Working Gas Volume is available, responding to high demand events.
- The lack of resilience to low LNG deliverability detected for the Iberian Peninsula is not de facto a risk of security of supply for Spain due to the high level of LNG diversification by country origin.
- The lack of resilience to low LNG deliverability in Portugal could be improved promoting the LNG diversification.

6.2 Supply Source Dependence

Supply Source Dependence assessment aims at the identification of Zones whose balance depends strongly on a single supply source.

This analysis has been done under average demand conditions to capture the yearly character of the analysis.

DEMAND	SUPPLY
1-day Average Situation	**"Full Minimisation" of source S** – Source S is reduced down to the minimum required to balance all zone – Rest of the sources increase up to each technical capacity

Supply Source Dependence to source S is identified when a Zone requires at least a **20 % supply share of the supply source S**

Figure 6.10: Supply Source Dependence Methodology

6.2.1 ANNUAL LNG SUPPLY DEPENDENCE

The Iberian Peninsula and the South of France has been identified in the ENTSOG TYNDP 2013–2022 as areas with strong annual dependency on LNG.

The results of the ENTSOG TYNDP highlight the role of new transmission projects debottlenecking the internal congestion in the French network and developing cross border capacity between France and Spain and between Spain and Portugal in order to mitigate the dependence on LNG source.

The analysis of the results of the simulations done for the TYNDP described in the Figure 6.11, and the additional sensitivity simulations of the TYNDP analysis carried out for this GRIP focus on n-FID projects in the South Region, show:

- The annual LNG dependence in France will decrease with the FID projects and would disappear with the n-FID transmission projects.
- Additional to these developments in France, the annual LNG dependence in Spain will diminish after the n-FID project developing the new cross border capacity between Spain and France.
- The annual LNG dependence for Portugal could be also mitigated if the 3rd IP Portugal-Spain is developed, in addition to the needed mentioned developments in France and Spain.

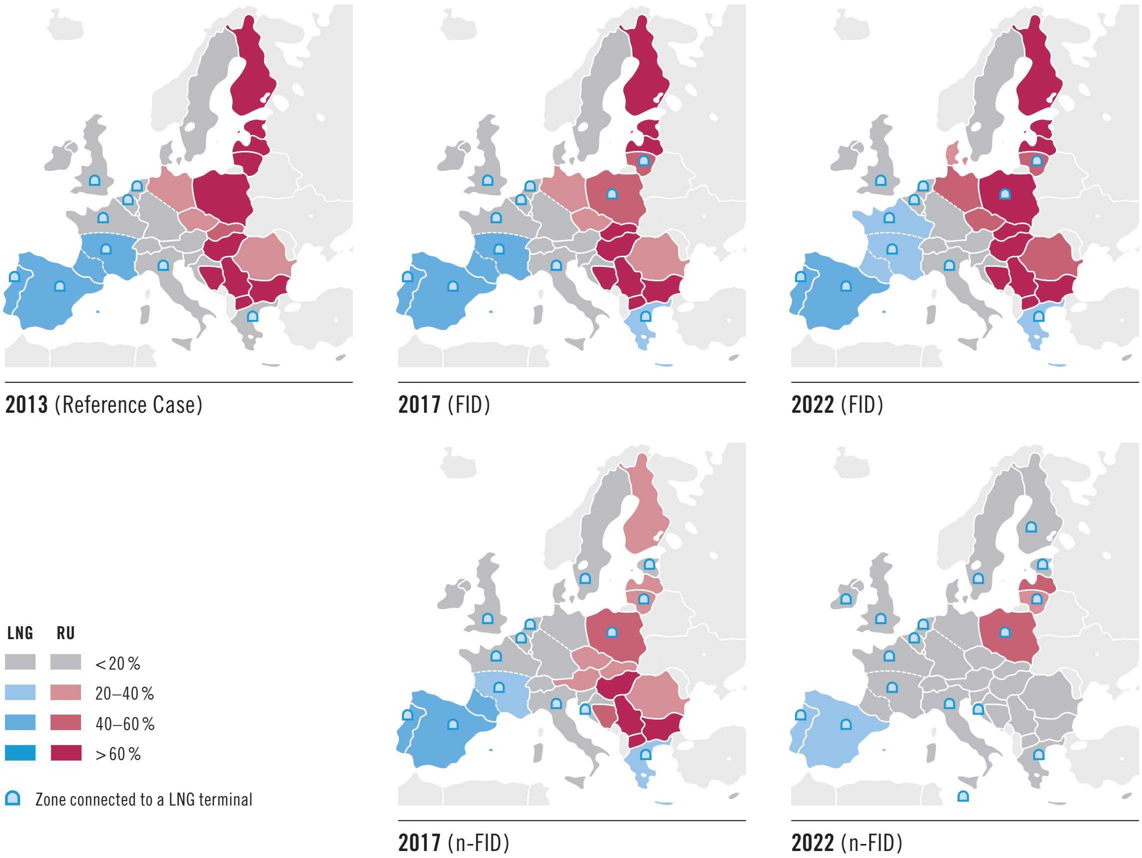


Figure 6.11: Supply Source Dependence on annual basis – Demand 1-day Average Situation

6.2.2 HHI APPROACH

In Figure 6.9, we can see the average historical supply basket for each country of the South Region. Historical data for the period 2009–2011 shows that the share of LNG in the total imports was:

- France: 29%.
- Portugal: 60%
- Spain: 72%

Figure 6.12 shows the **Herfindahl Hirschman Index, HHI, at "supply"**[1] for the average period 2009–2011 indicating the level of supply concentration of each country.

The level of supply concentration in Portugal is the highest while in Spain is the lowest. The level of supply concentration for France obtained by the HHI at supply show a value in the middle. So, we can conclude that Spain and France have a better level of diversification of gas origins by country than Portugal.

Totally different results are obtained calculating the **HHI at "supply & price"**, i.e. grouping the supply sources by correlated prices. In this case, due to the LNG global market, LNG is grouped as a single supply because it is linked with a single price. In Figure 6.13 we see the results of the Index.

Spain, Portugal and the GRTgaz South and TIGF zones in France have a "supply & price" concentration reaching about the double of GRTgaz North. So, we can conclude that the southern area of the South Region is undiversified regarding the sources of gas, i.e., the southern area of the South Region has a high dependence on LNG prices.

HHI AT SUPPLY

Spain	Portugal	France South & TIGF	France North
0.14	0.42	0.19	0.26

Figure 6.12: HHI at Supply
(Source: Internal development)

HHI AT SUPPLY & PRICE

Spain	Portugal	France South & TIGF	France North
0.57	0.52	0.53	0.29

Figure 6.13: HHI at Supply & Price
(Source: Internal development)

POTENTIAL HHI AT SUPPLY & PRICE

Spain	Portugal	France South & TIGF	France North
0.35	0.35	0.28	0.28

Figure 6.14: Potential HHI at Supply & Price
(Source: Internal development)

In order to capture the effect resulting of the creation of the new corridor "Bidirectional flows between Portugal, Spain, France and Germany" in the convergence of prices into the South Region as well as with the others European markets, we have estimated the evolution of the **HHI "supply & price"** with the new potential annual levels of LNG supply and spreading the current share of supply by pipelines in the North of France to the rest of the Region.

As a result we can observe the convergence in the **potential HHI "supply & price"**, i.e., a potential price convergence into the South Region and others European markets.

The vulnerability on prices due to the ligature to LNG prices which currently strongly affect the Iberian Peninsula and the South of France would decrease.

The corridor "Bidirectional flows between Portugal, Spain, France and Germany" is crucial eliminating prices divergence into the South Region and with the rest of central Europe, contributing to create fluidity and liquidity in the gas market, and therefore increasing competition into the South Region and in Europe.

1) $\sum_i \left(\frac{Si}{s\ total}\right)^2$ when Si: supply from country "i" and "S" is the total supply

6.2.3 HUB PRICES ANALYSIS

The prices divergence into the South Region has been highlighted by the CRE in a press release on 20th February 2013, citing peak differentials higher than 5€/MWh. Figure 6.15 shows this effect. Prices in the southern area of the South Region, Iberian Peninsula and South of France, are higher than in the North of France. So, there is a strong divergence on prices into the South Region.

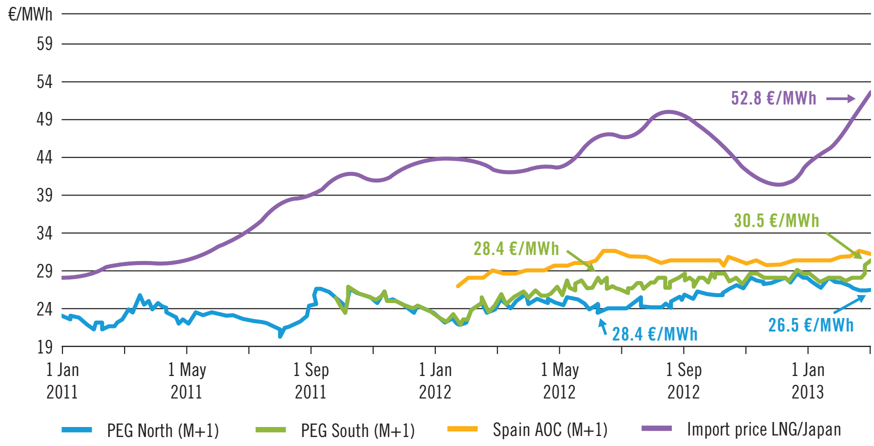


Figure 6.15: Gas price in the South Region
Source: Bloomberg, ICIS Heren, analysis by CRE

6.2.4 KEY CONCLUSIONS

Key conclusions obtained in the Supply Source Dependence assessment for the South Region are:

- The South of France (GRTgaz South and TIGF zones) and the Iberian Peninsula have currently a high annual dependence on LNG source. The main consequence of this LNG source dependence is also the LNG-prices ligature in the area causing strong price peak differentials into the Region and also with the rest of central Europe.
- Annual dependence on LNG source in the South Region will diminish developing the main n-FID transmission projects identified in the South Region, the new corridor between Portugal, Spain, France and rest of Europe.
- This corridor is therefore crucial, eliminating the divergence of prices into the South Region and with the rest of central Europe.

6.3 Network Adaptability to Supply Evolution

This assessment aims to look at the European infrastructure's ability to face very different supply mixes from short-term / long-term trends.

DEMAND

1-day Average Situation

SUPPLY

Supply source S move from Reference Supply to Maximum / Minimum Potential Supply scenarios

– **Even Maximisation:**
Maximisation of source S up to its Maximum Potential Scenario, with reduction of the others sources down to Minimum Potential Scenario

– **Even Minimisation:**
Source S goes down up to its Minimum Potential Scenario, the others sources increase up to their Maximum Potential Scenario

Achievement of minimum / maximum potential supply from source S, if no flow pattern enables to reach minimum / maximum potential supply from source S

-> lack network adaptability to supply evolution from source S

Figure 6.16: Network Adaptability to Supply Evolution Methodology

This assessment will capture the ability of the network to contribute to the optimization of shippers' supply portfolios. Network flexibility contributes to shippers compensation of the variations among cost of supplies source by the lesser or greater utilization of them. A competitive market for the end customers needs an interconnected and flexible network which minimizes the price spreads with the adjacent markets.

6.3.1 NEW CONFIGURATION OF GAS FLOWS IN THE SOUTH REGION NETWORK

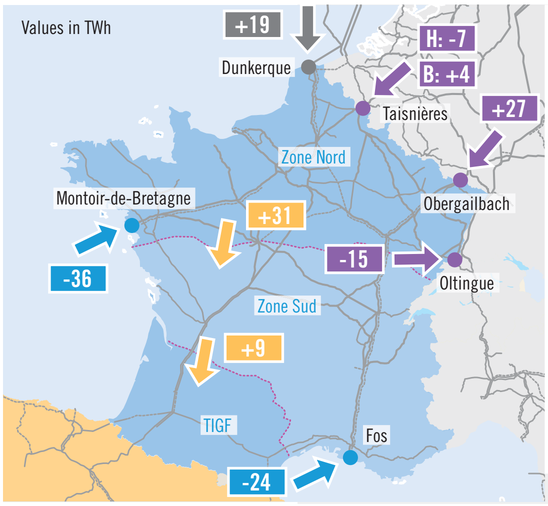
In the South Region, during previous years, new trends in supply mixes have been noticed. The influence of price discrepancies in Europe and throughout the world has resulted in a new configuration of gas flows entering the network in the South Region since the end of 2011. The first months of 2012 have seen a sharp drop in LNG entries and a marked dominance of northern flows to the south of the network:

- In **Northwest Europe**, due to excess of pipeline gas, spot prices on the market were lower in 2011 than long-term contract prices: the difference reached up to 8€/MWh.
- In **Asia**, gas prices remain much higher than prices in Europe with a demand for LNG that rose significantly in the second half of 2011 due, in particular, to the closure of the Japanese nuclear reactors after the accident at Fukushima in March 2011.
- In **Europe**, the significant drop in the use of gas to generate electricity attributed to both the rising generation of electricity from renewable energy sources and the increase of coal use, in addition to the economic crisis, have reduced the demand for natural gas in Europe, and in particular in the South Region. This fact has caused a surplus of supply originally destined to the European market.

The simultaneous consequence of this surplus of gas and a high demand and prices in Asia, have been taken advantage of by the shippers operating in the Region. Shippers, in order to maximize the LNG surplus in the southern area, have also maximized the gas flows from North to South covering the maximum demand as possible with them. Thereby, LNG surplus have been reloaded from the LNG Terminals in the Iberian Peninsula and in France and have been sent to Japan, where the demand for LNG is high.[1)]

Figures 6.17 to 6.20 show the results of the analysis developed in order to increase the knowledge of the effect for the South Region's gas system of these boundary global conditions.

In Figure 6.17 we can observe a **new configuration** of the gas flows in the French network with gas coming **from North to South**.



- **Drop of LNG supplies: -38% between 2011 and 2012**
- **Higher entries at Dunkirk (+12%) and Obergailbach (+38%) to offset LNG's supplies**
- **Growing exports to Spain (+18%), decreasing to Italy (-34%)**

Figure 6.17: New gas flows configuration in the French network (Source: Internal Development)

Figure 6.18 shows the increasing use of pipe supplies from the Northwest Europe to France.

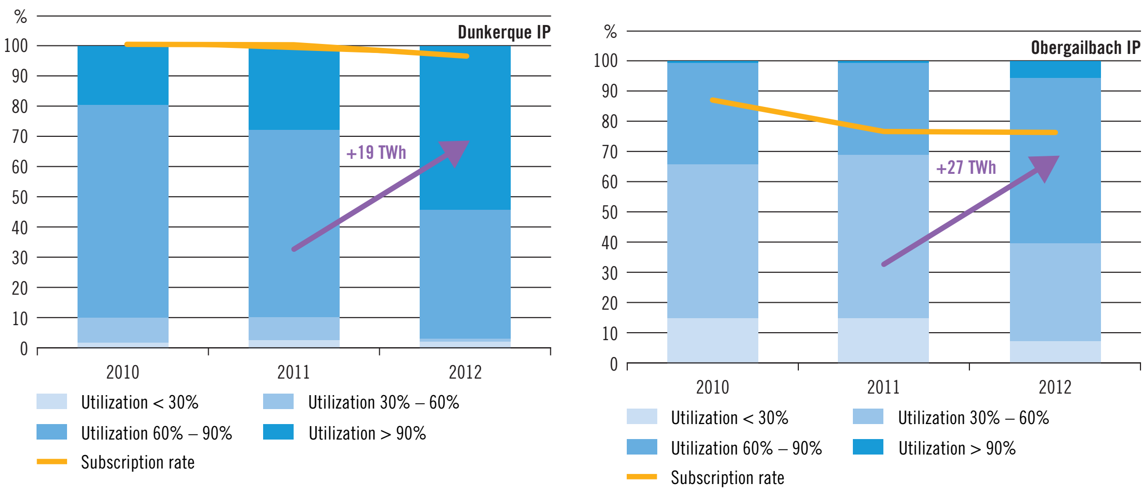


Figure 6.18: Evolution of utilization of French entry points (Source: Internal Development)

1) Despite a total count in 2012 of 70 re-exported cargoes actually discharged (up 60% from 2011), considering operational cost efficiency and the environmental impact, it is doubtful that reloads will continue to be a growing feature in LNG trading , they are, however, likely to continue in the coming years.

The decrease of LNG imports in France touched mostly Montoir, in the North Zone (-60 %). As the South Zone balance still relies mostly on LNG supplies, Fos managed to keep its activity at an average level (-19 %).

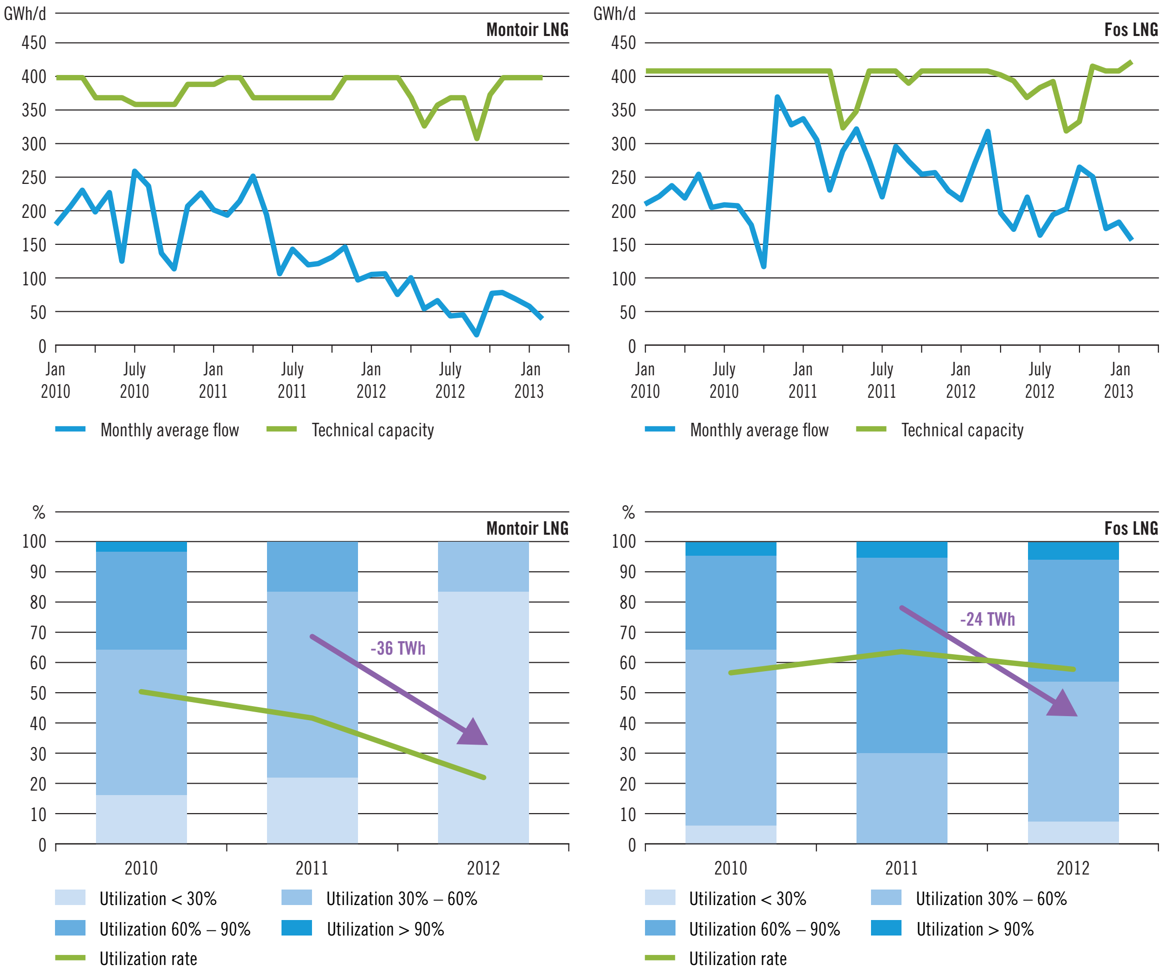


Figure 6.19: Evolution of utilization of French entry points (Source: Internal Development)

The different evolutions of these two LNG entry points are mainly due to the capacity limitation of the North-South link between these two adjacent balancing zones. Indeed, the downturn in LNG was offset by an increase by over 40 % in flows on the North-South link. Part of these gas flows were directly to Spain, resulting in an 18 % rise in the flows exiting the Midi PIR point; however, this increase in flows from North to South was not enough to diminish the use of LNG in the South zone, as it is possible in the North zone.

With a utilization rate of more than 95 % during 60 % of the time (93 % on average), the North-South link has become the most used interconnection in France. As a consequence, the price spread between the North and South PEGs reached almost 7 €/MWh in July 2012.

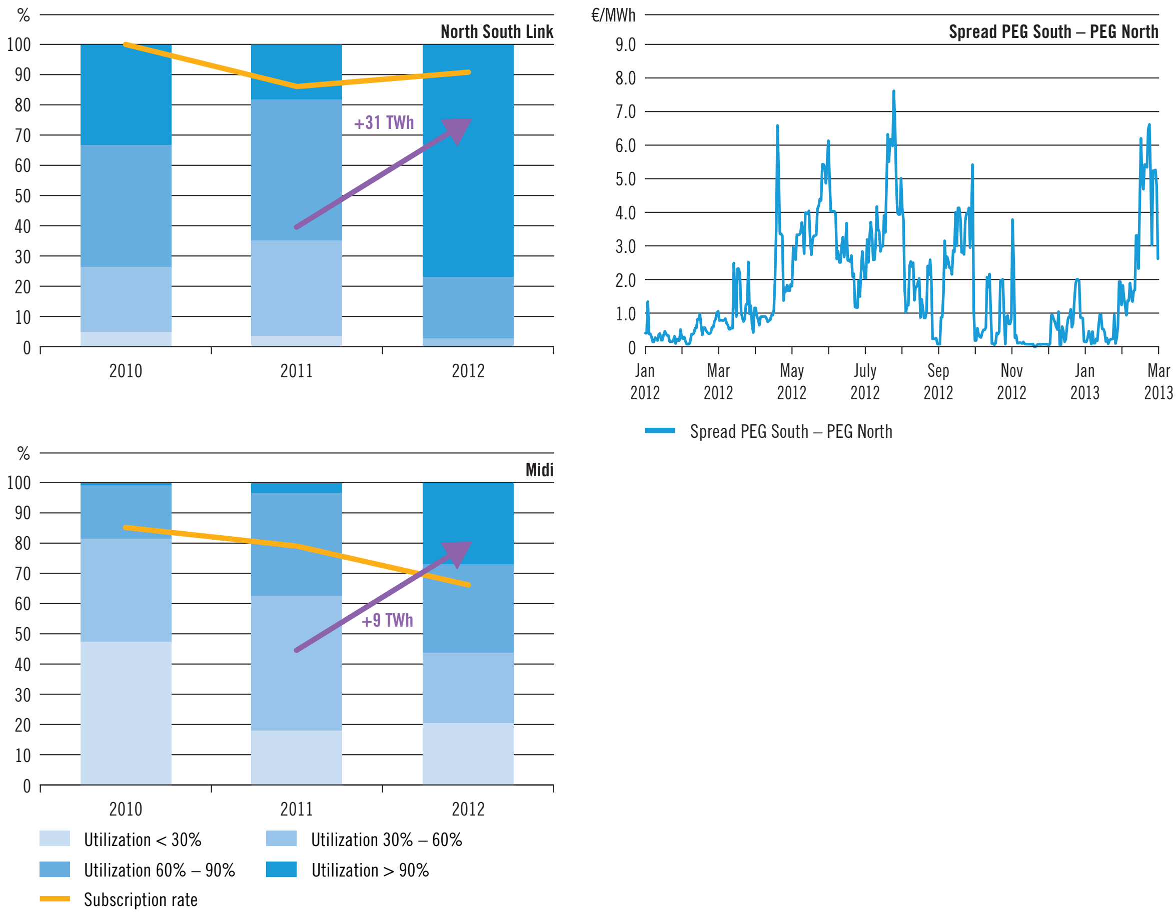


Figure 6.20: Evolution of utilization of French entry points (Source: Internal Development)

Figure 6.21 shows the main changes in the configuration of flows in the Iberian Peninsula comparing 2012 with 2011. The expansion in import capacity in combination with declining demand has resulted in a reduced utilization of LNG Terminals.

This new share of gas flows from the different entry points has not caused internal network congestions due to the radial Spanish network configuration.

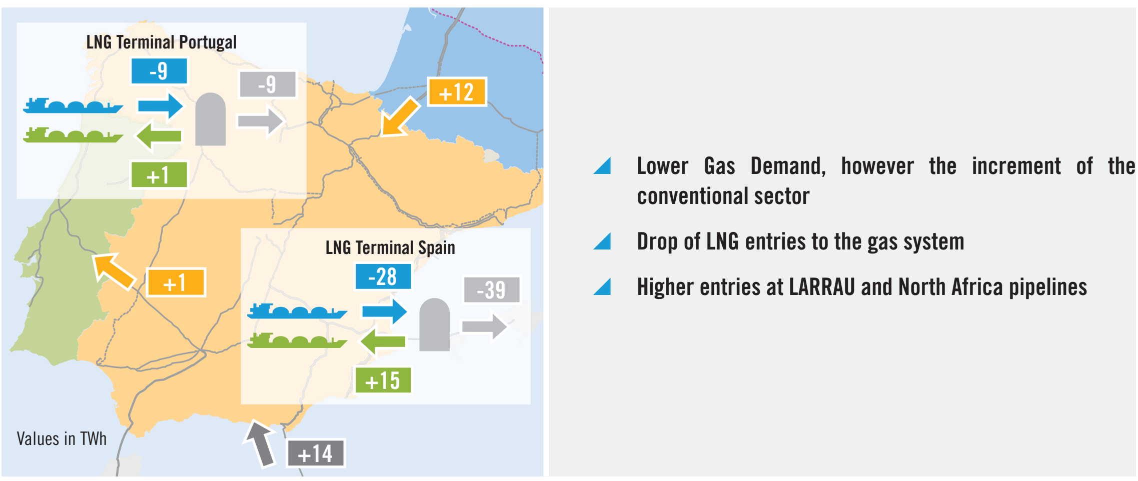


Figure 6.21: Evolution of utilization of Iberian Peninsula entry points (Source: Internal Development)

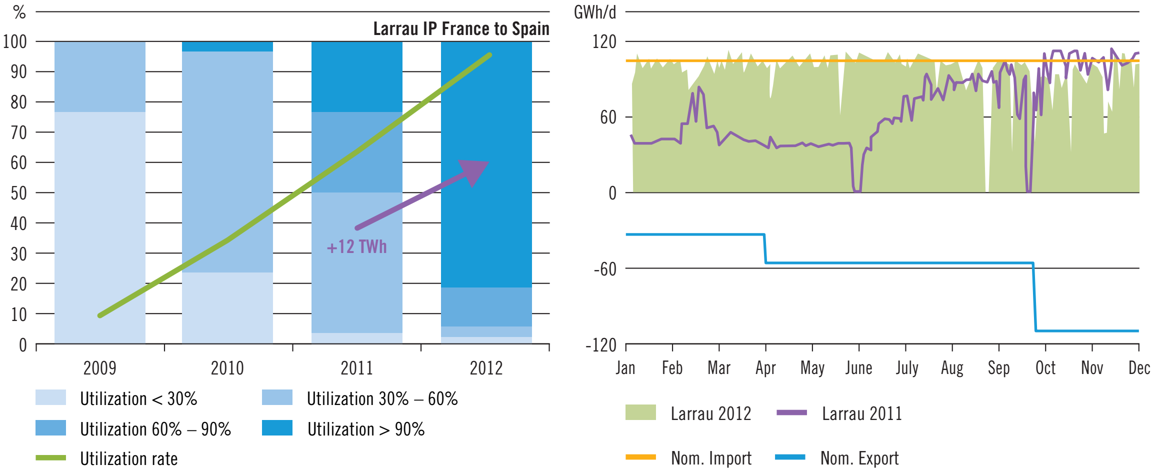


Figure 6.22: Evolution of utilization of Spanish entry points (Source: Internal Development)

However, we have not observed network physical congestions in the Iberian Peninsula network, the consequence of this maximum gas flow from North to South, saturating the North-South link, has derived in strong divergences in prices in the South Region: prices in the Spanish AOC have been around 5 €/MWh higher than in PEG Sud, reaching up to 9 €/MWh comparing with PEG Nord (see Figure 6.15).

In North America, gas prices remain much lower than European prices due to the extensive development of unconventional gas production, shale gas in particular. Additionally, the first final investment decision (FID) of LNG exports from North America has been taken in 2012.[1] This fact could trigger many changes in the LNG business in the next years.

It should be noted that the current situation could be reversed and, as it has happened in the past, if the LNG Atlantic basin has a gas excess, prices could be lower in the Iberian Peninsula than in the rest of Europe.

Then, given LNG Terminals capacity in the South Region, especially in the Iberian Peninsula, the flows could be inversed, in order to spread the benefit of low LNG prices to the rest of Europe. To be effective, such flows need larger bidirectional interconnection capacity from Portugal and Spain to Germany through France, in particular at, Spain-France and France-Germany boarders and also internally in France between PEG Nord and PEG Sud.

The following figure also illustrate that the situation in the next period could be inversed. "By 2020, internationally-trade LNG could make up as much as 20 percent of global gas supply with significant changes in the relative roles of exporters and importers. The growth in the number of buyers and sellers will create deeper LNG networks and open up new flexibility in the market and new competitive dynamics".[2]

Whatever gas flows will be in the future, the experience of the last years and the outlook of the future, highlights the need for a transmission network design solid enough to reach a more integrated market.

1) In the United States, FID was taken in August on the first phase of the Sabine Pass liquefaction project developed by Cheniere. GII GNL, "The LNG Industry in 2012"
2) The Age of Gas & The Power of Networks (General Electric Company)

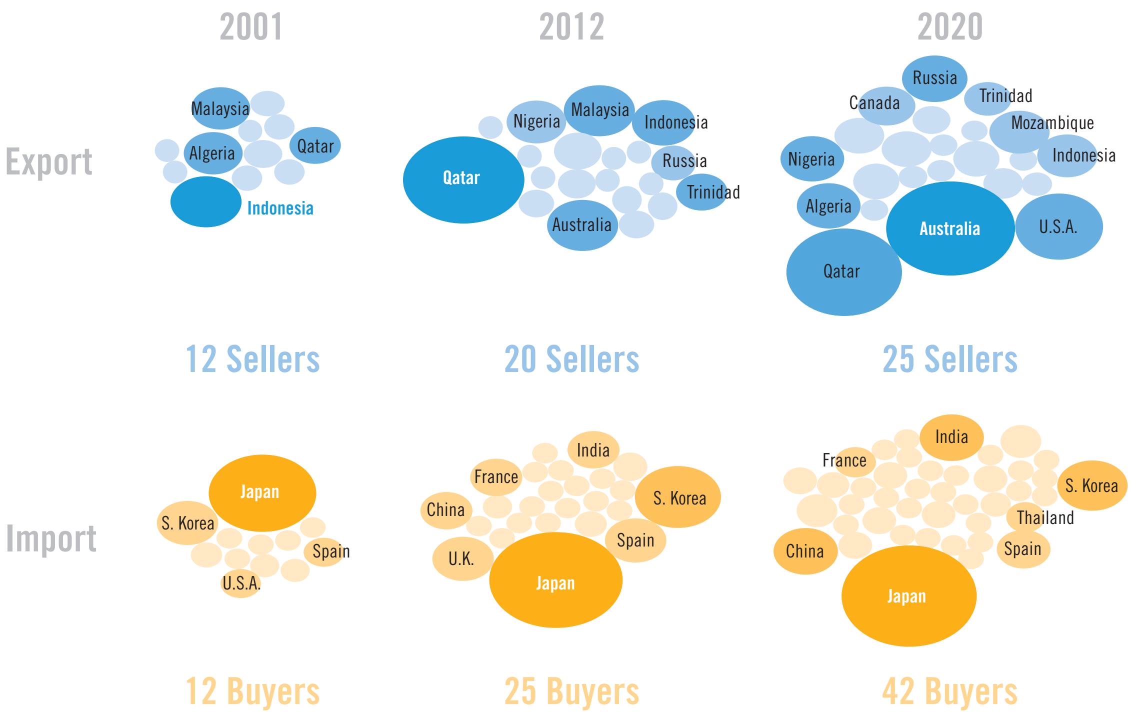


Figure 6.23: Deepening Global LNG Market (Source: The Age of Gas & The Power of Networks)

6.3.2 MARKET RESPONSES COMPLEMENTING THE FLEXIBILITY PROVIDED BY THE NETWORK

On the other hand, complementing the network flexibility provided by properly developing transmission infrastructures, tailored solutions would be developed for concrete events which could also help improve flexibility for shippers. An example of this tailored solution, under concrete events in the gas market, was the diversion of LNG cargoes from LNG Terminals in the South Region to Italy and Greece during the cold spell in February 2012. The extremely cold weather in Europe, mainly in the East but also in the West, increased the gas demand in the EU. This high level of gas demand combined with the reductions in some supply sources caused a significant stress on the transmission network. The gas flowing through the EU-IPs increased notably in comparison with the average utilization during January 2011. Withdrawal from UGS increased notably, as well as LNG tanks providing transitional mitigation, allowing increased levels of Send-Out from the LNG Terminals. Additionally, the market responded achieving agreements to reloading and diverting some cargoes where they were most needed.

However, these tailored solutions offered by the gas systems and markets depend on several circumstances affected by many factors which cannot be planned in advance:

- working volume availability in UGS, which could be conditioned by the previous use of them during winter,
- availability of additional LNG sources/cargoes,
- the new destination of the vessel which should not modify the ship logistics, neither increase the cost of transport nor the travel ships time,
- agreements involving operators and/or suppliers,
- compatibility certifications for vessels and the LNG Terminals,
- …

Therefore, due to their dependency on the above mentioned factors, these tailored solutions can complement the flexibility of the network, but they will never replace the development of transmission infrastructures and cross-border interconnections necessary for true market integration.

6.3.3 SOUTH REGION INFRASTRUCTURE'S ABILITY TO FACE VERY DIFFERENT SUPPLY MIXES

One of the main results obtained in the TYNDP 2013–2022 indicate **"the limited ability to decrease LNG to Iberian Peninsula and South of France due to the lack of interconnection with Northern Europe (merger of GRTgaz North and South Zone and MidCat by 2022 will partially mitigate the issue for Portugal, Spain and TIGF Zones)"**. One of the most important consequences of this fact is the occurrence of price spread between the Iberian Peninsula, the South of France and the North of France and the rest of Europe.

This report goes further in the analysis of this result: Maximum flows from North to South.

The objective of this analysis is to detect the congestions in the network to reduce the LNG Send Out in the Terminals located in the southern area of the South Region. For this purpose, the gas flow from North to South has been maximized limiting the entries to GRTgaz North by the current IPs capacity.

Based on the LNG potential supplies included in the ENTSOG TYNDP 2013–2022, it has been calculated the range of LNG potential for the southern area[1] of the South Region.[2]

Figure 6.24 shows the relevant effect of developing MidCat, and merging GRTgaz North and South zones providing network adaptability to reduce the annual dependence on LNG in the southern part of the South Region. The area between yellow and red lines indicates the different levels of LNG supply required, or in other words, the flexibility provides by transmission projects to reduce LNG supply dependence and to allow gas flows from the North of France to the Iberian Peninsula and South of France.

The adaptability of the network contributes to the optimization of shippers' supply portfolios. Through the new network flexibility, shippers will compensate the variations among cost of supplies source by the lesser or greater utilization of some of them. The competitiveness in the gas market minimizing the prices divergences with adjacent areas will also result on competitiveness improvement for the industry and the rest of the end consumers of the gas system having a clear positive impact in the economy of the respective countries.

Network flexibility to face LNG dependency

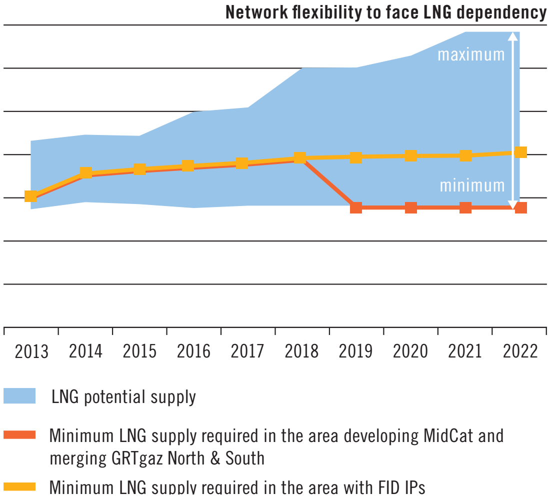


Figure 6.24: LNG supply dependence vs. the development of n-FID Transmission projects – maximum gas flow North to South

1) The southern area of the South Region comprises TIGF, GRTgaz South, Spain and Portugal market zones.
2) For this estimation, the LNG potential supply for Europe has been proportionally distributed to each LNG Terminal in the area according to respectively Send Out capacity.

Maximum flows from South to North

In the previous analysis we have focused on the minimum level of LNG required in the Region. Deeply analysis has also been developed in order to capture possible limitations for the maximum Send Out from LNG Terminals if it is required by the market.

Historically, LNG Terminals in the Iberian Peninsula and in the South of France have had different Send Out yearly and daily profiles. In the Iberian Peninsula, due to a lack of UGS and cross-border interconnection as tools to cover demand fluctuations, the Send Out from the LNG Terminals follows the demand modulation profile. In France, LNG Terminals usually have a flatter profile during the year and the day. In terms of utilization factor , the average historical utilization factor in the Iberian Peninsula was around 0,50 while in France it was near 0,70. In the recent period, this factor has diminished a lot where possible, due to the LNG price spread with Asia and for the reduction of the gas consumption in the area of influence.

Therefore, we can conclude the utilization of the LNG Terminals depends on interconnection capacities as well as the level of demand and the alternative options for the commodity in a global market.

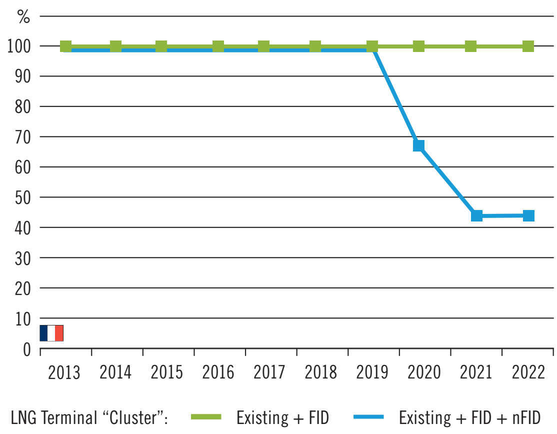
For these reasons, our objective is to further investigate how the development of the corridor “Bidirectional flows between Portugal, Spain, France and Germany” could integrate the existing and coming LNG Terminals projects in the area; and how it could increase their utilization in case of low LNG price, whether from important needs of gas in central Europe or due to any other interest of the shippers operating in the market.

In order to further analyse this aspect, the maximum gas flow from the South of the Region to the GRTgaz North zone has been calculated. Intermediate potential supply from Algerian gas by pipeline has been considered prior to determine the LNG Send Out. Due to the significant n-FID LNG Terminals projects increasing Send Out capacity in the South of France, this analysis has been done for both clusters, FID LNG Terminals and n-FID LNG Terminals.

Figure 6.25 and Figure 6.26 show the evolution of the resulting potential utilization factor for the LNG Terminals in the southern area of the South of France according to the development of the main transmission projects in the Eastern Axis as well as the development of the n-FID LNG Terminals projects.

Assuming maximum gas flow from South to North, these results show the simultaneous utilization factor that could be reached for the LNG Terminals in the South of France considering also the maximum utilization factor reached for the Iberian LNG Terminals.

Evolution of LNG terminals utilization factor with the current IPs



Evolution of LNG Evolution of LNG terminals utilization factor developing Midcat & merge GRTgaz North South

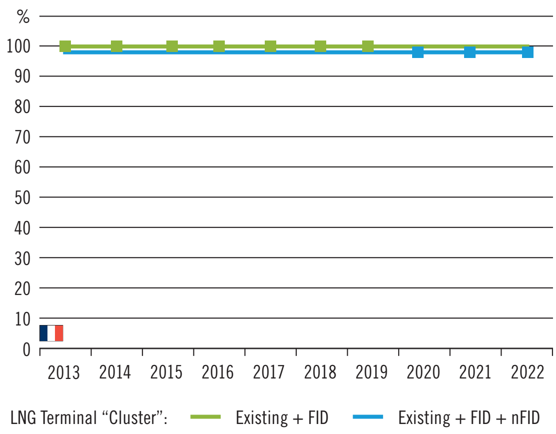


Figure 6.25: Utilization factor of the LNG Terminals in the South of France – maximum gas flow South to North

Main result highlighted in Figure 6.25 is the effect of merging GRTgaz North and South zones: the network transmission capacity would offer enough flexibility to increase the utilization of the LNG Terminals in the South of France simultaneously with the maximum gas flow from Spain though the interconnection IPs FID and n-FID (Larrau + Biriatou + Le Perthus).

Figure 6.26 shows the increment of the evolution in the utilization factor in the Iberian LNG Terminals according to the level of interconnection capacity with France.

Main result highlighted in Figure 6.26 is the effect of developing the n-FID IP (MidCat project) and merging GRTgaz North and South zones in the utilization of the Iberian LNG Terminals. The utilization factor showed in the graphs represents a "flat" utilization of the Iberian LNG Terminals, meaning that this utilization could increase due to the role played for these facilities in the Iberian Peninsula contributing to the seasonal/weekly/daily modulation of the demand.

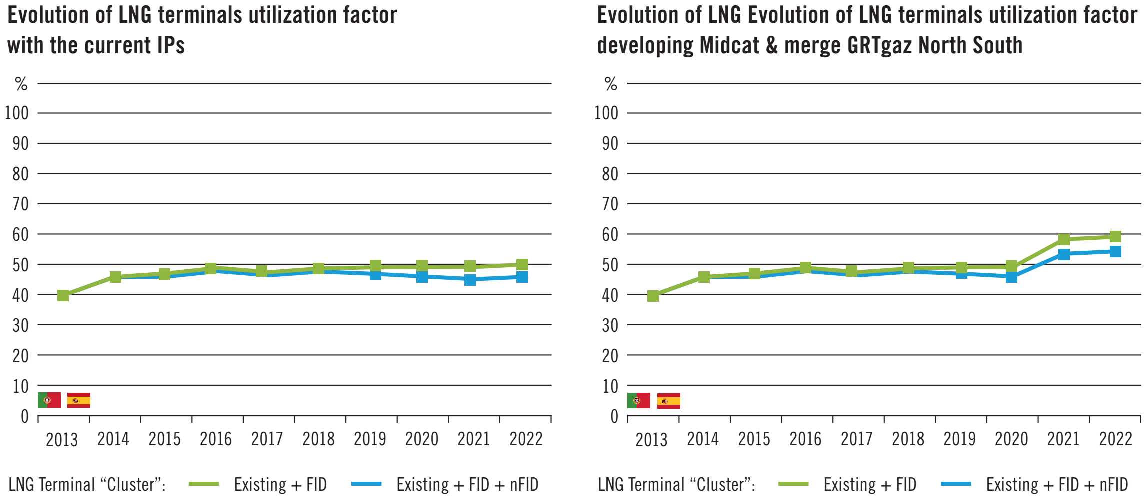


Figure 6.26: Utilization factor of the LNG Terminals in the Iberian Peninsula – maximum gas flow South to North

Complete integration of this new source to central Europe requires the development of reverse flow from France to Germany.

So, main conclusion for this analysis indicates that the new corridor "Bidirectional gas flow between Portugal, Spain, France and Germany" facilitate the integration of the current and new LNG Terminals in the area, increasing liquidity in the market, and opening possibilities of arbitrage between the different European gas sources.

6.3.4 KEY CONCLUSIONS

Key conclusions obtained in the **Network adaptability to Supply evolution** for the South Region are:

- Network flexibility provided by properly developing transmission infrastructuresis necessary for true market integration. Complementary, market responses developed as tailored solutions for concrete events could also help to improve flexibility for shippers, but they can never replace the development of transmission infrastructures and cross-border interconnections.
- Network growth creates greater flexibility and improved economics. Denser networks contribute to making energy systems more robust and therefore more resilient to disruption and less likely to exhibit extreme volatility on prices.
- The adaptability of the network contributes to the optimization of shippers' supply portfolios. The competitive in the gas market minimizing the divergences in prices with adjacent areas will also results on improving the competitiveness for the industry and the rest of the end consumers of the gas system having a clear positive impact in the economy of the respective countries.
- The development of the corridor "Bidirectional flows between Portugal, Spain, France and Germany" could integrate the existing and coming LNG Terminals projects in the area, increasing their utilization, whether from important needs of gas in central Europe or due to any other interest of the shippers operating in the market. Complete integration of this new source to central Europe requires the development of reverse flow from France to Germany.

Image courtesy of GRTgaz

6.4 Capability for Supply Source Diversification

In the ENTSOG TYNDP 2013–2022, the assessment of the Supply Source Diversification aims at determining the ability of each Zone to access each identified supply source. It is measured by the number of sources in whom a Zone may have physical access to covering at least 5 % or 20 % of its total supply.

This assessment is based on independent Targeted Maximisation simulations where each source is sent one by one in direction of a particular Zone in order to check source accessibility. This assessment does not cover the contractual access to a given source or specific market conditions which may be independent from physical access but have an impact on source accessibility.

DEMAND

1-day Average Situation

SUPPLY

"Targeted Maximisation" of source S to zone Z

Several simulations in all directions in order to test the supply reach from source S

– For each simulation, Source S is increased up to its Maximum Potential scenario with reduction of the others sources down to their Minimum Potential Scenario, in order to achieve the targeted supply share in the zone Z

Identification of supply sources each Zone may have access (simultaneity not tested) according the 5 % and 20 % targeted supply share

Identification of the number of supply sources a zone may have access according the 5 % targeted supply share

Figure 6.27: Capability for Supply Source Diversification Methodology

In the Figure 6.28 we can see the results obtained in the ENTSOG-TYNDP 2013–2022. It is highlighted the increment of supply sources in the South Region as a consequence of developing n-FID projects.

For the GRIP South Region, following the strategic concept of the North-South Corridor in Western Europe, i.e., to better interconnect the Mediterranean area and thus supplies from Africa and the Northern supply Corridor, with supplies from Norway and Russia, we will focus our analysis in the maximization of Algerian gas and Russian gas.

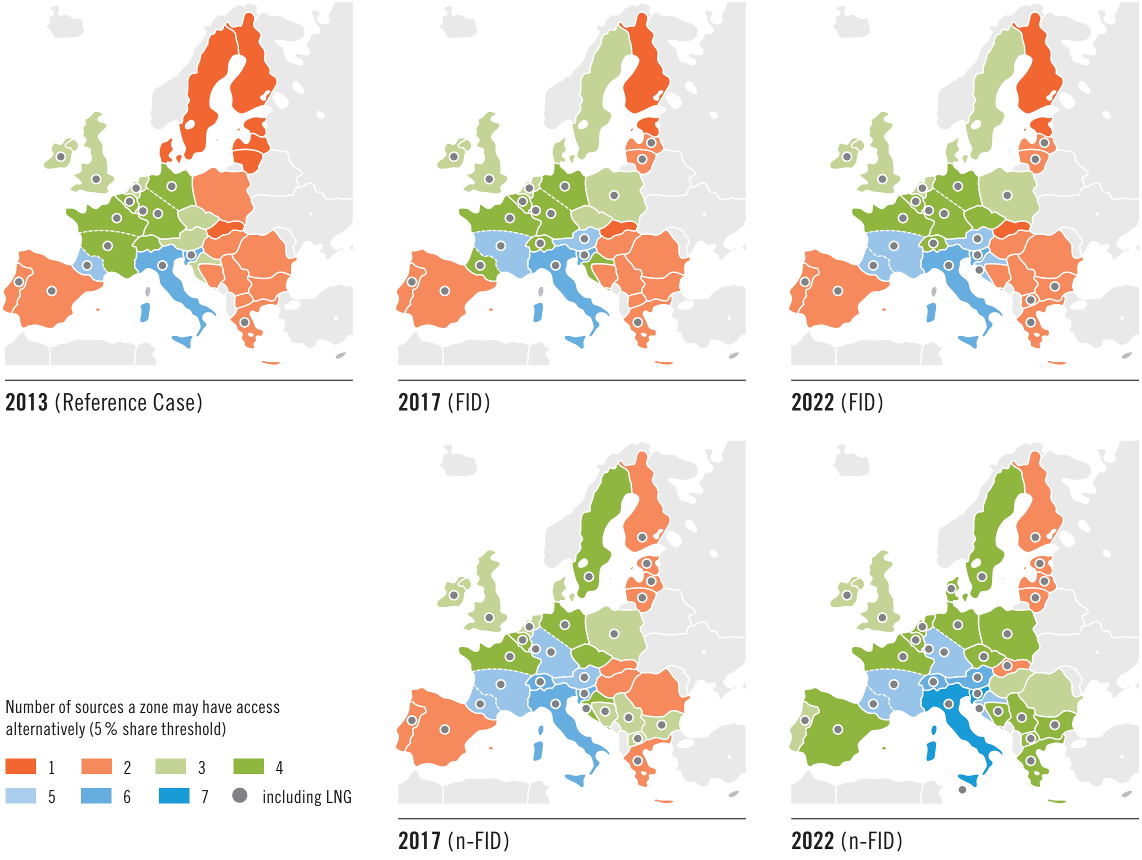


Figure 6.28: Supply Source diversification

6.4.1 MAXIMIZATION OF ALGERIAN GAS

The Maximum Potential supply from Algeria is based on the High case of the "Gas Export Availability" data from Mott MacDonald's report: Supplying the EU Natural Gas Market (Sep 2010) which was ordered by the European Commission. This Maximum Potential Supply is 12 % lower than the capacity of the pipelines from Spain and Italy.

We focus our analysis on the maximization of Algerian gas through pipes MGE and MedGaz from the Iberian Peninsula to central Europe. Using the NeMo tool developed by ENTSOG, for the year 2022, we have run simulations of the European network considering the cluster of the existing infrastructures + the FID projects. Additionally to this cluster, we have also simulated the network including the development of the new corridor "Bidirectional flows between Portugal, Spain, France and Germany".

For these simulations, current capacity of the pipes from Algeria to Spain is maximized.

Going deeper in the effect of the development of the new corridor "Bidirectional flows between Portugal, Spain, France and Germany", it should be underlined that:

- Figure 6.29 shows the spread of Algerian gas through Europe. After developing MidCat project, merging the GRTgaz North and South zones and the creation of gas flow from France to Germany, Algerian gas could reach the North of France, Switzerland and Germany.

The potential supply share showed in the figure is directly derived for the current capacity of the pipelines from Algeria to Iberian Peninsula. The extension of these pipelines will modify the potential supply share.

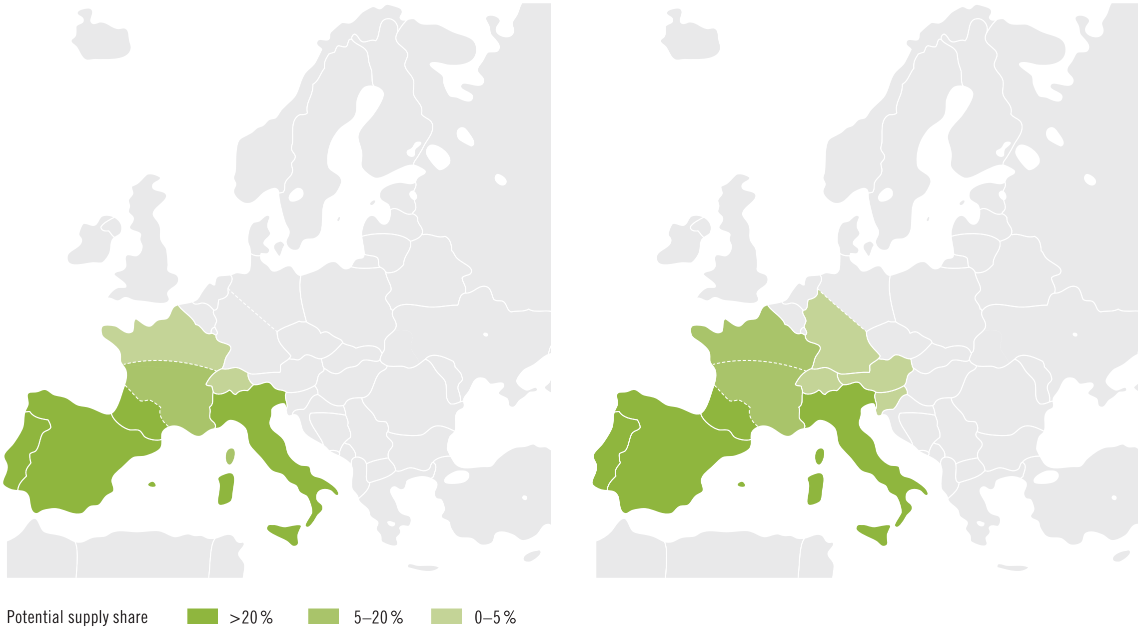


Figure 6.29: The spread of Algerian gas through Europe under two infrastructure clusters in 2022
Left: Existing + FID
Right: Existing + FID + Midcat project + Merger North South zone + bidirectional flow from France to Germany

It should be pointed out that the existing pipelines can be extended:

- Gazoduc–Maghreb–Europe from the current 12 bcm to 18 bcm, i.e., +6 bcm
- Medgaz from the current 8 bcm to 20 bcm, i.e., +12 bcm

The proximity and the level of reserves of Algeria may encourage investment in pipelines from Algeria with the aim of increasing diversification to Europe. Long term supply visibility from Algeria would be promoted by partners' agreements as well as it has been the case of gas with Norway which, thanks to EEC free trade agreements, shows long term stability.

- Despite the European supply situation derived from the Maximisation of Algerian gas is the same for both clusters of infrastructure, in the simulation adding the new transmission projects, the new gas flows from the South is compensated by a reduction of the entries from Belgium and Norway. The new axis provides a new route from the Iberian Peninsula to France which, in addition to the current supply from Norway and Belgium, consolidates the North of France as a zone of confluence of routes allowing flexibility and interchanges between different gas flows.

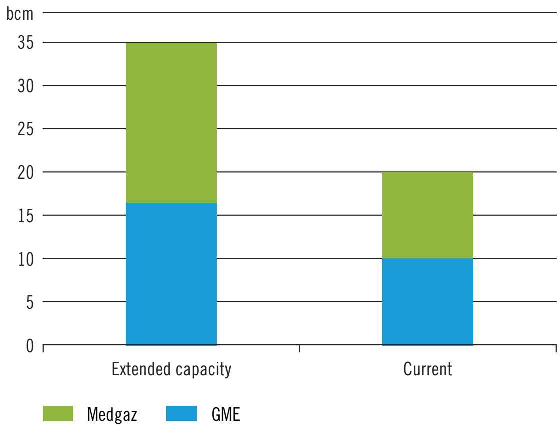


Figure 6.30: Possible extension of pipelines from Algerian to the Iberian Peninsula

The development of this new transmission projects creating a new route from the South contributes to consolidate a well-meshed network, enable the access to a new one supply source, facilitates the establishment of diversified suppliers' portfolios and improves the robustness of the gas network, making it more flexible.

6.4.2 MAXIMISATION OF RUSSIAN GAS

The Supply Potential of Russian gas is based on the export values given in the Energy Strategy of Russia for the period up to 2030 (published in 2010). Maximum scenario assumes low exports to Turkey and CIS countries and to Asia, leading to the higher exports for EU-27, and represents an increment higher than +30 % compared with the current supply.

Using the NeMo tool developed by ENTSOG, for the year 2022, we have run simulations of the European network considering the cluster of the existing infrastructures + the FID projects. Additionally to this cluster, we have also simulated the network including the new corridor "Bidirectional flows between Portugal, Spain, France and Germany".

Going deeper in the effect of the development of these new transmission projects, it should be highlighted that:

- Figure 6.31 illustrates the spread of Russian gas through Europe. After merging the GRTgaz North and South zones, the MidCat project and the 3rd IP Portgal-Spain, the Russian gas which currently reaches France, could also flow to the Iberian Peninsula reaching Portugal. Based on the assumptions considered for the assessment, the share of Russian gas that could flow to the Iberian Peninsula is reduced. However, the effect creating liquidity in the market could be very important. It opens possibilities of arbitrage between the different European gas sources, making the transmission system a powerful contributor to the price convergence in the area.

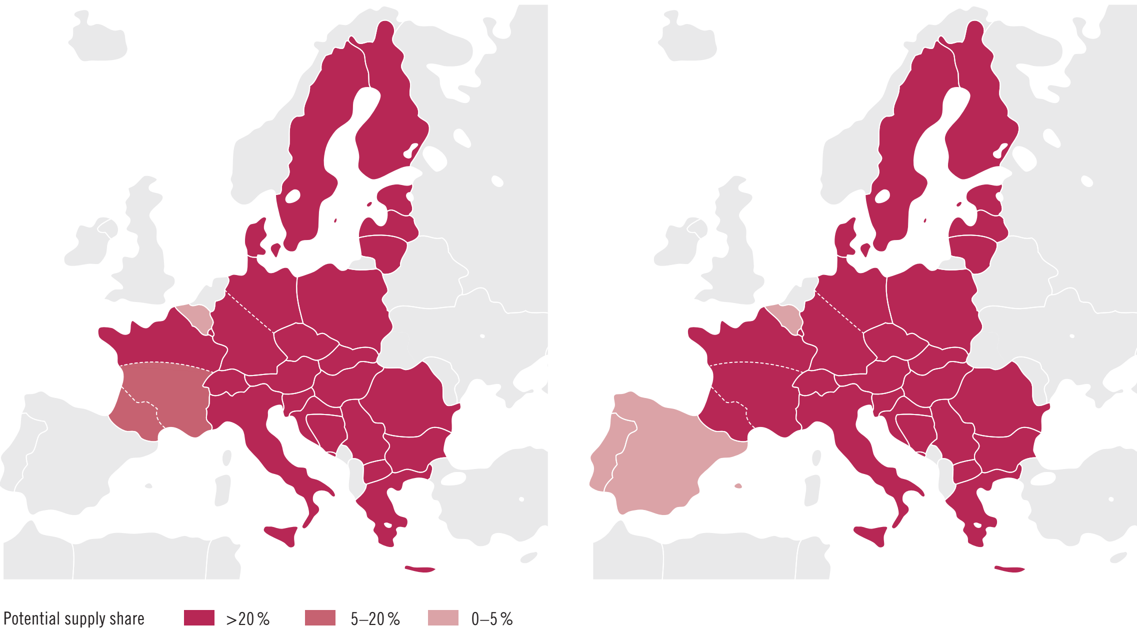


Figure 6.31: The spread of Russian gas through Europe under two infrastructure clusters in 2022
Left: Existing + FID
Right: Existing + FID + Midcat project + Merger North South zone + 3rd IP Portugal Spain

6.4.3 MAXIMIZATION OF NORWEGIAN GAS

As mentioned in the Supply chapter, "the supply potential from Norway is set to remain fairly constant over the coming years, according to ENTSOG, and so it should be expected that South Region imports of Norwegian gas will remain fairly constant over the next ten years accordingly".

For that reason, this document didn't go deeper in the analysis of the Targeted Maximization of the Norwegian gas supply. Nevertheless, the assessment done in the ENTSOG TYNDP 2013–2022 regarding the "Supply Source Diversification Assessment" showed that similar results are obtained for the Iberian Peninsula in the Maximization of the Norwegian gas simulation when compared to the maximization of Russian gas simulation. In this situation, with the n-FID projects foreseen for 2022, both Portugal and Spain can also have access to Norwegian gas covering at least 5% to 20% of its total supply.

6.4.4 KEY CONCLUSIONS

Key conclusions obtained in the assessment **Capability for supply source diversification** for the South Region are:

- The development of the new transmission projects creating a new route from the South contributes to consolidate a well-meshed network, enable the access to a new one supply source, facilitates the establishment of diversified suppliers' portfolios and improves the robustness of the gas network, making it more flexible.
- The effect creating liquidity in the market opening possibilities of arbitrage between the different European gas sources makes the transmission system a powerful contributor to the price convergence in the area.


Image courtesy of GRTgaz

6.5 Transmission and Odorisation of Natural Gas

Natural gas is odor-free, but in order to identify any leaks on the distribution network and on internal facilities, odorant is added to the natural gas. The distribution of odorised gas is compulsory in all European countries. In France and Spain, the odorisation process is centralized by transmission systems operators upon entry onto the system. In most European countries, the odorisation takes place just upstream of the distribution networks. In the South Region, Portugal is an example of that situation, although partial odorised gas is being accepted at the interconnections with Spain from January 2010.

Further to contacts made in 2011, a difference in gas odorisation practices was evidenced between France on the one side and Germany and Belgium on the other side, which means that reverse flows towards these countries is currently impossible.

This topic is the subject of a particular point in the network code on interoperability prepared by ENTSOG and submitted to ACER in September 2013. Then follow the process of formal validation by ACER, the EC, the Member-States, the Council and the Parliament. In the NC is stated that the transmission system operators shall seek an agreement within six months. Where no agreement can be reached or where the competent national authorities agree that the proposal is not sufficiently effective, the transmission system operators shall cooperate to develop options by identifying and assessing: a conversion towards non-odorised gas in the odorised transmission network or part thereof; the potential physical flow of odorised gas into the non-odorised transmission network or part thereof and interconnected downstream systems; an acceptable level of odorant for the interconnected transmission networks.

Being directly concerned as boarder TSO with Belgium and Germany, first exchanges between GRTgaz and national stakeholders showed the need for a wide-ranging consultation in order to weigh up the impacts of the harmonization process. In parallel to this, with regards to the creation of firm capacity in the France-Belgium direction, the installation of a new pipeline and an interconnection will allow in 2015 for non-odorised gas to be transmitted between Dunkirk and Belgium. It has to be noted that no French customers will be connected to these works, directly or indirectly.

TSOs are working in the harmonization of gas odorisation practices with the goal to reduce barriers to the European market integration.

6.6 Analyses Based on 2014 – 2022 IPs Capacity Subscription in South Region

TSOs, cooperating in developing this GRIP, understand our position as developers of transmission projects which can contribute to get the internal European Market and satisfy market needs as well as to reach the European energy policies.

The South Gas Regional Initiative Work Plan 2011 – 2014 establishes that the final goal on CAM for 2014 would be having in place joint coordinated capacity allocation mechanisms for the allocation of cross-border capacity in all the interconnections between the balancing zones in the region. To reach this objective, Enagás, REN, TIGF and GRTgaz committed to develop a joint allocation procedure inspired on ENTSOG's Network Code (NC) on Capacity Allocation Management (CAM) to allocate bundled products on both sides of the border in a coordinated mechanism.

Waiting for the total implementation of NC-CAM at Regional level, this sub-chapter will show the "current" cross-border interconnection point's capacity booked from 2014 to 2022 in Regional IPs. This information, taking into account the heterogeneity of the regulatory treatment of the booking of capacity in each of the countries of the region, can be considered as a pre-signal of market needs and expected utilization of Regional Gas Network in order to define future developments.

6.6.1. CAPACITY SUBSCRIPTION AT IPS BETWEEN PORTUGAL AND SPAIN

From October 2012, bundled Cross-border capacity at the physical interconnection points, Badajoz-Campo Maior and Tuy-Valença do Minho is marketed in the VIP (Virtual Interconnection Point) between Portugal and Spain.

According to Portuguese regulatory treatment, the maximum contract period is one year, so the capacity subscription at the interconnection points between Portugal to Spain from 2014 to 2022 doesn't reflect the forecasted activity at these IPs.

No subscription graphs have been included due to no relevant data is available regarding the long term capacity subscription at the interconnection points between Portugal to Spain and no fruitful conclusions can be taken in the long term based on the data available.

6.6.2. CAPACITY SUBSCRIPTION AT IPS BETWEEN SPAIN AND FRANCE

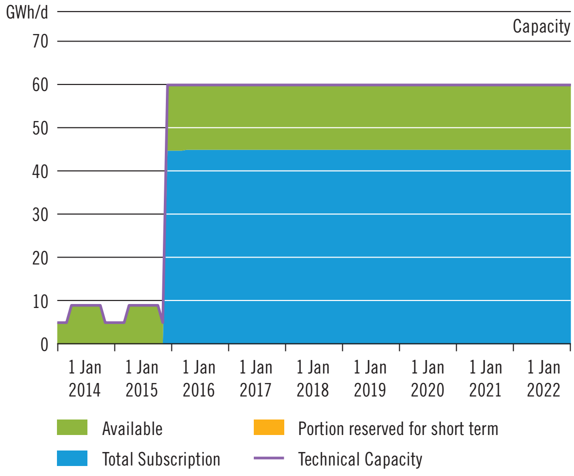


Figure 6.32: Biriatou IP Spain – France flow direction

Biriatou/Irún IP capacity subscription (2014–2022)

- Spain – France flow direction
  According to the latest subscription information, booked capacity would reach to 75 % from 2016 to 2022.
- France – Spain flow direction
  According to "Open Season for the development of new gas interconnection capacity between Spain and France as from 2015 (May 2010)", firm capacity at French side for this IP is zero and at Spanish Side is 60 GWh/d. There is no booked capacity at this flow direction.

Larrau IP capacity subscription (2014–2022)

- France – Spain flow direction
  According to latest information, 89 % of technical capacity would be booked on long term basis until 2022.
- Spain – France flow direction
  According to the latest subscription information, long-term booked capacity at this IP from Spain to France + flow direction would reach 70 % from 2014 to 2022.

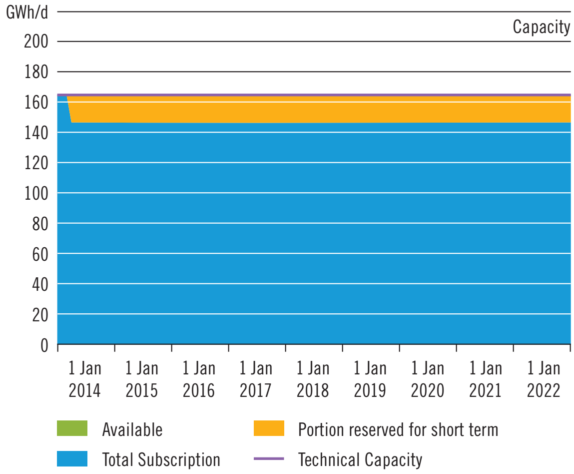


Figure 6.33: Larrau IP France – Spain flow direction

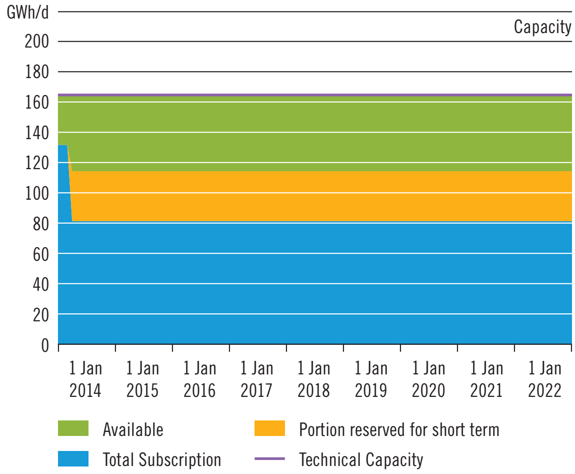


Figure 6.34: Larrau IP Spain – France flow direction

6.6.3. CAPACITY SUBSCRIPTION AT IPS WITHIN FRANCE

PIR MIDI IP capacity subscription (2014–2022)

- TIGF–GRTgaz (PEG Sud) flow direction
  According to the latest subscription information, booked capacity at this IP from TIGF to GRTgaz flow direction would reach 75 % from 2016 to 2022.
- GRTgaz (PEG Sud)–TIGF flow direction
  According to the latest subscription information, booked capacity at this IP from GRTgaz to TIGF flow direction would have an average utilization of 60 %.

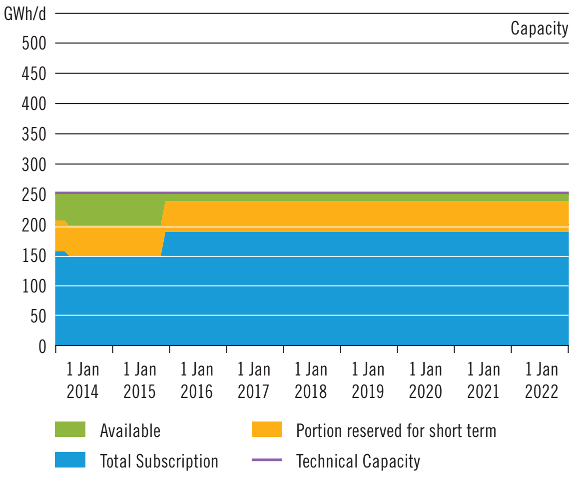


Figure 6.35: PIR Midi IP–TIGF–GRTgaz flow direction

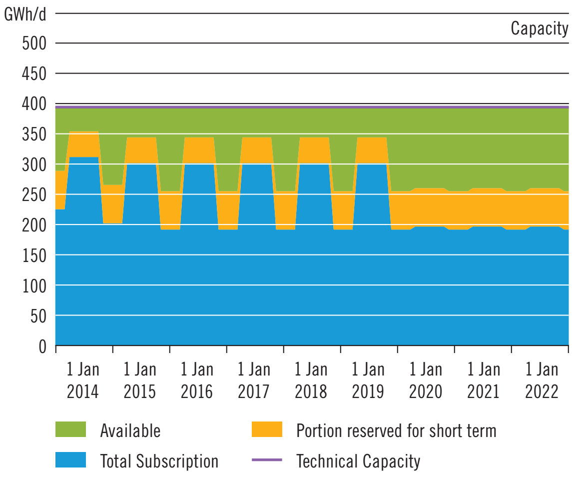


Figure 6.36: PIR Midi IP-GRTgaz–TIGF flow direction

Liaison North-South IP capacity subscription (2014–2022)

Firm capacity for the North-South linked is restricted to 230 GWh/d. Such a physical constraint accounts for the existence of two balancing zones. The current conditions lead to a high rate of subscription to the South link. Subscriptions are restricted until 2018 by the CRE. As a consequence, long-term subscriptions are not possible. The terms and conditions for subscriptions from April 2014 are currently being discussed. This situation is a prime example of why capacity requirements to be built between the North and the South zones. The subscription rate in the south-north direction is, however, very low.

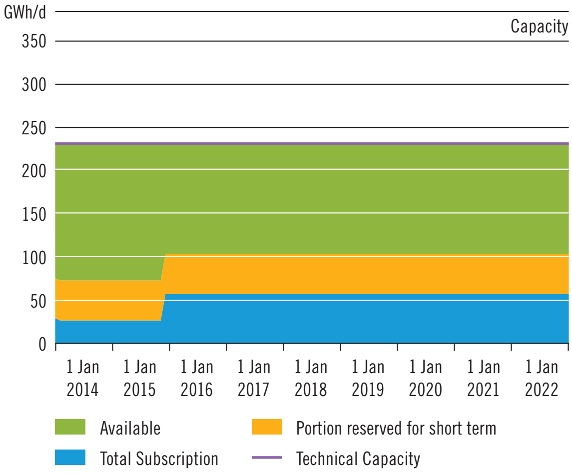


Figure 6.37: GRTgaz (PEG South)–GRTgaz (PEG North) flow direction

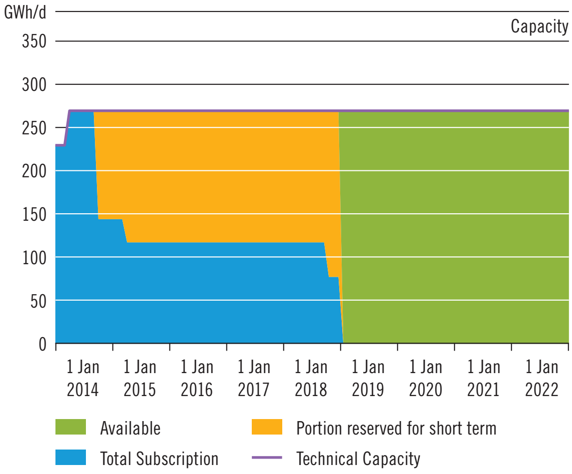


Figure 6.38: GRTgaz (PEG North)–GRTgaz (PEG South) flow direction

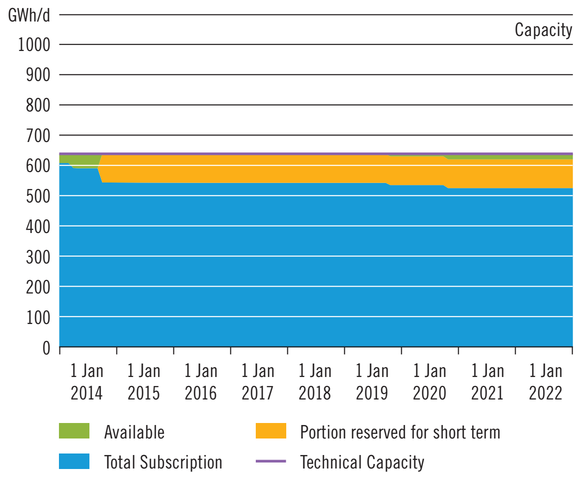


Figure 6.39: Taisnières H IP Belgium – France flow direction

Taisnieres
IP capacity subscription (2014 – 2022)

- Belgium-France (GRTgaz – PEG Nord) flow direction

According to the latest subscription information, there would be a high level of booked capacity at Taisnieres IP from Belgium to France both H-gas and L-gas.

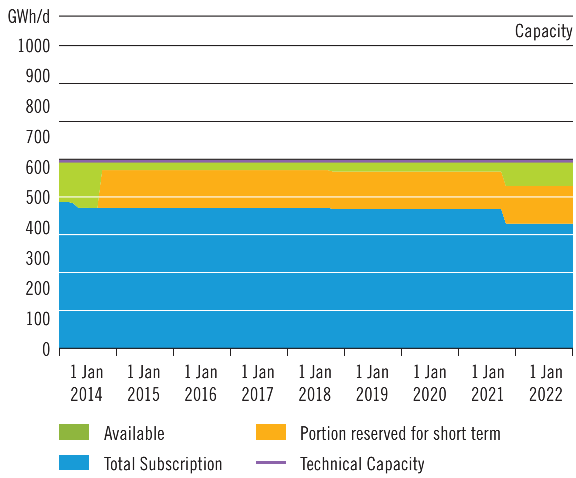


Figure 6.40: Obergailbach IP Germany – France flow direction

Obergailbach
IP capacity subscription (2014 – 2022)

- Germany-France (GRTgaz – PEG Nord) flow direction

According to the latest subscription information, booked capacity at this IP would have an average utilization of 70 % on long-term basis.

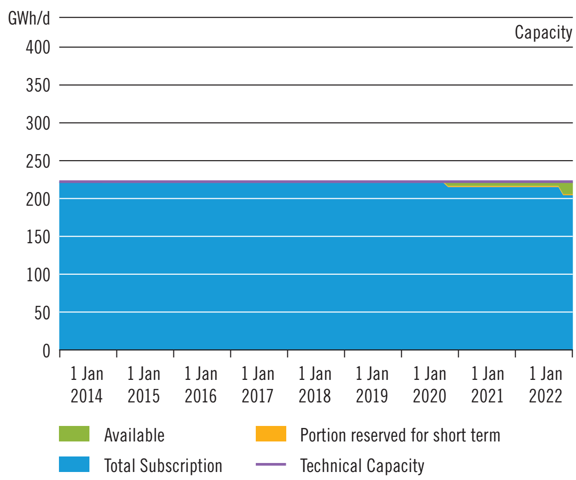
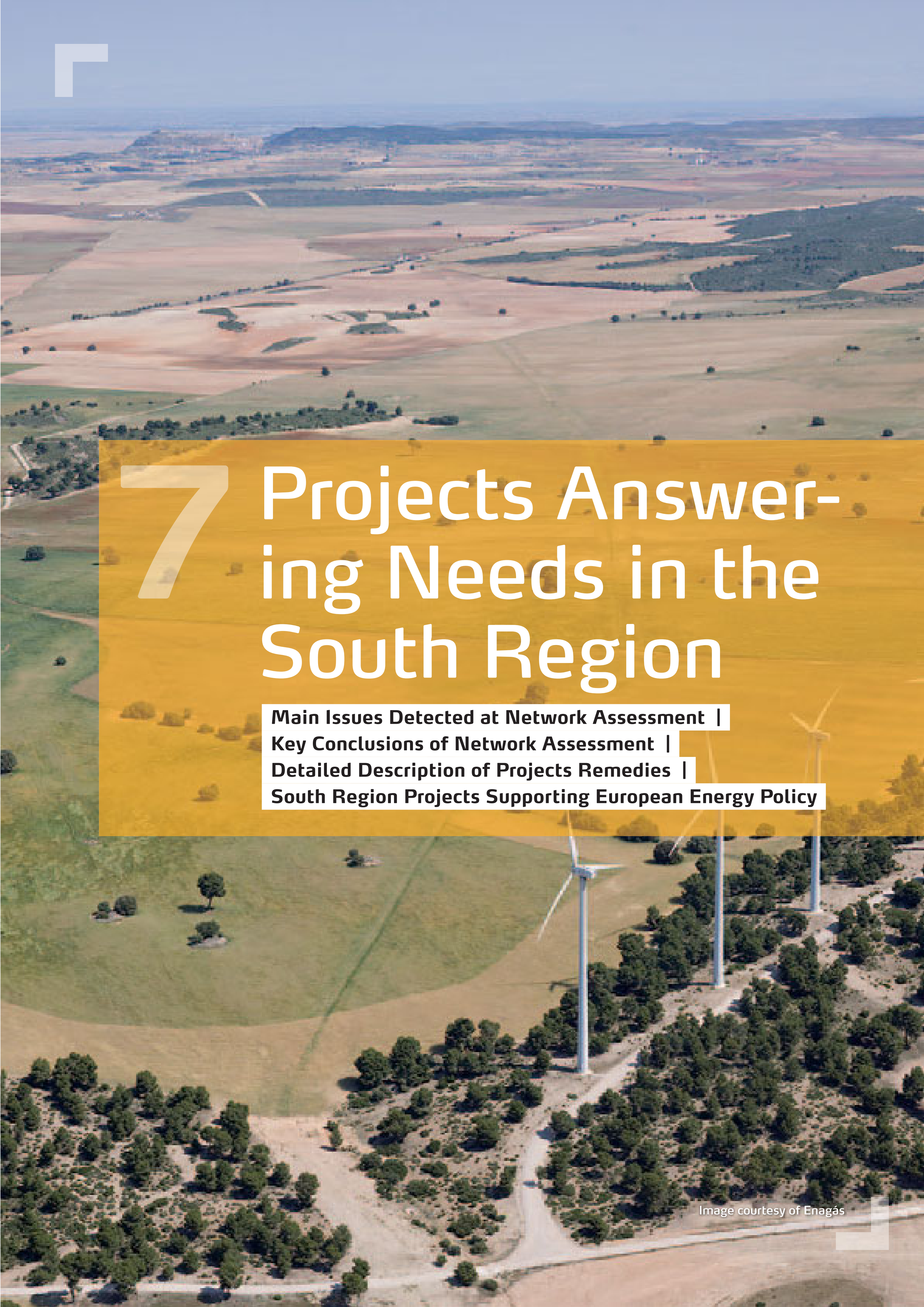


Figure 6.41: Oltingue IP France – Switzerland/Italy flow direction

Oltingue
IP capacity subscription (2014 – 2022)

- France (GRTgaz – PEG Nord) – Switzerland / Italy flow direction

Technical capacity at Oltingue IP from France to Switzerland / Italy is actually total subscribed from 2014 to 2022.



7 Projects Answering Needs in the South Region

Image courtesy of Enagás

7.1 Main Issues Detected at Network Assessment

7.1.1 DIVERGENCE OF PRICES AT SOUTH REGION

This divergence on prices into the South Region has been highlighted recently causing peak differentials higher than 5 €/MWh between the Spanish AOC and PEG Sud and reaching up to 9 €/MWh comparing with PEG Nord. Prices in the southern area of the South Region, Iberian Peninsula and South of France, are much higher than prices in the North of France indicating the strong divergence on prices in the South Region.

The LNG-prices ligature in the South of France (GRTgaz South and TIGF zones) and the Iberian Peninsula as a consequence of the high LNG dependence in the area causes strong price divergence into the Region as well as with the rest of central Europe.

7.1.2 LACK OF SOUTH REGION INFRASTRUCTURE'S ABILITY TO FACE VERY DIFFERENT SUPPLY MIXES AND PRICE CONVERGENCE

In the South Region, during previous years, we have observed new trends in the supply mixes. The influence of price discrepancies in Europe and throughout the world has resulted in a new configuration of gas flows entering the network in the South Region since the end of 2011 and will continue in the following years.

However, one of the main results obtained in the TYNDP 2013–2022 indicate "…the limited ability to decrease LNG to Iberian Peninsula and South of France due to the lack of interconnection with Northern Europe…", i.e., the lack of network transmission capacity to face very supply mixes.

The adaptability of the network contributes to the optimization of shippers' supply portfolios. Through the network flexibility, shippers will compensate the variations among cost of supplies source by the lesser or greater utilization of some of them.

7.2 Key Conclusions of Network Assessment Answering to Main Issues Detected

7.2.1 REMEDY TO DIVERGENCE OF PRICES AT SOUTH REGION

Annual dependence on LNG source in the South Region will diminish developing the main n-FID transmission projects identified in the South Region, the new corridor "Bidirectional flows between Portugal, Spain, France and Germany". The creation of new network capacity, opening the way to reduce LNG dependence in the southern area of the Region, is therefore crucial eliminating the divergence of prices into the South Region and with the rest of central Europe.

Moreover, these new infrastructures projects contribute to improve the competitiveness for the industry and the rest of the end consumers of the gas system in the South Region.

The competitive in the gas market minimizing the divergences in prices with adjacent areas also result on improving of the competitiveness for the industry and the rest of the end consumers of the gas system having a clear positive impact in the economy of the respective countries.

7.2.2 REMEDY TO LACK OF SOUTH REGION INFRASTRUCTURE'S ABILITY TO FACE VERY DIFFERENT SUPPLY MIXES

Whatever gas flows will be in the future, the experience of the last years highlights the need for a transmission network design solid enough to reach a more integrated market. Network flexibility provided by properly developing transmission infrastructures is necessary for true market integration. Complementary, market responses developed as tailored solutions for concrete events which could also help improve flexibility for shippers, but they never replace the development of transmission infrastructures and cross-border interconnections.

The development of the main n-FID transmission projects in the Region:

- 3rd IP Portugal-Spain,
- MidCat Project,
- the core network reinforcement in France linked with the merge of GRTgaz North and South zones and,
- the creation of bidirectional flow from France to Germany,

i.e., the new corridor, "Bidirectional flows between Portugal, Spain, France and Germany", contribute to the strategic concept of the North-South Corridor in Western Europe, i.e., to better interconnect the Mediterranean area and thus supplies from Africa and the Northern supply Corridor, with supplies from Norway and Russia.

The development of these projects have been identified as main n-FID projects in the South Region providing flexible capacity in the network to face very different supply mixes from short-term/long-term trends.

After developing MidCat project, merging the GRTgaz North and South zones and the creation of gas flow from France to Germany, Algerian gas could reach the North of France, Switzerland and Germany. Therefore, the developments of these projects provide a new source to Central Europe increasing the diversification of sources and consequently the security of supply.

The development of these main projects could also integrate the existing and coming LNG Terminals projects in the area, increasing their utilization, whether from important needs of gas in central Europe or due to any other interest of the shippers operating in the market.

After merging the GRTgaz North and South zones, the MidCat project and the 3rd IP Portugal-Spain, the Russian gas which currently reaches France, could also flow to the Iberian Peninsula reaching Portugal. The effect in the market creating liquidity could be very important. It opens possibilities of arbitrage between the different European gas sources, making the transmission system a powerful contributor to the price convergence in the area.

Through the new corridor, "Bidirectional flows between Portugal, Spain, France and Germany", the Northern supply Corridor with supplies from Norway and Russia will be better interconnected with the southern part of the South Region increasing liquidity in the market which could favour to the shippers as well as the end consumers.

The adaptability of the network contributes to the optimization of shippers' supply portfolios. The competitive in the gas market minimizing the divergences in prices with adjacent areas will also results on improving of the competitiveness for the industry and the rest of the end consumers of the gas system having a clear positive impact in the economy of the respective countries.

7.3 Detailed Description of Projects Remedies

Figure 7.1 shows main n-FID+FID transmission projects identified as remedies for South Regions in order to give answer to main issues detected at Network Assessment.

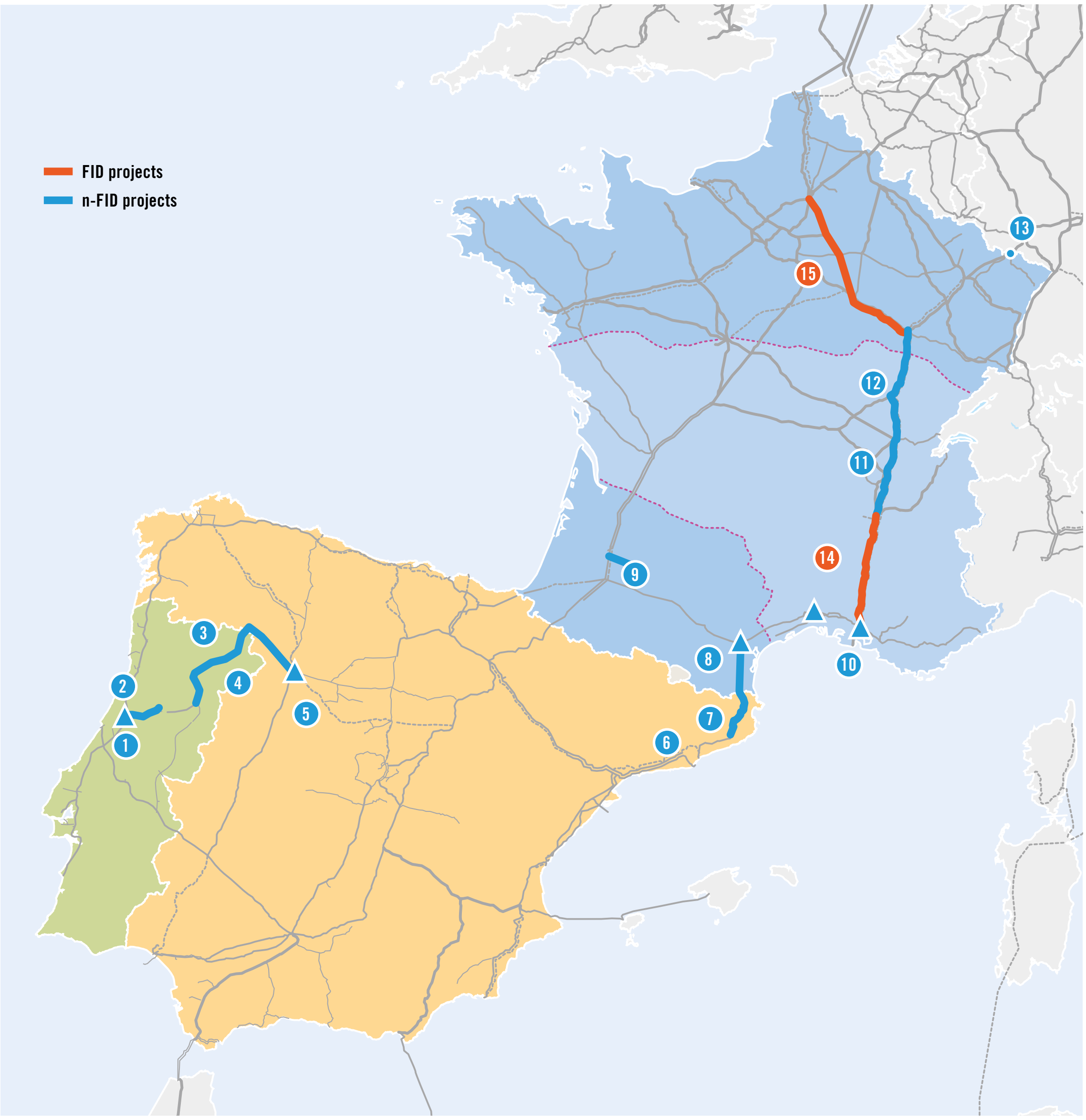


Figure 7.1: South Region's projects remedies

- FID+n-FID Reinforcement of the French network from South to North
  - the Bourgogne pipeline between Etrez and Voisines and the east Lyonnais pipeline between Saint-Avit and Etrez
  - the Eridan pipeline and the Arc de Dierry
  - Reverse flow from France to Germany at Obergailbach/Medelsheim Interconnection point
- Interconnection point between Iberian Peninsula and France at Le Perthus – currently known as MidCat
- 3rd interconnection point between Portugal and Spain

Technical description of these projects:

	Infrastructure	TYNDP 2013–2022 Code Project[1]	Length (km)	Diameter (")	Compressor Power (MW)	Project Status	Commision-ing Date	TSO/Country
	3RD INTERCONNECTION POINT BETWEEN PORTUGAL AND SPAIN							
1	PT–ES Interconnector Cantanhede Compressor Station	TRA-N-284			12	n-FID	2019 Q4	
2	PT–ES Interconnector Pipeline Cantanhede–Mangualde	TRA-N-285	67	28		n-FID	2021 Q4	**REN Portugal**
3	PT–ES Interconnector Pipeline Spanish Border–Celorico	TRA-N-283	158	28		n-FID	2017 Q4	
4	Interconnection ES–PT (3rd IP)	TRA-N-168	86	28		n-FID	2017 Q4	**Enagás Spain**
5	CS Zamora power increase	TRA-N-159			23	n-FID	2018 Q4	

Table 7.1: 3rd Interconnection Point between Portugal and Spain

	Infrastructure	TYNDP 2013–2022 Code Project[1]	Length (km)	Diameter (")	Compressor Power (MW)	Project Status	Commision-ing Date	TSO/Country
	IBERIAN-FRENCH CORRIDOR: EASTERN AXIS–MIDCAT PROJECT							
6	Iberian-French corridor: Eastern Axis–Midcat Project (CS Martorell)	TRA-N-176			36	n-FID	2021	**Enagás Spain**
7	Iberian-French corridor: Eastern Axis–Midcat Project (Pipeline Figueras–French border)	TRA-N-161	25	36		n-FID	2021	
8	Iberian-French corridor: Eastern Axis–Midcat Project Pipeline Spanish Border–Barbaira + CS Barbaira	TRA-N-252	120	32	10	n-FID	2021	**TIGF France**
9	Iberian-French corridor: Eastern Axis–Midcat Project Pipeline Lupiac–Barran	TRA-N-252	28	32		n-FID	2021	
10	CS Monpellier	TRA-N-256			15/20	n-FID	2021	**GRTgaz France**
	CS Saint Martin de Crau				10			

Table 7.2: Iberian-French corridor – Eastern Axis/MidCat Project

1) For further information about each project, see Annex A, "Ten Year Network Development Plan 2013–2022" Document

	Infrastructure	TYNDP 2013–2022 Code Project[1)]	Length (km)	Diameter (")	Compressor Power (MW)	Project Status	Commisioning Date	TSO / Country
N-FID DEVELOPMENTS TO MERGER GRTgaz NORTH AND SOUTH ZONES								
11	Est Lyonnais pipeline	TRA-N-253	170	48		Non-FID	2019	**GRTgaz France**
12	Bourgogne pipeline	TRA-N-043	190	48		Non-FID	2018	
13	Reverse capacity from France to Germany at Obergailbach	TRA-N-047	60	42		Non-FID	2018	

Table 7.3: n-FID developments to merger GRTgaz North and South Zones

	Infrastructure	TYNDP 2013–2022 Code Project[1)]	Length (km)	Diameter (")	Compressor Power (MW)	Project Status	Commisioning Date	TSO / Country
FID DEVELOPMENTS TO MERGER GRTgaz NORTH AND SOUTH ZONES								
14	Eridan	TRA-F-041	220	48		FID	2016	**GRTgaz France**
15	Arc de Dierrey	TRA-F-036	308	48		FID	2015 Q4	

Table 7.3: FID developments to merger GRTgaz North and South Zones

Image courtesy of Enagás

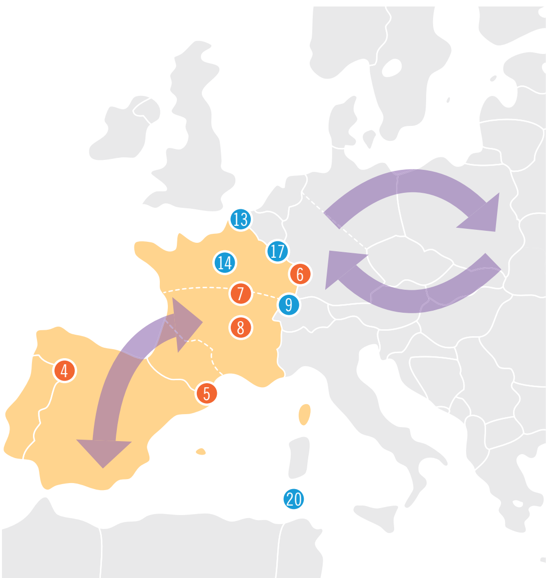
1) For further information about each project, see Annex A, “Ten Year Network Development Plan 2013–2022” Document

7.4 South Region Projects Supporting European Energy Policy (PCI Process)

During actual PCI process leaded by European Commission according to "REGULATION (EU) No. 347/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 April 2013 on guidelines for trans-European energy infrastructure and repealing Decision No. 1364/2006/EC and amending Regulations (EC) No. 713/2009, (EC) No. 714/2009 and (EC) No. 715/2009", it was defined four priority corridor at ad-hoc Regional Group "North-South Gas Interconnection in Western Europe".

One of the priority corridors defined as a "Projects of European Common Interest" directly impacts the South Region by promoting greater bidirectional capacity from/to the Region and adding more diversification of supply at Europe.

This priority corridor, called **"Bidirectional Flows between Portugal, Spain, France and Germany"** would support to the EU Energy Pillar also to increase of South Region gas network flexibility by removing internal bottleneck and eliminating the divergence of prices in order to improve regional competition.



Project	Description
4	PCI 3rd interconnection point between Portugal an Spain
5	PCI Eastern Axis Spain-France-interconnection point between Iberian Peninsula and France at Le Perthus (currently known as Midcat)
6	PCI Reinforcement of the French network from South to North – Reverse flow from France to Germany at Obergailbach / Medelsheim Interconnection point (France)
7	PCI Reinforcement of the French network from South to North on the Bourgogne pipeline between Etrez and Voisines (France)
8	PCI Reinforcement of the French network from South to North on the east Lyonnais pipeline between Saint-Avit and Etrez (France)
9	PCI Reverse flow interconnection between Switzerland and France
13	PCI New interconnection between Pitgam (France) and Maldegem (Belgium)
14	PCI Reinforcement of the French network from South to North on the Arc de Dierrey pipeline between Cuvilly, Dierrey and Voisines (France)
17	Interconnection between France and Luxembourg
20	PCI Gas Pipeline connecting Algeria to Italy (Sardinia) and France (Corsica) (currenty known as Galsi & Cyréné pipelines)

Figure 7.2: Main PCI Projects at South Region

N Bidirectional flows between Portugal, Spain, France and Germany

N Rest of PCI projects at South Region

Figure 7.2a: North-South Gas Interconnection in Western Europe

8 Conclusion

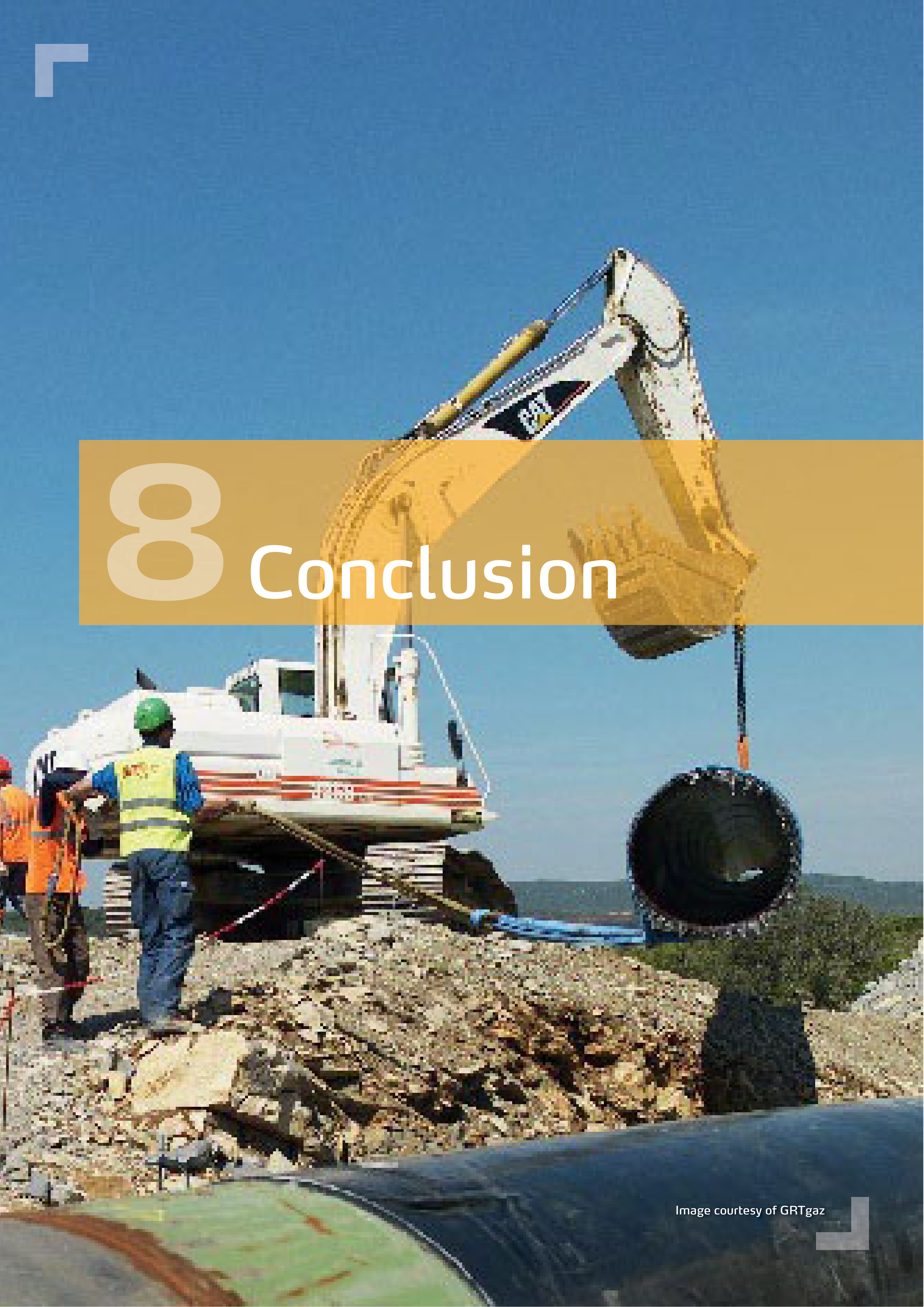


Image courtesy of GRTgaz

As explained in the TYNDP, the achievement of the desired level of Competition, Security of Supply and Sustainability (the Energy policy pillars) is enabled through the achievement of the desired level of market integration which can be measured at two levels, commercially and physically. This GRIP gives for the South Region a detailed assessment, in terms of level of physical market integration of the gas system for the next ten years.

Many inputs have been used in the elaboration of this GRIP South in order to improve the previous edition published in November 2011. Among these inputs, we have to underline the European TYNDP 2013–2022, TSOs' TYNDP, feedbacks received on these reports, and exchanges organized with stakeholders through SGRI and ENTSOG platforms.

The main results of this report are the following:

- **Demand:** The economic crisis in Europe and the competition on Energies at word level (i.e. high gas demand in Asia and excess of coal supply in USA) result, for short/medium terms, in decrease of the use of gas in Europe, mainly due to decline of the gas for power generation.
- **Supply:** Nevertheless, the forecast for new gas imports in Europe remain high for the 2020–2030 period owing to the drop in domestic production. The South Region could become a valuable source of supply for the rest of Europe, thanks to its LNG Terminals and its proximity to Algerian gas. On the other hand, the high dependence on LNG, could be improved if Russian and Norwegian gas could reach more significantly the Iberian and South of France gas markets. These two goals would need the development of the North-South corridor between Algeria and Germany, through the Iberian Peninsula and France.
- **Projects:** A great number of projects have been identified in the South Region, needed for interconnection developments and/or additional infrastructures, such as LNG Terminals or storages. Some of those projects already decided are going to increase significantly the capacity of the interconnections, within countries of the South Region and from the South Region to the rest of Europe, and therefore the integration of the gas market.
- **The Assessment of the Network** identifies the lack of ability of the existing and FID transmission projects in the Region to face very different supply mixes and to create price convergence as the main issues for the gas system in the South Region. However, the analysis also detects the main projects currently planned to remedy these issues: the projects of the new corridor, "Bidirectional flows between Portugal, Spain, France and Germany" as well as other FID transmission projects currently on going. Network flexibility provided after these developments enhances competitiveness for the industry and the rest of the end consumers of the gas system having a clear positive impact in the economy of the respective countries.
- The investments needed for achieving an upper level of market integration is significant. In the Region the range of costs of all the PCI projects ("Bidirectional flows between Portugal, Spain, France and Germany") is about 2 Billion Euros[1], and these envelop is far higher if we take into account all identified projects.

1) Estimated value in 2009

Today market players are not keen to commit on long term for lack of visibility over future market trends. This climate of uncertainty in Europe has to be mitigated with clearer Energy Policy on the role of the natural gas on long term in order to secure the cost-effectiveness of these investments for the market as well as the support of the competent authorities.

To support this development, on 17 April 2013, the European Parliament adopted regulation 347/2013 on "guidelines for trans-European energy infrastructure". Through this guideline, the European Commission is encouraging market participants to perform cost-benefit analyses to select the Projects of Common Interest and support their development through accelerated permit granting, improved Regulatory treatment and Financial support.

Natural gas must play a pivotal role in the energy transition, with its great flexibility combined with high energy efficiency to generate electricity, provide heating and as fuel. On longer terms, the emergence of biogas and "power to gas" are new assets supporting the development of carbon neutral gas supply by 2050.

Image courtesy of REN – Gasodutos

Legal Disclaimer

GRIP co-authors have prepared this Report based on information collected and compiled from their internal source, from stakeholders and from other sources. GRIP co-authors do not audit or verify the truth or accuracy of any such third parties' information.

The content of the Report (hereinafter referred to as "Content") is provided on an "as is" basis. GRIP co-authors do not guarantee the accuracy, completeness or timeliness of the Content. GRIP co-authors are not responsible for any errors or omissions, regardless of the cause, for the results obtained from the use of the Content.

In no event shall GRIP co-authors be liable to any party for any direct, indirect, incidental, exemplary, compensatory, punitive, special or consequential damages, costs, expenses, legal fees, or losses, including, without limitation, lost income or lost profits and opportunity costs, in connection with any use of the Content.

All analyses and forecasts are mere statements of opinion as of the date they are expressed and not statements of fact or recommendations. When making decisions of any nature, any party shall rely exclusively on its own information, forecast, skill, judgment and experience and not on the Content.

Abbreviations

ACER	The European Agency for the Cooperation of Energy Regulators
CAM	Capacity Allocation Mechanism
CCGT	Combined Cycle Gas Turbine
CEER	Council of European Energy Regulator
CNG	Compressed Natural Gas
CNE	Comisión Nacional de Energía, National Energy Commission
CRE	Commission de Régulation de l'Energie, French Regulator
CREOS	Luxembourg's TSO
DSO	Distribution System Operator
Enagás	Spanish TSO
ENTSOG	European Network of Transmission System Operators for Gas
FID	Final Investment Decision
GRIP	Gas Regional Investment Plan
GRIP South	Gas Regional Investment Plan in the South Region (ES, FR and PT)
GRTgaz	French TSO
GWh	Giga Watt hours
IEA	International Energy Agency
IP	Interconnection Point
LNG	Liquefied Natural Gas
Mtoe	Million Tonnes of Oil Equivalent
NRA	National Regulatory Authority
PEG	French gas hub
REN	Portuguese TSO
SoS	Security of Supply
TIGF	French TSO
TSO	Transmission System Operator
TWh	Tera Watt hours
TYNDP	Ten Year Network Development Plan
UGS	Underground Gas Storage

Publisher: ENTSOG aisbl
Avenue de Cortenbergh 100
1000 Brussels, Belgium

Editors: Enagás, GRTgaz, REN – Gasodutos, TIGF

Design & Layout: DreiDreizehn GmbH, Berlin | www.313.de

ENTSOG AISBL

Avenue de Cortenbergh 100
1000 Brussels, Belgium
Tel. +32 2 894 51 00

info@entsog.eu
www.entsog.eu