COMMISSION
DE RÉGULATION
DE L'ÉNERGIE

Networks

# Electricity and gas interconnections in France

## *A tool for the construction of an integrated European market*

June 2016

# Message from the CRE Board

Interconnections are vital to the development of the internal energy market: by facilitating trade between Member States and diversifying the sources of supply, they optimise the cost of energy for the end consumer and improve Europe's security of supply.

Since it was created, the CRE has played a leading role in this area, promoting the development of interconnections at the French borders and by making them more efficiently used.

Two main conclusions emerge from this report on the operation of interconnections:

- France is well interconnected with its neighbours. In the electricity market, the average export capacity is 13.5 GW, compared to a peak consumption of 102 GW. For gas, the exit capacity has doubled and the entry capacity has increased by 50% in 10 years;
- the use of interconnections has been significantly improved over the last 10 years and is now largely optimized. In terms of electricity, France, as part of Central West Europe region, was a pioneer in the implementation of market coupling, and more recently in the establishment of a method for calculating capacity called flow based, which allows capacity to be allocated to the most useful flows. In terms of gas, all the interconnections are used in accordance with competitive processes compliant with European network codes, which the CRE applies in full and of which it anticipated the implementation.

After major efforts, the question of creating new interconnections is now being raised.

For both electricity and gas, new interconnections are expensive and complex projects. When the internal network reinforcements made necessary by a new interconnection are taken into account, the investment costs often exceed one billion euros.

In a context of major and rapid changes in the industry (renewable energy development, stabilization of consumption, emergence of new uses and new flexibilities...), it is essential that investment decisions are made on the basis of market tests and solid cost-benefit analyses, which take into account all the networks' internal reinforcements required for the full exploitation of this new capacity.

This was the case for the new electricity interconnection between France and Italy (Piemonte Savoia project) that was approved by the CRE in 2015. Similarly, strengthening the electrical interconnection with Great Britain now appears justified by economic fundamentals. In 2014, the CRE and its counterpart Ofgem granted an exemption to the non-regulated ElecLink interconnection project and RTE has just submitted the CRE with a financial incentive request for the implementation of a new regulated interconnection with Great Britain (IFA 2 project) which will be examined in the second half of 2016.

In the gas market, the case of the Midcat project, a new gas interconnection between France and Spain, also illustrates this issue. Given the required internal reinforcements, the project would cost about three billion euros (including over two billion euros for the French part) to build capacity totalling up to about 15% of gas consumption in France or Spain.

The CRE has supported this project with the launch of an open season in 2010 (which was unsuccessful) and its inclusion on the list of European projects of common interest. But, in view of changes in the gas market in the last few years, including the stability of demand and existing over-capacity, a number of conditions must be met for such an expensive project to be launched without placing Spanish and French consumers at excessive risk.

An open season must first be released by the TSOs involved, in accordance with the rules of the European network codes. This step is necessary to ensure that there is a market need for such infrastructure, and all or part of its cost can be covered by the market players' capacity bookings.

If the result of the market test is negative, which is likely in the current context, the decision to launch the project cannot be taken without sound cost-benefit studies.

These studies should include identifying and quantifying the benefits for each country concerned and for the European Union. Project financing should be organized in connection with these benefits, following the CBCA (cross border cost allocation) approach provided for European projects of common interest.

Regarding the Biscay Gulf electrical interconnection project between France and Spain, overcoming technical uncertainties is an essential prerequisite before commenting on the opportunities it offers in terms of the costs and benefits that it might generate.

In compliance with the law, the CRE approaches its work with the benefit of the final consumer in mind. It will ensure that gas and electricity consumers are not exposed to considerable costs to build infrastructure facilities whose usefulness for developing the European market and security of supply has not been demonstrated.

# Contents

# Part 1: French electricity and gas interconnections are at the heart of Europe's energy market

# 1. Interconnections: the bedrock for building an integrated European energy market

Interconnections are an essential part of the electricity and gas systems in Europe. The emergence of mass consumption has been accompanied by the creation of large networks that were gradually interconnected to improve security of supply.

In the electricity sector, solidarity mechanisms were set up between neighbours and, in the case of gas, international trade was developed, allowing gas to become a leading source of energy. Europe is now equipped with electricity and gas networks of international dimensions that make up the support structure for the internal electricity and gas markets.

## 1.1. The emergence of interconnected networks in Europe

Constructing EU-wide networks has been a long process, which began after the Second World War with the creation in 1951 of the UCPTE (Union for the Coordination of production and transport of electricity) whose objective was to develop collaboration between operators and to implement the synchronization of production facilities in Europe. France played an important role in this process by engaging early in the completion of interconnections, an evolution that accompanied the construction of the nuclear fleet and the emergence of France as a major exporter of electricity. Electrical interconnections have been promoted as favouring security of supply through export contracts and mutual assistance agreements to enhance the resilience of the European electricity system.

With the opening of markets, the role of interconnections has grown further since they have become the preferred medium for the development of trade between Member States and to implement the idea of an integrated market.

**Figure 1: The European electricity transmission network**


*Source: ENTSOE*

In the case of natural gas, the networks were first developed with a local perspective around production fields. The emergence of a significant gas industry has its origins in the 1950s, when the use of imports became a necessity to support the increasing demand as energy requirements grew very strongly and where gas accounted for a way to diversify the energy mix in Europe.

The Netherlands played a central role with the Groningen field which fuelled the neighbouring countries and was a key factor in the emergence of a transnational network. The interconnections were then developed in the framework of international supply contracts with Algeria, Norway and Russia.

France was an early major importer of gas, it contributed to the achievement of major trans-European gas corridors. Today, France imports almost all its requirements and is a transit country for Spain and Italy for which it conveys gas from Norway.

**Figure 2: The European gas network**


*Source: ENTSOG*

## 1.2. The key role of interconnections in creating an integrated European energy market

The creation of an internal European market for electricity and gas is one of the major projects of the European Union with the ambition to go beyond national borders to consolidate the unity between Member States. The application of competition policy on electricity and gas has been the main instrument, which resulted in the adoption of three successive "legislative packages" from 1996 to 2009. These packages have produced an organizational strategy favouring the independence of system operators, who are responsible for providing the community with efficient infrastructure which form the support structure of a pan-European competitive market.

The competition rules, first introduced at the national level, have been the subject of increasingly deep harmonization. The third legislative package was adopted in 2009 and introduced the principle of European network codes, common rules whose role is to facilitate cross-border energy exchanges to

promote the development of wholesale liquid markets and offer end consumers a wider choice of suppliers.

In fact, cross-border interconnections play a central role in the establishment of a European market, they are the cornerstone of the market model for gas and for electricity. The creation of the Agency for the Cooperation of Energy Regulators and the European network of system operators for electricity and gas, ENTSOE and ENTSOG, reflects the priority given by the EU to the quality of cross-border coordination of regulators and infrastructure managers in its institutions.

As regards security of supply, interconnections can exploit complementarities between Member States. This principle of solidarity that has long been part of the operation of the electric system, is increasingly present in the case of gas with a gradual strengthening of the mutual assistance rules in the event of a supply crisis. The Regulation on natural gas supply security adopted in 2010 and under review has established a number of rules to facilitate the flow of gas across the country. The draft revision highlights the regional dimension of crisis management, in particular by proposing to establish regional emergency plans.

# 2. The market models put forward by European documents associate marketplaces and interconnections

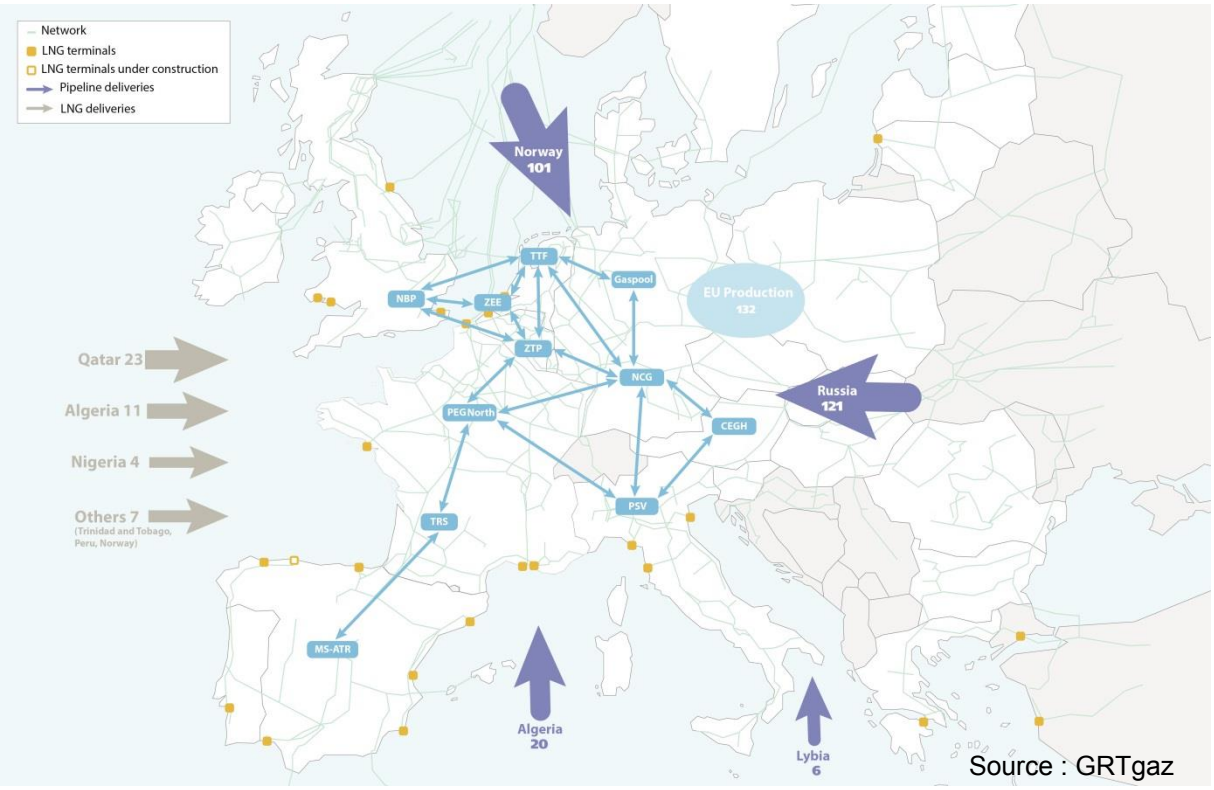
The European directives and regulations encourage the same overarching principles for gas as for electricity. Built around third party access to transmission and distribution networks, these texts offer converged frameworks in which wholesale prices are central to the coordination between the various means of supply and the organization of flows between member states.

Electricity and gas, however, have technical characteristics that result in different rules for managing interconnections. Gas interconnections are used primarily to supply the market from external sources while electric networks maximise the means of electrical production to respond to cross-border wholesale prices. Thus, implicit capacity allocations at interconnections are suited to electricity, but not to gas, since the principle of merit order for power generation has a key role in electrical transmission network management, status which is not enjoyed as far as natural gas is concerned.

## 2.1. Gas: the "hub to hub" model

In a document published in 2011 by the Council of European Energy Regulators (CEER), the regulatory authorities sketched a target model for the European gas market. These principles began to be developed during the work on network codes on capacity allocation mechanisms at interconnections and balancing, which were published in October 2013 and April 2014 respectively. Based on the generalization of the "entry-exit" model, which establishes the principle of access to the network via capacity bookings in which inputs and outputs are dissociated, the proposed model is to simplify access to interconnections through a "one stop shop" system, allowing stakeholders to buy up "grouped" capacity at interconnections. This would entail overseeing both the output capacity of a market area and the corresponding input capacity in the neighbouring area. The interconnections were then conceived as linking the market areas, also called "hubs", where the network operators make available to stakeholders Services aimed at developing a wholesale market (over the counter transactions, gas exchanges). The European market thereby consists of market places connected by interconnections; the opening of national markets has brought about very strong growth in liquidity. The organizational framework, which has steadily been implemented, now associates, via interconnections, national hubs used for spot transactions and balancing, and two large marketplaces, TTF (Netherlands) and NBP (UK), that offer hedging products whose price indices are used as reference in many long-term contracts.

**Figure 3: The "hub to hub" model and convergence of wholesale prices in Europe**




In France, there are two market areas, the North PEG and Trading Region South (TRS), connected by the north-south link. In 2018, a single market area is to be created, the Trading Region France (TRF). The interconnections with Belgium, Germany, Spain and Switzerland (which gives access to the Italian market) allow French hubs to be interconnected with the main European markets. CRE worked on the implementation of this model well before the adoption of the third legislative package by progressively reducing the number of balancing zones, thus promoting the liquidity of wholesale markets and competition, and developing interconnection capacity at its borders through open seasons. The quality of the integration of France to the rest of the European market was a key factor for the development of competition, it allowed it to benefit from the liquidity of the northern European market and thus to benefit from significant price reductions.

## 2.2. Electricity: market coupling

As for gas, the market model promoted in Europe gives a central role to the electricity exchanges. This requires the implementation of tools to manage the interface between supply and demand centrally: wholesale prices should help manage effectively the needs of consumers by organizing the use of means of production in accordance with their rising costs. This logic is set down according to different time segments, where a one-day period constitutes the preferred segment for production scheduling.

Electrical interconnections serve this model through the progressive implementation of market coupling in the entire European Union (see 2.3.1 in Part 2). The principle of coupling, implemented to

the day-ahead transactions, must be progressively applied to the intra-day period, for which the implicit allocation is the target model proposed by the CACM regulation.

The improvement to rules governing the allocation of interconnection capacity is an ongoing process which has two components, one quantitative (increased capacity made available) and other economic (allocate capacity to transactions that have most value). In this context, increasingly strong attention is paid to methods of calculating capacity in particular with the establishment of flow-based coupling (see section 2.2.1 of Part 2), as well as periods closer to real time.

CRE is heavily involved in European regulator working groups that contribute to the development of texts and the interpretation and application of network codes once adopted. It encourages development at the borders of France, attaching great importance to the soonest possible implementation of the new rules, including in advance of the requirements set out by EU legislation.

# 3. The European network codes

By providing for the development and implementation of harmonized rules for interconnection management - network codes - the third legislative package was a key step in the development of integrated market models for gas and electricity.

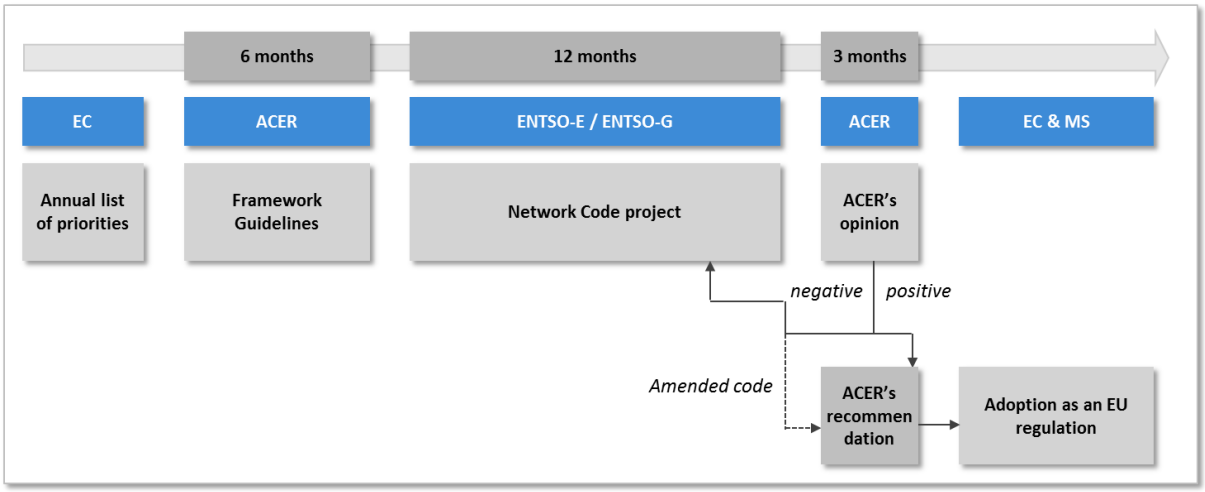
Target models defined by those network codes derive mainly from regional initiatives implemented in the mid-2000s in cross-border cooperation, the guiding principle being the idea of testing innovative measures to improve market integration. One example in this context is that the first market coupling initiative was developed between France, Belgium and the Netherlands and implemented by 2007.

## 3.1. The development of the European network codes

The preparation of the European network codes expanded the remit of the regulatory authorities by giving them an active role in defining the network codes via the ACER, which is charged with developing guidelines that provide the foundation of network codes written by then ENTSOE and ENTSOG. Regulators also approve the allocation rules implemented by the network operators, in anticipation or pursuant to these network codes.

The development of network codes, which started from the adoption of the third package in 2009, has many steps, from the ACER framework guidelines to their adoption in comitology (Figure 4). This is a long process that takes place over several years and requires constant monitoring by regulators.

**Figure 4: The European network codes drafting process**




As a member of the ACER, CRE participates in the work of the thematic working groups bringing together European regulators, in which are discussed the directions for the regulation and the interpretation and implementation of European legislation. CRE pilots some work, notably playing a leading in developing network codes on capacity allocation and the harmonization of tariff structures for gas, as well as the network codes on long-term capacity allocation and balancing for electricity. CRE also co-leads the task force on gas infrastructure, dealing with the Ten Year Network Development Plan of ENTSOG and implementation of the energy infrastructure package.

## 3.2. European network codes adopted in the electricity sector

In electricity, three network codes were adopted. They cover capacity allocations and congestion management (CACM), forward capacity allocation (FCA) and on the grid connection of the means of production. The CACM and FCA texts introduce significant changes by setting a very ambitious roadmap for the harmonization of operating rules for electrical interconnections.

CACM guidelines were published in the EU Official Journal of 24 July 2015. Covering the day-ahead and intraday periods, they are part of the European legislation on the market coupling principle. These guidelines include the generalization of flow-based coupling and the establishment of a single allocation platform for intraday exchange. Electricity exchanges which handle coupling acquire a new status, that of operator of the electricity market (NEMO Nominated Electricity Market Operator). These guidelines also address capacity calculations by requiring TSOs to cooperate in areas of calculation and develop a unique network model for the EU.

Adopted by Member States on 30 October 2015 the network code on forward capacity allocation (FCA), which deals with long-term periods, should enter into force in July 2016. It seeks to establish the principles for a harmonized interconnection capacity allocation for annual and monthly periods with the establishment of a single platform in Europe. As of 2013, regulators have decided to ask that their transmission system operators to prepare a version of the harmonized allocation rules (HAR) in advance of requirements to ensure that the code can be applied in a timely manner. Adopted in 2015, these rules are in place at the French border since 1 January 2016.

A number of network codes are still in preparation. The code on balancing is the third "market" code to be adopted by the EU, it deals in particular with the management of balancing across borders via interconnections. A number of technical codes are also being validated, the System Operation Guideline was adopted by member states on Wednesday, May 4, 2016 in comitology.

## 3.3. Network codes adopted in the gas sector

In the case of gas, three European network codes were adopted in relation to capacity allocation, balancing and network interoperability. A fourth code, on the harmonization of tariff structures is currently being prepared and could be adopted before the end of 2016.

The harmonization of capacity allocation methods (CAM) and congestion management (CMP) was a priority during the adoption of the third package in 2009. The strong contractual congestion levels in Europe, the heterogeneity of rules for allocating capacity and a lack of cooperation between TSOs for the marketing of products have led the European Commission to give priority to the fluidity of gas trade between Member States. Indeed, the gas interconnection capacity at that time was largely pre-empted by long-term contracts of existing players; it was often very difficult for new entrants to acquire capacity.

The CAM network code has profoundly changed the functioning of the European market with the generalization of the "entry-exit" system around a virtual hub. The interconnection usage rules have been harmonized on the basis of a shared architectural vision heavily inspired by the electric market model. The role of interconnection is to link the hubs together through the marketing of bundled products, allocated according to auction procedures specifically described in the code (types of products, auction mechanisms). This text will be complemented with provisions relating to investment, that is to say the supply of additional capacity whose implementation would be decided upon on the basis of the demand expressed by users. This principle is consistent with public offerings conducted in France to decide upon interconnections upgrades.

Network codes on balancing and interoperability have also been adopted. The first entails the establishment of a European Union-wide market based balancing regime: market players as well as network operators have to go through the wholesale markets to manage the balance between injections into the network and consumption. The network code on interoperability manages the harmonization of technical rules that could hinder the flow of gas. It includes decisions on interconnection agreements or the odorization of gas.

# Part 2: French electricity interconnections

# 1. France is well interconnected and a significant net electricity exporter

Summary of messages:

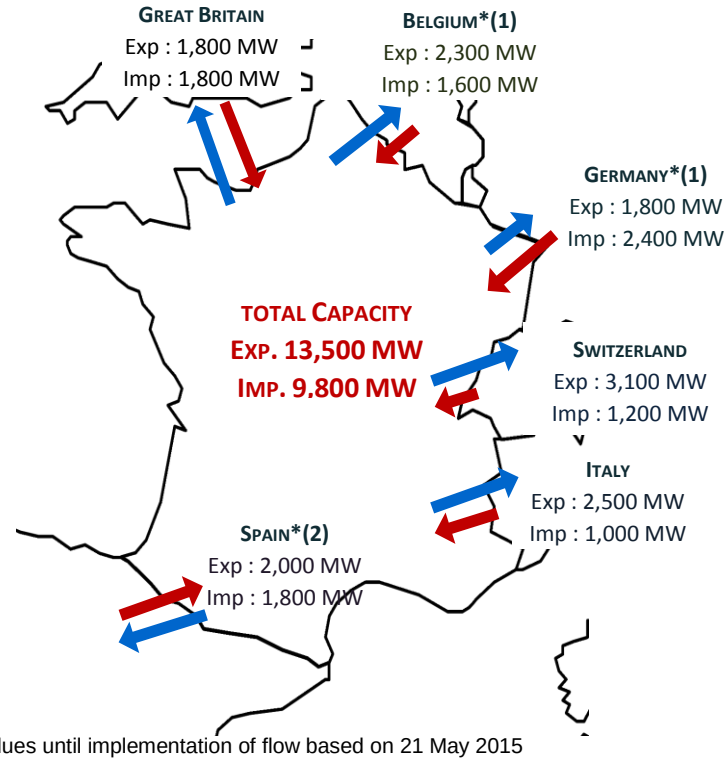
- With an average tradable capacity, recorded in late 2015, of 13.5 GW export and 9.8 GW import, France is well interconnected with its neighbours. A new line between France and Spain, commissioned in October 2015, will ultimately double the interconnection capacity between the two countries, bringing it to 2,800 MW.
- France is the largest electricity exporter in Europe: in 2015, it exported 93.8 TWh of electricity and has a positive net export balance with all its neighbouring countries except Germany. It also imported 31.4 TWh, mainly from that country.
- France's export balance reached a historic record on July 13, 2015 at 6:30 am, with a peak of 15.6 GW, partly due to the implementation of the flow based market coupling in the CWE region that has increased trade with Belgium and Germany.
- The interconnections utilization rates are very high (above 85%) with Great Britain, Italy and Spain, explained by a significant price differential with France. They are weaker however with Germany and Belgium, reflecting the frequent price convergence with France (over the last three years, the convergence rate is almost 50% for these two borders).
- With market coupling, the day-ahead timeframe is the primary period for the nomination of interconnection capacity, long-term products are used as hedging products. Finally, since 2010, intraday trade at interconnections has been multiplied by 3, mainly driven by the development of trade with Germany and Switzerland.

## 1.1. France is historically well interconnected with its neighbours

France is interconnected with all neighbouring countries except Luxembourg. It is also interconnected with Great Britain since 1986 by an undersea DC cable. The interconnection capacity at the French borders was progressively strengthened to achieve, in late 2015, an average trading capacity of 13.5 GW export and 9.8 GW import, representing more than 10% of national production capacity.

Interconnection capacity available with neighbouring countries sometimes have significant differences across borders. Switzerland is the country with which the infrastructure is most developed for export, particularly because of the power purchase agreements attached to certain historical French plants such as Fessenheim and Bugey. With other countries, average observed tradable capacities are between 1,800 MW and 2,500 MW export, and 1,000 MW to 2,400 MW import. Germany is a special case since its import capacity (2,400 MW) is significantly higher than its export capacity (1,800 MW).

**Figure 5: Average tradable capacities observed at borders (NTC D-2) in late 2015**




*(1) Average values until implementation of flow based on 21 May 2015

*(2) Average values following commissioning of Baixas-Santa Llogaia line

*Source: RTE – CRE Analysis*

A new interconnection between France and Spain (Baixas - Santa Llogaia line) was commissioned in October 2015. It was designed to double the interconnection capacity between the two countries to total 2,800 MW import and export. The tradable capacity observed, from the commissioning of this line to the end of 2015, however, has averaged only 2,000 MW export and 1,800 MW import. In the first four months of 2016, the average observed tradable capacity increased to 2,400 MW export and 2,000 MW import. This increase is in part due to the lifting of a regulatory constraint on the Spanish side, which had limited the tradable capacity, in relation to internal constraints on the Spanish network Commercial capacity will reach its goal of 2,800 MW on average after the completion of reinforcements to the Spanish internal network.

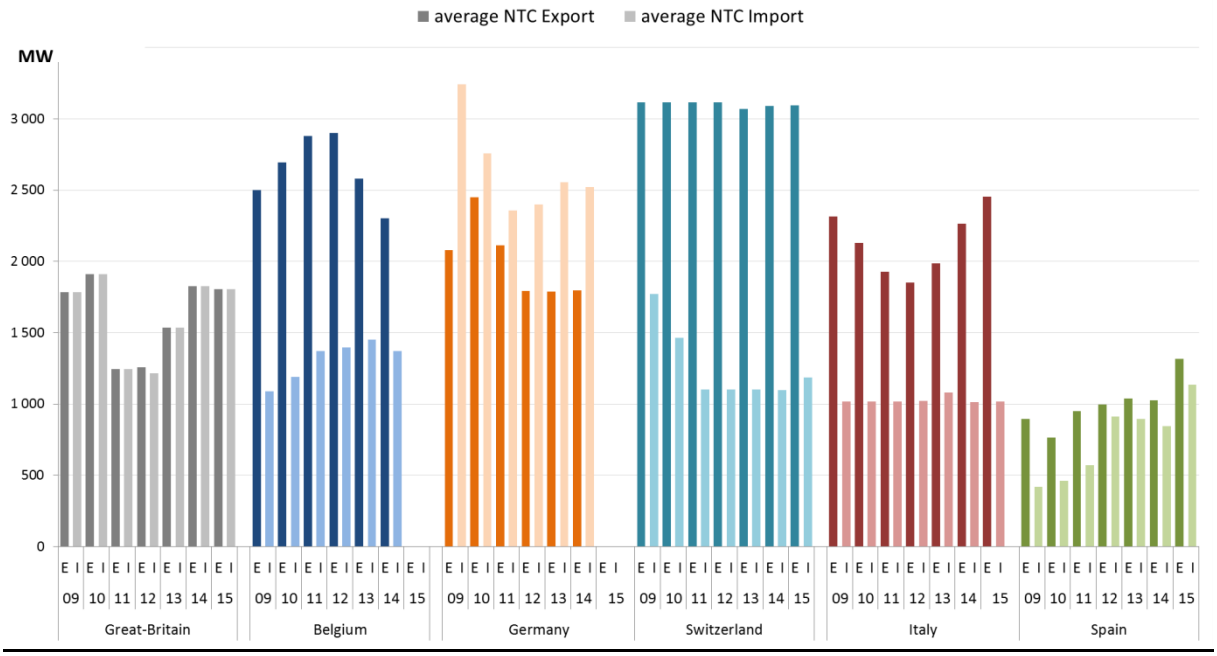
At the border with Italy, since 2011 internal reinforcements work on the French and Italian sides, including the Albertville – Piossasco line, allowed the capacities offered to market players for export to be significantly increased. The J-2 calculated capacity, averaging 1,900 MW in 2011 amounted to 2,500 MW in 2015. Despite these reinforcements, high spreads remain on the border (average spread of 13.8 € / MWh in 2015). The Piemonte Savoia project (see section 3.2.) will increase interconnection capacities available between France and Italy to 1,200 MW from 2019 onwards.

Commercial capacity made available to the border with Great Britain correspond to the cable thermal capacity (2,000 MW in both directions); it may, however, be curtailed during planned maintenance or unplanned outages of the system. In 2011 and 2012, work to modernize the AC/DC conversion plants

was undertaken on the structure, causing a decrease in the availability of the interconnection and therefore the capacity available to the market. From late 2012 to 2013, recurring major incidents (oil leakage) resulted in a significant number of capacity curtailments at that interconnection.

A flow based capacity calculation methodology has been implemented since May 21, 2015 at the borders with Germany and Belgium and will be discussed in section 2.2.

**Figure 6: Average commercial capacities at French interconnections (average J-2 NTC) from 2009 to 2015**




*Source: RTE, CRE analysis*

**Limiting TSO**

In cases where the TSOs concerned have not yet implemented a coordinated capacity calculation[1], each TSO independently calculates the value of cross-border capacity it can offer to the market in compliance with the security requirements for its network. The value chosen and allocated to the market is then the minimum value among those calculated by the TSOs. The TSO which proposed that minimum is called the "limiting TSO".

As a result of continuous internal reinforcements made in recent years, RTE is rarely the limiting TSO with respect to the capacity offered to the market across all its borders.

Indeed, on the Spanish border in 2015, RTE limited the capacity only 17% of the time for import and 11% of the time for export. From May 2014 to May 2015, RTE was the limiting TSO 8% of the time for export and 56% for import at the Belgian border, and 4% of the time for export and 32% of the time for import at the German border.

At the other borders, the rules for capacity calculations implemented do not allow for such a detailed analysis. At the Italian border in 2015, only an annual capacity calculation is performed according to the conditions set out by Terna, and RTE is therefore the limiting TSO only by exception. At the British border, all of the cable capacity is made available to the market except in cases of maintenance or damage. Finally, on the Swiss border, TSOs only verify that their networks can handle a capacity of 3,000 MW in summer and 3,200 MW in winter in the direction of exports from France to Switzerland.

## 1.2. France is net exporter of electricity, except with Germany

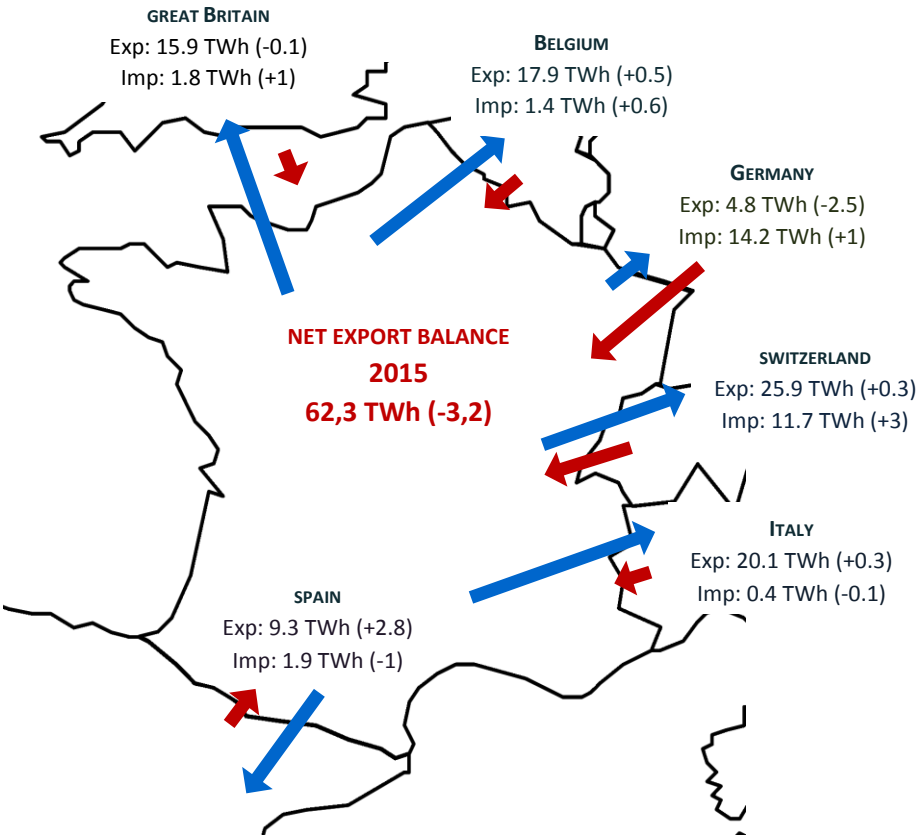
In 2015, France exported 93.8 TWh as compared to 31.4 TWh of imports. With a net balance of 62.3 TWh, France is by far the largest electricity exporter in Europe. This is due, firstly, by the characteristics of the French generating fleet including its nuclear and hydro capacity and, secondly, its privileged geographical position, which gives it excellent integration into the European system. In 2014 for example, the net export balance was almost twice that of Germany, representing over 12% of its production[2]. The record is however contrasted depending on the border. Thus, in 2015, France exported large volumes to Italy (20.1 TWh), Belgium (17.9 TWh) and Britain (15.9 TWh), mainly importing countries. According to the European Network of TSOs for electricity, ENTSOE (European Network of Transmission System Operators for Electricity), in 2014, Italy has covered 14.3% of consumption by imports, a figure that reached 19.7% Belgium and 6.3% in Great Britain. The case of Switzerland is unique: 25.9 TWh, this is the country to which France exports more, while Switzerland is itself a net exporter of electricity. This is explained in part by the role played by Italy, the largest European importer, and also by the existence of long-term contracts to sell electricity from France to

[1] In 2015, RTE only used coordinated capacity calculations within the CWE region (flow based capacity calculations since May 2015). Coordinated calculation was introduced to North Italian borders in February 2016.

[2] Data from the report "Electricity in Europe 2014" published by ENTSOE

Switzerland. Exports also strongly dominated the trade with Spain, a trend that is enhanced with an increase of 2.8 TWh compared with 2014, to 9.3 TWh of electricity exports in 2015, reflecting the establishment of market coupling in May 2014 and the commissioning of the new interconnection Baixas-Santa Llogaia in October 2015. Germany is the only country with which imports are dominant, a situation that can be explained by the strong development of wind and photovoltaic power in Germany, and the German contribution to the coverage of some French winter peak demand.

**Figure 7: Trade flows in French electricity interconnections in 2015 (and changes from 2014)[3]**

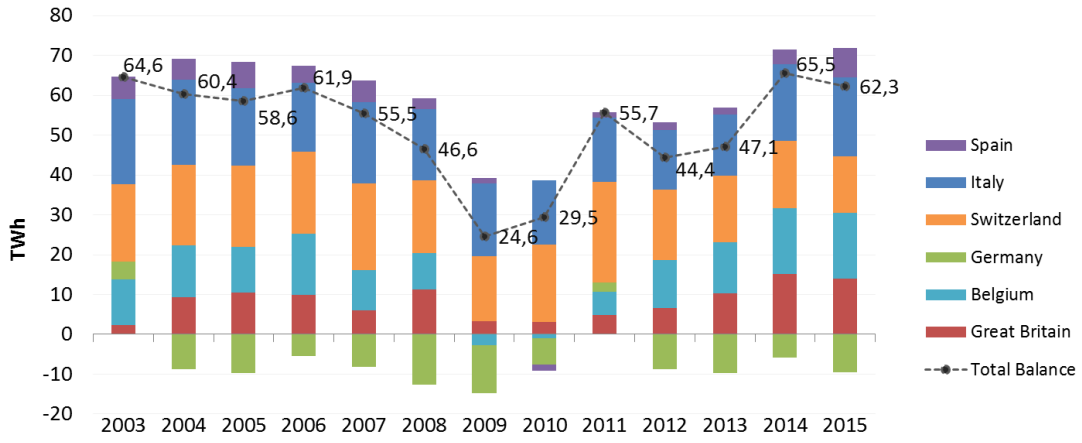



*Source: RTE, CRE analysis*

France's net export balance in 2015 was the third highest since 2003, as shown in Figure 8. France exported 55 TWh on average over the last five years (2009 and 2010 were characterized by a significant decline in exports reflecting mainly the drop in French production). 2015 was in line with the import-export balance observed over several years since France has consistently been a net exporter vis-à-vis Italy, Switzerland and Belgium since 2003. This was also the case with Spain, with the exception of 2010. Import trends vis-à-vis Germany were also validated with the exception of 2003 and 2011, the year that was marked by the stoppage of eight German nuclear reactors after the Fukushima accident.

[3] Throughout the report, flows are calculated by taking the sum of nominations at long-term, daily and intraday periods and therefore represent trade flows (and not physical flows).

**Figure 8: Evolution of net annual import/export balance since 2003**




*Source: RTE, CRE: analysis*

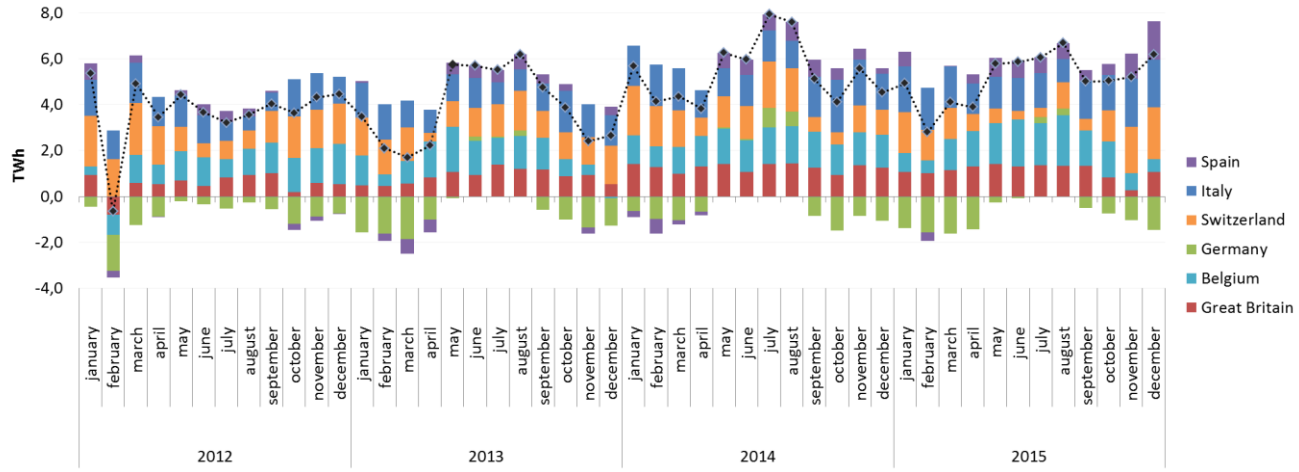
Annual data mask situations that may vary seasonally, with evolutions underlining the complementarities between national production fleets and between consumption patterns, which clearly demonstrates the benefits of the interconnections in terms of economic optimization and enhanced energy solidarity between Member States. In the specific case of France, interconnections provide useful flexibility to meet the winter demand peaks. This is particularly true as regards trade with Germany. The monthly flows balances show that imports from Germany occur essentially during autumn and winter months. Spain also contributed, to a lesser extent, to covering the needs of France during the winter months. However, we observed that even with the implementation of the market coupling at this border in May 2014, this situation was only repeated in February 2015. Overall, exports to France are strongly influenced by its consumption and are therefore lower in winter than in summer.

Over the past four years, France has had a monthly net import balance only in February 2012, during which France experienced an exceptionally cold spell. During the first ten days of the month, temperatures reached levels lower than 10°C below seasonal norms. While France is the European country whose consumption is most sensitive to temperature due to electric heating (2400 MW of additional power is needed during the peak for each degree lost in winter), consumption records were recorded, reaching a 102 GW peak on February 8, 2012 at 7pm. In February 2012, there was a reversal of the balance of trade with Great Britain, Belgium and Spain. The contribution of imports at the French borders at that time amounted to 8,600 MW, 9 February at 10am.

**Imports record, which helped facing the cold snap of February 2012**

During the cold snap of February 2012, the average price of electricity on the French spot market (EPEX SPOT Auction) reached € 367.6 / MWh for delivery on Thursday, February 9, 2012 and € 147.3 / MWh for the next day. Hourly prices for delivery on February 9 were close to € 1000 / MWh for several hours in the morning, reaching up to € 1,938.5 / MWh at 10am. With an import capacity in 2012 of 9 GW, cross-border interconnections covered nearly 10% of the electricity needs of France during the peak consumption. The interconnections with Great - Britain, Belgium, Spain and Germany were used to their maximum. Although the cold snap did not spare the neighbours of France, the lower sensitivity of their demand to temperature variations implied that they have not undergone such major consumption peaks. France's supply-demand balance was ensured through a maximum utilization of most interconnections. Thanks to the cooperation between European countries, France accessed the lowest cost of means of production available abroad to ensure its electrical supply, allowing it to cross an electricity consumption record without experiencing black- out.

**Figure 9: Evolution in net monthly balance since January 2012**




*Source: RTE, CRE: analysis*

**Export record**

France is, structurally, a net exporter of electricity - the largest electricity exporter in Europe. Its net exports balance reached a record level in 2015 with a historic high of 15.6 GW July 13 at 6:30 am. The implementation of the flow based market coupling in the central-western region of Europe in May 2015 increased trade with Belgium and Germany. The maximum exchanges observed since May 2015 exceeded the maximum over the past previous five years. Besides, since 2013 France has always been a net exporter during summer.

## 1.3. Highly used French interconnections

Market coupling by its nature directs flows from the country where the price is the lowest to the country where it is the highest. Thus, the establishment of market coupling at the day-ahead timeframe with all neighbouring countries (except Switzerland) created an automatic link between the market price differential and flows at the borders. An analysis of price differentials between countries must address the characteristics of a market area at a specific time and include the influence of interconnections on the formation of wholesale prices. France is interconnected with six countries, the significance of its export balance shows that French wholesale prices tend to be lower than those of countries to which it exports. The interconnections are therefore mainly used for export.

**Utilization and price convergence rate**

A combined analysis of the interconnections utilization rate and price convergence rate for each French border sheds light on the use of interconnections. If an interconnection is effectively managed (as is the case with market coupling), then it will be used to its maximum if there is a price differential between the two countries, that is to say as long as there is no price convergence. A low utilization thus reflects a strong price convergence rate between the 2 markets on both sides of the interconnection.

It is observed in Figure 10 that interconnections operated, in 2015, in the export direction over 82% of the time, except with Germany, and that utilization rates are high, though varying with the border. Wholesale market prices have been lower for several years in Germany than in France, and France is frequently a net exporter to all countries with which it is interconnected while importing from Germany. The extension of market coupling creates flow patterns influenced by the whole of Europe. Besides, in the framework of the flow based methodology, the state of tension between supply and demand in each bidding zone influences the allocation of capacity to the various interconnections: they are assigned primarily to borders where price differentials are highest.

Figure 11 shows the rate of convergence between France and its neighbouring countries, that is to say, the percentage of time their spot price is equal to France's spot price[4]. Note that the convergence rate is high for German and Belgian borders while it is lower for Italian and Spanish borders: over the last 3 years, the convergence rate is on average 50% for German and Belgian borders whereas it is 3% for the other two borders.

In more detail:

- The border with Spain is the only one where the average utilization rate is almost equal for import and export since 2013, close to 90%. Price differentials between France and Spain show high variability and can be high in one direction or the other, which explains the observed reversals in flows. The average price differential was 17.5 € / MWh in 2013 for

[4] Price convergence calculated to € 0.01.

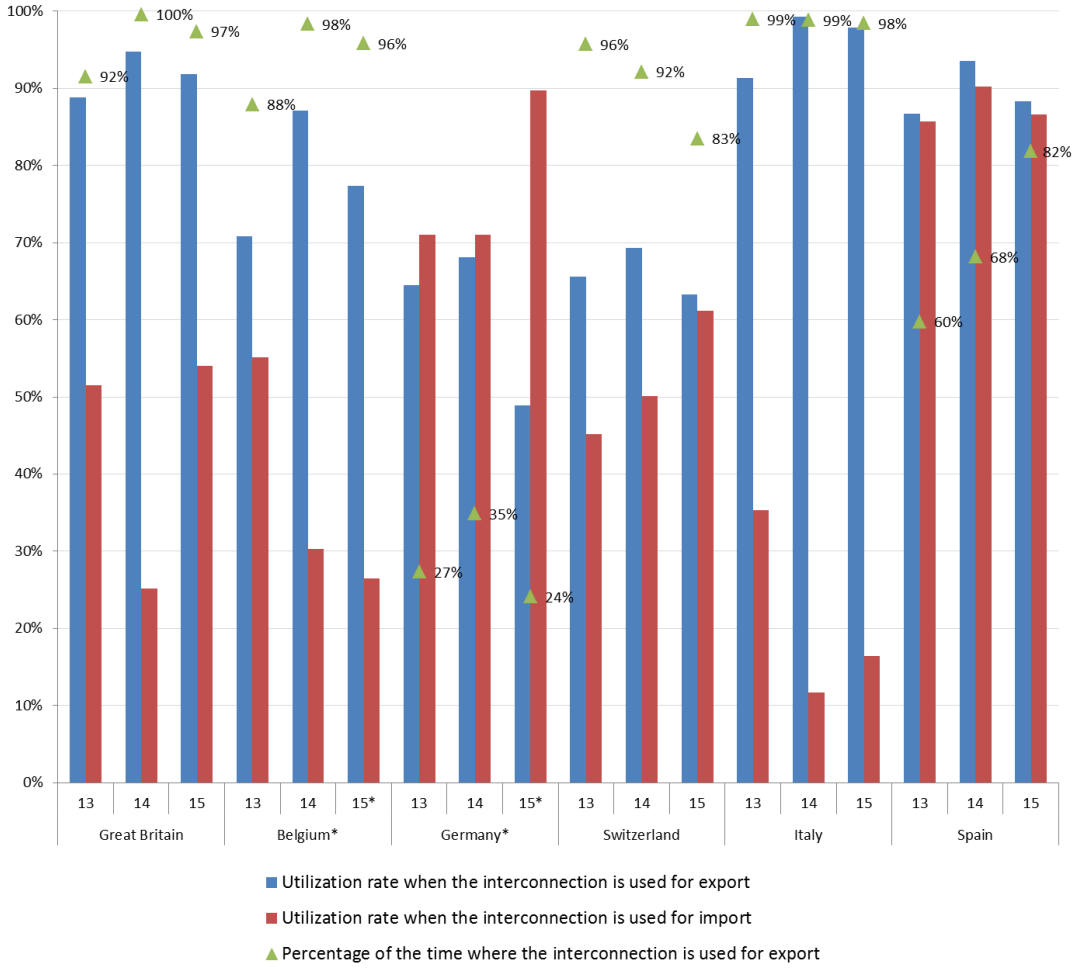
exports, it fell from € 20 / MWh in 2013 to 11 € / MWh in 2015 for imports. Since the implementation of the day-ahead market coupling in May 2014, exports have become largely dominant, from 60% of the time in 2013, rising to 82% in 2015. It was also observed that since the implementation of the market coupling, price convergence increased to 12.7% in 2015 while it was less than 6% in the previous two years.

- The France – Belgium Interconnection[5] is also used overwhelmingly for export, with a relatively high price differential in this direction (13.2 € / MWh on average since 2013). The utilization rate however fell from 2014 to 2015, reaching 77% in 2015, reflecting a growth in the rate of price convergence 62.9% over this last year.
- Between 2014 and 2015, the utilization rate for imports increased with Germany, while the rate of price convergence declined (from 51% in 2014 to 24% in 2015). For exports, the decline in 2015 utilization rate mirrored a declining price differential (about € 8.5 / MWh in 2013 and 2014 to € 3.6 / MWh in 2015).
- The English and Italian interconnections are characterized by utilization rates higher than 90% since 2013[6], and even close to 100% for Italy. We observe very high average spread in the export direction (most trade at these interconnections being for exports): with Great Britain, 19.3 € / MWh in 2013, 18.5 € / MWh in 2014 and 19.6 € / MWh in 2015, with Italy, € 23.5 / MWh in 2013, 19.5 € / MWh in 2014 and 15.9 € / MWh in 2015.
- The France - Switzerland interconnection is also mainly used for export, but with a lower utilization rate: in 2015 of 63% when the interconnection is used for export and 61% when used for import. This is explained by a low price differential between the Swiss market and the French market (6 € / MWh on average since 2013 for export, 3.6 € / MWh on average over the same period for import). The low rate of convergence with Switzerland is mainly explained by the absence of market coupling at that border.

[5] In the case of Belgium and Germany, the utilisation and convergence rates in 2015 are calculated using data from the 1st January 2015 (before the implementation of flow based calculation).

[6] Slightly less than 90 % in 2013 on the France – England interconnection

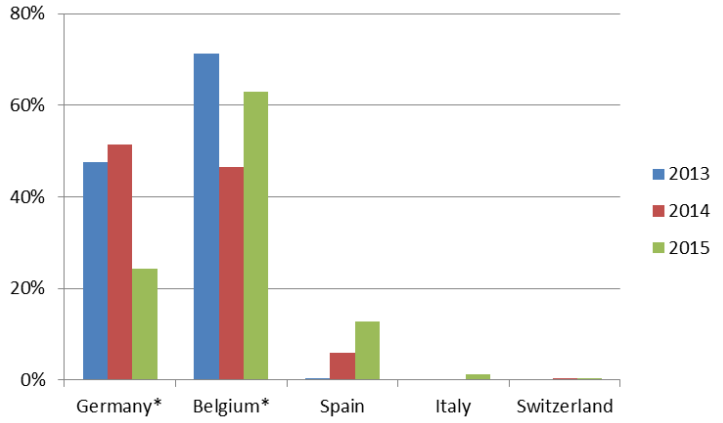
## Figure 10: Interconnection utilization rate and % of the time they are used for export from 2013 to 2015




In the case of Belgium and Germany, the utilisation rate in 2015 are calculated using data from January the 1st to May 20 2015, before the implementation of flow based calculation.

*Source: RTE, CRE analysis*

**Figure 11: Rate of convergence**[7]




*In the case of Belgium and Germany, the rates in 2015 are calculated using data from the 1st January to May 20 2015, before the implementation *of flow based* calculation

*Sources: EPEX SPOT, Belpex, OMEL, IPEX, analysis: CRE*

## 1.4. Nominations at each timeframe varying with the border

Interconnection capacity is sold for different trading periods: long-term (annual and monthly products mainly), day-ahead and intraday. For long-term periods, capacity is allocated by explicit auction (that is, capacity and energy are purchased separately). Market players who purchase capacity may physically use it by nominating flows, or, if they do not nominate, profit from its resale in the day-ahead market (a procedure called "use-it-or -sell-it"). Regarding the day-ahead timeframe, allocations are made implicitly (energy sold includes the interconnection capacity, nomination is automatic) on all interconnections on which market coupling was introduced. For intraday timeframe, capacity is allocated explicitly to all borders except the interconnections with Germany and Switzerland where implicit and explicit allocations coexist.

**The long-term products** allow market participants to hedge against the risk of price variability in the spot markets. Their nominations, that is, their physical utilization rate, reaches high levels at interconnections in the export direction to Great Britain (90% of nominations) and Switzerland (74% of nominations).

- At the France - Great Britain interconnection, the regularity of the price differential orientation combined with power purchase contracts allows actors to have a high certainty about the direction of flow and thus nominate their transmission rights and secure their profit without resorting to the day-ahead spot market, thereby avoiding the costs associated with the services of an exchange.
- As regards Switzerland, which in 2015 represented approximately 30% of the total exports of France, the historical presence of long-term contracts, with priority access, explains the predominance of this timeframe for export.

[7] The convergence rate is calculated to the nearest € 0.01. It signifies the time during which spot prices are the same on both spot markets to the nearest € 0.01.

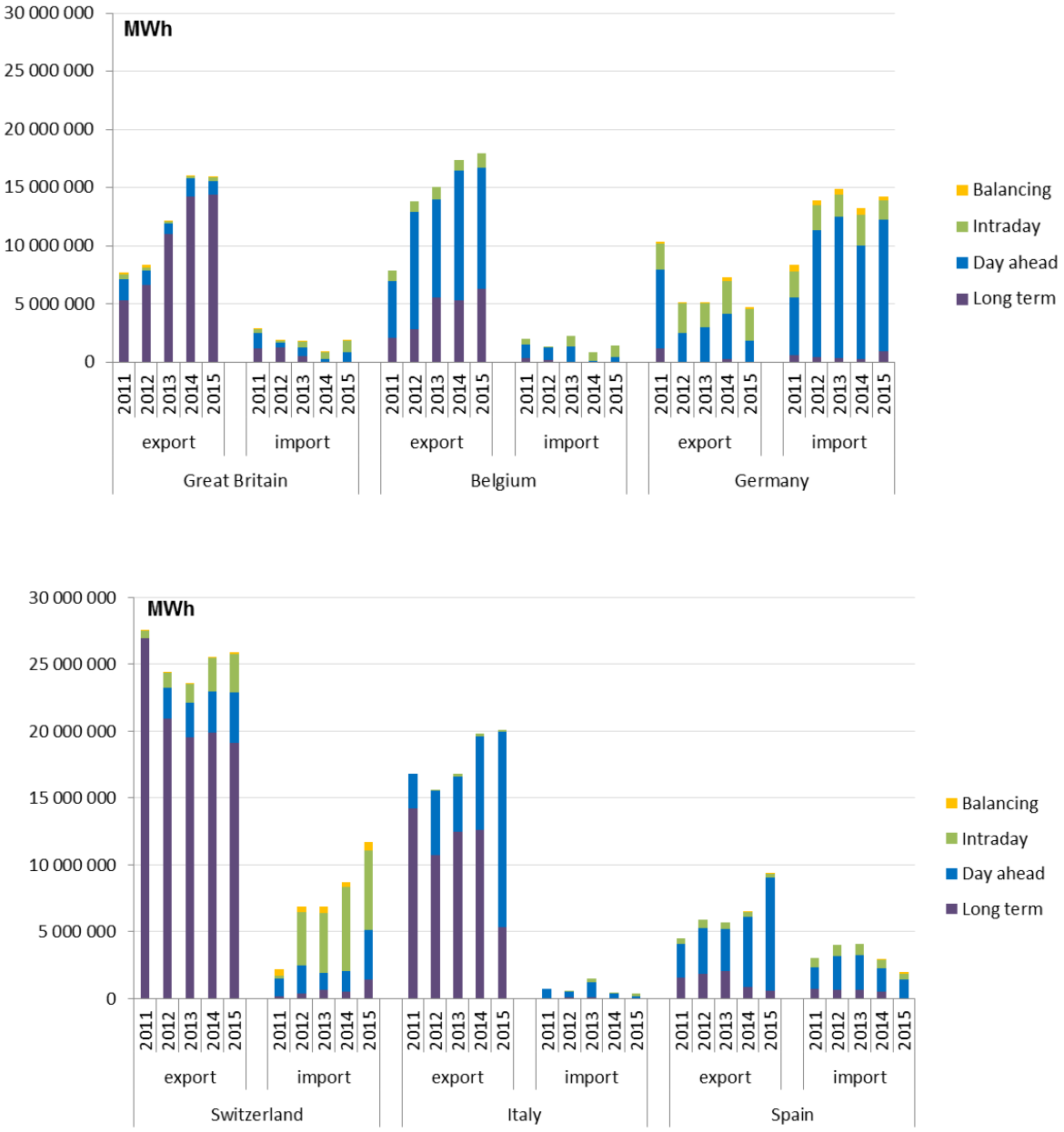
The France - Belgium and France - Italy interconnections show, in terms of exports, similar proportions of long-term nominations (around 30% of all nominations in 2015). Market coupling allows optimal capacity utilization in the day-ahead timeframe, however some players still continue to nominate in order to secure their access to capacity, especially in case of tension between supply and demand on the day-ahead market. The much lower long-term nominations at the border with Spain (less than 10%) is attributable to a much greater fluctuation of the direction of trade on this border.

Since 2011, there has been an increase of capacity utilization at the day-ahead timeframe. While nominations for the day-ahead timeframe represented only 31% of nominations in 2011, their share rose to 46% in 2015. This increase is related to the implementation of market coupling on 5 of the 6 French interconnections[8]. At the interconnections between France and Germany and Belgium, the day-ahead timeframe share in 2015 represented 70% and 56% of nominations, for all trading periods. With Spain, the share of day-ahead trading amounted to 87% of total nominations in 2015.

With the implementation of market coupling, which allows optimal capacity utilization for the day-ahead timeframe, market players are increasingly using long-term products as hedging products and tend less to subscribe to physical nominations. This trend is particularly marked at the border with Italy, where coupling was implemented in February 2015. In the space of a year, day-ahead nominations doubled (14.6 TWh in the direction exports and 0.16 TWh in the direction of imports in 2015). Conversely, long-term nominations for export have been divided by 2.4 in one year, to 5 TWh in 2015. In Spain, where coupling was implemented in May 2014, the long-term nominations fell by more than half between 2014 and 2015.

[8] Germany, Belgium, Italy, Spain and UK

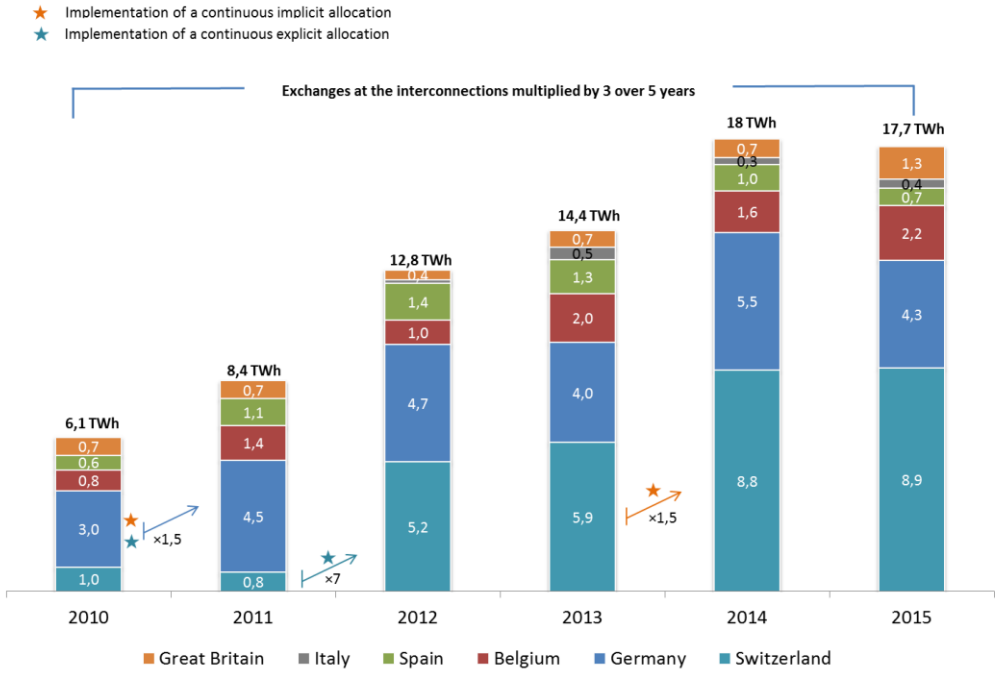
**Figure 12: Distribution of nominations by timeframe and border in 2011-2015**




*Source: RTE, CRE analysis*

Although nominations at the **intraday period** are in the minority (they represent only 14% of nominations in 2015), they have increased since 2010. In total, intraday trading at French interconnections has increased threefold in 5 years, to 17.7 TWh in 2015 (Figure 13). Trade is particularly important at the borders with Germany and Switzerland, on which continuous (implicit and explicit) allocation methods were implemented: in 2015 they represented 75% (13.2 TWh) of volume traded at the intraday timeframe at the French borders. Such an increase was not observed, however, at the interconnections with Great Britain, Italy and Spain, for which the allocation mechanism is still based on explicit auctions. Note that these borders are particularly optimized for the day-ahead timeframe and offer only very little residual capacity.

## Figure 13: Development of trade in intraday at the interconnections since 2010 (TWh)




*Sources: EPEX Spot, RTE, CRE analysis*

## 2. The rules governing capacity allocation and calculation have been improved steadily

Summary of messages:

- At the French borders, the CRE has worked for several years in collaboration, with RTE and its counterparts, improving the rules for allocating and calculating interconnection capacities. These developments allow the use of existing interconnection capacity to be optimised.
- The central west Europe region has played a pioneering and leading role in the integration of European markets. It was the first to implement day-ahead market coupling, in 2007[9], and the first to implement a flow based day-ahead capacity calculation, on 21 May 2015. The next major step for this region will be the implementation of a flow based capacity calculation, at the intraday period.
- The year 2014 and the beginning of 2015 marked the successful expansion to new borders of market coupling at day-ahead timeframe. France is now coupled with all of its borders, except Switzerland's.
- At the intraday period, the implementation of a common platform meeting the European target model is expected in mid-2017. In the meantime, several early implementation projects have been undertaken with the German, Swiss and more recently Belgian borders.
- The early implementation of the network code relating to the allocation of capacity at long-term timeframe lead to, by the end of 2015, the harmonization of the rules for allocating long-term products for all French borders and improvements to the firmness regime for these products at the France – Italy interconnection.
- In the region encompassing the northern Italian borders, a new D-2 coordinated capacity calculation methodology was set up in early 2016 and is expected to optimize the allocated capacity levels and network security. CRE also asked RTE to work with its Spanish counterpart to implement a D-2 coordinated capacity calculation on the France – Spain interconnection.
- The extension of the day-ahead market coupling at the Franco-Swiss interconnection is now technically possible but is subject to the outcome of bilateral negotiations between the EU and Switzerland. This absence of market coupling between France and Switzerland generates an additional supply cost estimated at 58 million € / year on average.

[9] At the borders with France, Belgium and the Netherlands (market coupling having been extended to Germany in 2010).

## 2.1. Capacity calculation plays a vital role in optimizing the capacity offered to the market

The capacity that is offered to the market, called tradable capacity, differs to physical electricity transmission via cables, called thermal capacity. The safety rules that require network operators to be in a position to cope with the loss of a line, production, the level of consumption or network constraints can limit flows at borders.

The process of calculating interconnection capacity serves to maximize the amount of capacity available to the market while ensuring the safety of the electrical system, and also limiting the cost of any potential remedial actions. The first step is to establish a grid model based on the volume and location of production and consumption, network topology and estimated exchanges at borders. The remaining physical margins available in the case of either a fully functioning network or a simulation of a partially unavailable network, are then evaluated. As part of a coordinated capacity calculation, this step is common to all the TSOs concerned. These physical margins are then distributed among the borders and so is the capacity that can be allocated at each interconnection.

Two methods exist today for allocating capacity between borders: the method called “NTC” (*net transfer capacity)*, where the capacity is divided on a fixed basis between the various borders, and the flow based method, where distribution is dynamic, taking into account the interdependence of the various exchanges and their value, in order to optimize the overall cost of supply across a region. The flow based method is now used for day-ahead trading at the borders of the CWE region[10].

## 2.2. The CWE region - a pioneer in the implementation of target models

### 2.2.1. Flow based calculation has enhanced solidarity between countries

The CWE region has played a leading role in the integration of European markets. In particular, it was the first to implement day-ahead market price coupling: applied on the borders between France, Belgium and the Netherlands since 2007, market coupling has been extended to Germany in 2010. This mechanism allows the power purchase offers from several countries to be matched in order to secure the cheapest means of production within the entire area, subject to the trading capacities at each border. Thus, it ensures that interconnections are efficiently used, that is to say from the country where electricity is cheapest to that where it is the most expensive. Since the entry into force of the Regulation on capacity allocation and congestion management ("CACM Regulations"), this mechanism is the European target model for the allocation at day-ahead timeframe, which should be deployed by all Member States.

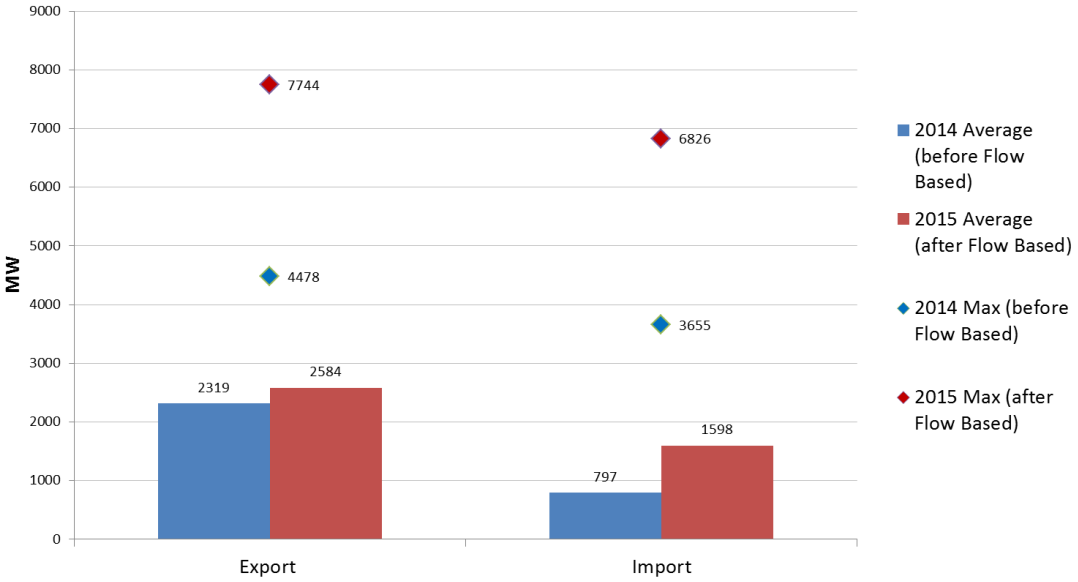
More recently, the CWE region has again played a pioneering role in implementing, as of May 21, 2015, a flow based capacity calculation. This capacity calculation method is the European target

[10] The Central West region (CWE) includes France, Germany, Belgium, the Netherlands and Luxembourg, as well as Austria as an observer country.

model described in the CACM Rules[11]. With this method, the physical transmission capacity is automatically assigned to exchanges towards the area where it has greatest utility.

The study of flows deriving from the coupling of the day-ahead market before and after the practice of flow based capacity calculation shows the significant increase in export and import capacity of France with Germany and Belgium. Figure 14 compares changes in flows between France - Belgium and France - Germany with a flow based calculation (period from 21 May to 31 December 2015) and with NTC calculation (period from 21 May to 31 December 2014). The implementation of flow based calculation not only allowed for an increase in average flows exchanged across French borders (11.4% for export and 100% for import), but also doubled the maximum import and export flows, reflecting the major benefits of flow based practices in relation to security of supply: if a country is facing a tense situation leading to a rise in market prices, flow based calculation takes account of this price differential and tends to direct the flows to this price area.

**Figure 14: Changes in flows between 21 May to 31 December 2014 and 21 May to 31 December 2015 (before and after the implementation of flow based method)**

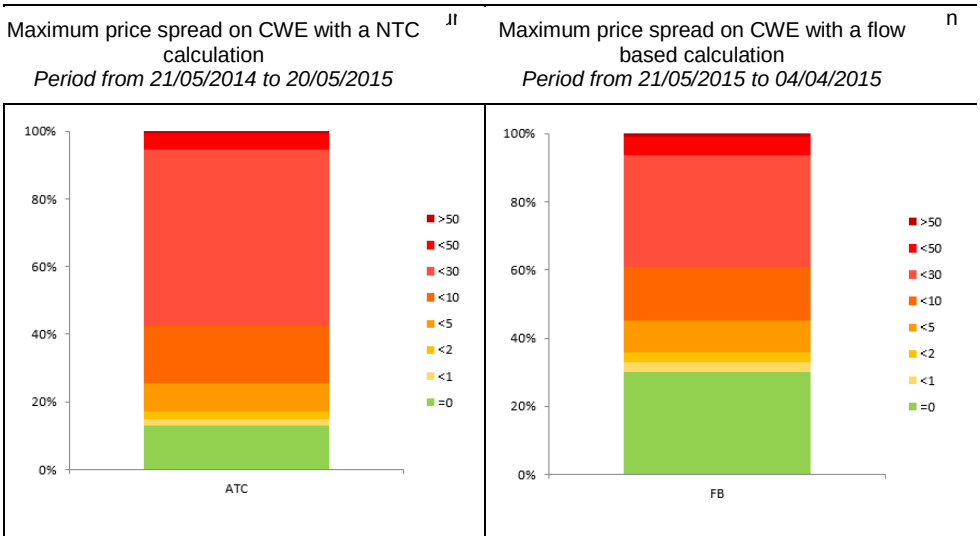



*Source: RTE, analysis: CRE*

This increase in flows generated a decrease in spreads within the CWE region. Figure 15 shows, as a case in point, that the maximum price differential in the region tended to reduce since the implementation of flow based: the price differential was less than 10 € / MWh for 40% of the time with an NTC calculation, whereas since the implementation of flow based this is the case 60% of the time.

[11] It will apply to all the capacity calculation regions for which it has an added value compared to the NTC capacity calculation method.

**Figure 15: Evolution of the maximum spreads in the CWE region: NTC versus flow based calculation**




*Sources: CWE Network Operators*

In addition, flow based method have had a real effect on price convergence in the CWE region: the market prices of the 4 CWE countries have converged on average 30% of the time since the launch of flow based (total convergence) while they fully converged just 13% of the time the year before the launch.

A test "to scale" of the flow based (parallel run), conducted from January 2013 to May 2015, has shown that the implementation of this methodology would have generated lower production costs across the Central West region over this period, of the order of one hundred million euros per year.

### 2.2.2. Improvements have also been made at the intraday timeframe

- **Enhanced capacity calculation at the intraday timeframe in the CWE region**

The implementation of flow based market coupling has had consequences on the level of capacity made available to market participants in the intraday period: the level of capacity available at the intraday timeframe has declined. This is explained in part by the optimizing of the day-ahead allocation allowed by the flow based market coupling and secondly by the method of determining the intraday capacity.

Indeed, across the French CWE borders, no capacity calculation is currently performed at the intraday timeframe. The capacity offered to the market is the residual capacity of the day-ahead timeframe, itself defined by the flow based domain established at the day-ahead timeframe. The regulators of the CWE region had, at the time of their approval of the flow based, identified this effect and had accordingly asked the TSOs to implement a systematic calculation of the capacity at the intraday period. The target model provided by the CACM Rules for intraday trading in CWE is a flow based capacity calculation. This should be implemented by the end of 2017 in the CWE region. However, a

temporary solution has been proposed by the TSOs and approved by regulators. It should allow for an increase in the level of capacity made available to market participants in the intraday period[12].

- **Towards the implementation of the intraday allocation target model at the France-Belgium border**

CACM regulation proposed as a target model the implicit and continuous allocation via the electricity power exchanges at the intraday timeframe. It nevertheless provides for the possibility of requests, on a transitional basis[13], for the implementation of explicit access to interconnection capacity and to allow OTC[14] trading. The combination of implicit and explicit allocations is the chosen solution, at the end of 2011, at the borders with Germany and Switzerland. Moreover, we note that it is on these two borders that intraday trades are the most important (see Figure 13).

The European project "XBID" aims to establish a platform on which, at the intraday timeframe, interconnection capacities will be allocated based on the target model defined by the CACM regulation. CRE fully supports this project. In addition, since the platform of the "XBID" project is to be implemented by mid-2017, the CRE considers that early implementations should be envisaged where possible and appropriate.

In 2015, the French and Belgian regulators also worked to improve the present method of capacity allocation, called the improved prorata-based allocation, to approach further the target model. Following a public consultation jointly conducted in late December 2015, they decided to put in place for six months an explicit capacity allocation between France and Belgium, which will be replaced in the Autumn of 2016 by an implicit allocation consistent with the provisions of CACM regulation.

- **Development of short-term products to facilitate the balancing of market stakeholders as close as possible to real time**

The "real time" balancing needs of market stakeholders are expected to rise due in particular to the development of electricity production from renewable sources. But now, the products traded on the organized electricity market as well as the capacity sold to French interconnections at intraday timeframe are, at the shortest, hourly products. Offering products with a shorter period could better meet the balancing needs of stakeholders.

In November 2015, the CRE approved the introduction in December 2015 of capacity products with a period of 30 minutes for France - Germany and France - Switzerland interconnections for intraday

[12] From the second quarter of 2016, all TSOs in the CWE region have the opportunity to reassess the intraday level of capacity on a daily basis. If the level of residual capacity falls below a certain threshold over a border, the TSOs involved will increase capacity, provided that this increase is validated by all TSOs and it is compatible with the security of their networks.

[13] On borders for which explicit access has been decided upon, the regulators concerned may approve the withdrawal of the explicit allocation having jointly undertaken a public consultation which assesses whether the “non-standard” products offered on the organised market meet the needs of the market participants

[14] OTC: Over the counter.

timeframe. On the organized electricity market, products of 30 minutes' duration will also be available before the end of 2016. Since the duration of these products matches the imbalance settlement period, the stakeholders have an additional lever via the organized market and interconnections for more accurate balancing and to reduce their costs of imbalance settlement.

## 2.3. Significant progress on other borders

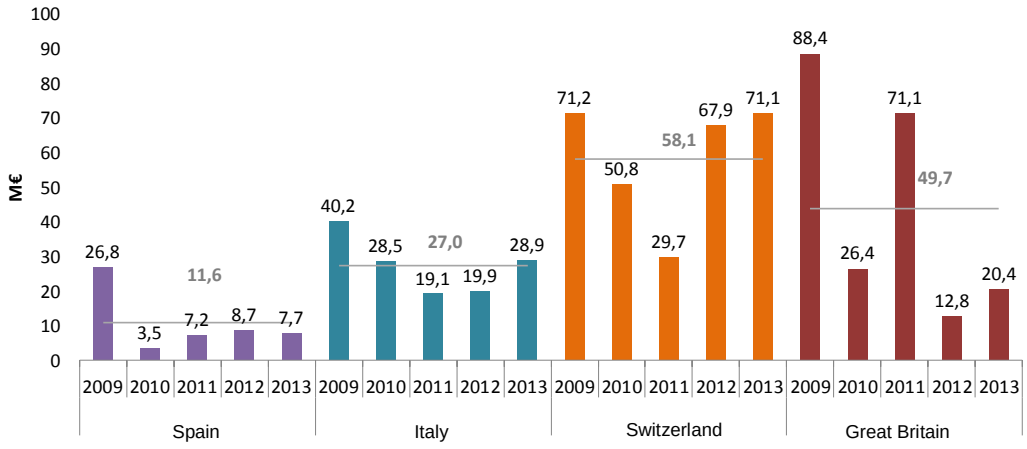
The CWE region has paved the way for several improvements in calculation and capacity allocation mechanisms at different timeframes, which have since been introduced on the other French interconnections.

### 2.3.1. The success of the geographical extension of market coupling

2014 and the beginning of 2015 were marked by an expansion of day-ahead market coupling. Market coupling implemented in the CWE region since 2010 was extended in February 2014 to 15 countries[15] in total, coupling France with the British market. A few months later, market coupling was extended to Spain and Portugal (May 2014), then to Italy and Slovenia (February 2015).

Figure 16 illustrates the significant gains made possible by market coupling: on average over the years preceding the extension of market coupling (2009-2013), the cost of supply for the day-ahead markets would have been reduced by nearly € 82 million a year if market coupling had been implemented with Great Britain, Spain and Italy.

**Figure 16: Additional costs of supply linked to the absence of market coupling (2009-2013)**




*Source: RTE Analysis: CRE*

[15] Germany, Austria, Belgium, Denmark, Estonia, Finland, France, Great Britain, Latvia, Lithuania, Luxembourg, Norway, Netherlands, Poland, Sweden

### 2.3.2. Towards implementation of a single platform for the allocation of long-term products

The network code on forward capacity allocation (FCA) was adopted by the Member States in October 2015 and should enter into force in the third or fourth quarter 2016. It defines the target model for the long term timeframe. An important step was taken in this direction in 2015, with its early implementation on all interconnections at the French borders. This translated concretely to the adoption of harmonized allocation rules for long-term products, called HAR rules (Harmonised Allocation Rules) and by merging the two largest capacity allocation platforms (CASC[16] and CAO[17]) to provide a common platform called JAO (Joint Allocation Office). Since the annual auctions for 2016 (which took place in late 2015), the HAR rules are now applied to the interconnections of twenty-three European countries, for all allocation auctions relating to long term transmission rights. JAO is now the allocation platform for the vast majority of borders.

In more detail:

- At the France – Spain border, the move towards harmonized rules and the establishment of the JAO platform have not introduced major changes, as the interconnection had already joined the CASC platform in March 2014. This transition to CASC rules was an opportunity to improve the firmness of the long-term products (removal of the cap applied to the price differential paid to market participants in case of curtailments - see box below), so that it approaches the target model.
- At the France – Italy border, the early implementation of the FCA code was an opportunity to change the firmness of long-term products specific at this interconnection. As part of the development of HAR and after the implementation of coupling with Italy in February 2015, RTE and Terna have changed these rules to move from a compensation representing 110% of the price of the initial auction to compensation at the market spread. The interconnection thus reached the HAR harmonised firmness regime in 2016.
- At the France - Great Britain border, an important step was taken with the inclusion of the border in the scope of application of the HAR rules, whereas historically its allocation rules were defined in a specific document (IFA access rules, Interconnection France England). A dedicated annex will maintain a certain number of specific features, relating partly to the specific characteristics of this interconnection, which operates in DC. It should be noted that to date, at this border, capacity is always allocated via a specific platform called CMS (Capacity Management System).

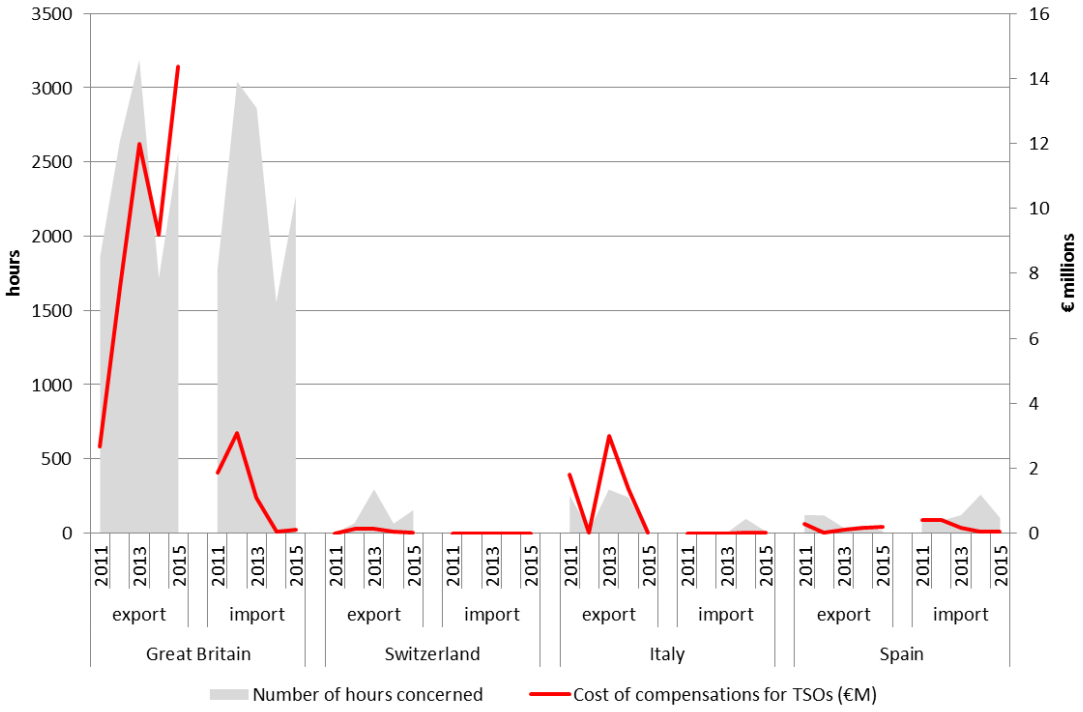
[16] CASC platform allocated cross-border capacity by explicit auctions for the Central West region (France, Germany, Belgium, Netherlands, Luxembourg), the Central South region (France, Germany, Austria, Italy, Slovenia, Greece), all borders of Switzerland and the France-Spain border, for different timeframes (annual, monthly, day-ahead and intraday according to borders).

[17] CAO, a platform which allocated long-term transmission rights for Austria, the Czech Republic, Germany, Hungary, Poland, Slovakia and Slovenia.

Once the FCA code comes into force, a new set of harmonized rules, for which the current HAR will form the basis, will be produced in order to ensure compliance with all provisions of the code. In addition, all European countries allocating long-term transmission rights will have to join the single platform, including the France - Great Britain interconnection.

**Analysis of capacity curtailments**

**Figure 17: Border by border capacity curtailments in hours and million €, from 2011 to 2015**




*Source: RTE, analysis: CRE*

**Figure 18: Average scale of curtailments by border from 2011 to 2015**

| Average scale of curtailments (MW) | | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|
| G-B | Export | 465 | 654 | 32,44 | 27,9 | 32,61 |
| | Import | 477 | 684 | 33,37 | 37,34 | 50,71 |
| Switz. | Export | 0 | 317 | 12,44 | 23,54 | 16,56 |
| | Import | 0 | 0 | 0 | 0 | 0 |
| Italy | Export | 526 | 44 | 14,43 | 8,76 | 21,76 |
| | Import | 0 | 0 | 0 | 50,29 | 24,46 |
| Spain | Export | 423 | 291 | 39,01 | 15,34 | 23,05 |
| | Import | 626 | 623 | 17,57 | 12,71 | 16,42 |

*Source: RTE, analysis: CRE*

When the level of capacity sold at long term timeframes exceeds what the TSO can provide, in case of an unforeseen incident affecting the network for example, the TSO may be forced to make capacity curtailments.

The number of curtailments varies greatly from one border to another. In Belgium and Germany, for example, there has been no curtailment since 2011[18]. Conversely, there are a lot of curtailments on the France - Great Britain border, and a significant scale (reduction may involve a greater or lesser number of MW). These differences are mainly explained by the meshing of an interconnection: the German and Belgian border networks are dense and allow for some flexibility. In contrast, at the English border, a single DC power cable supplies all trade; any problems or maintenance work on the cable automatically causes significant capacity curtailments.

In the event of capacity curtailments, the TSO informs the market stakeholder who has the capacity that it cannot be supplied, and pays financial compensation for to the number of MWs curtailed. This is the "firmness" associated with long-term products. CRE, in the context of developing the FCA code and HAR rules, worked toward this compensation being based on the price differential, not a simple refund of the price of the initial auction, as was the case on most of our borders historically. All our interconnections, except the one with Switzerland and Great Britain, now apply this firmness regime.

### 2.3.3. Substantial improvements in the calculation of the interconnection capacity at the France - Italy and France – Spain borders

CRE approved on December 9, 2015 a new method of D-2 coordinated capacity calculation on North Italian borders[19] based on the gathering by the TSOs involved, two days before "real time", of the inputs related to production, consumption and network conditions, in order to derive together the maximum overall tradable capacity. This coordination should enable better management of uncertainties closer to real time and enable better capacity utilization, while providing better network security. This methodology is used to calculate the capacity allocated since February 1, 2016. Before the implementation of this new method, the capacity calculated annually was used for the day-ahead allocation, possibly adjusted to account for planned maintenance. This annual calculation is made under a coordinated process involving all concerned TSOs.

CRE ensures that the level of capacity allocated to borders is optimized. CRE has asked RTE to provide, by the end of 2016, feedback on the implementation of this new methodology, in particular concerning the evolution of actually allocated capacity.

At the France – Spain border, a coordinated D-2 capacity calculation project is to be implemented in 2017 by the TSOs to improve levels of capacity available to the market in day-ahead coupling. This is to replace the current calculation, performed weekly, and improve the coordination between the two TSOs, which is currently very limited. The expected changes will optimize the volume of allocated capacity while providing better network security.

[18] With the exception of October 2015 in the Belgium – France direction, TSOs had to apply over three days curtailments of 23,33 MW on average.

[19] Interconnections between northern Italy and bordering countries: France, Switzerland, Austria / Germany, Slovenia.

## 2.4. The specificities of the interconnection at the France - Switzerland border does not allow for optimized management of capacity allocation

Due to non-membership of Switzerland in the European Union, the France - Switzerland interconnection is subject to a special regime. Interconnection capacity is indeed primarily used for historical long term contracts that offer priority and free access, which doesn't exist on any other French border. These contracts also have special access conditions, allowing, for example, their holders to make late nominations. Until early 2012 and the expiry of a contract for 610 MW, long-term contracts were saturating capacity for export. CRE and Elcom, the Swiss regulator, decided that the capacity thus released would be made available to the market and would be allocated by explicit auctions.

The extension of day-ahead coupling to the Franco-Swiss interconnection is now technically possible but is subject to the outcome of bilateral negotiations between the EU and Switzerland. This lack of market coupling between France and Switzerland generates additional costs for supply estimated at an average € 58 million / year (Figure 16). Progress has been made however at the intraday timeframe, with the establishment of a continuous explicit allocation in January 2012 and the creation in July 2013 of an organized intraday market in Switzerland, integrated with the German and French markets through implicit capacity allocation, simultaneously with explicit allocation. Priority access afforded by long-term contracts and a lack of day-ahead market coupling give the intraday timeframe a crucial but poorly suited role in the allocation of large amounts of capacity. The implementation of day-ahead market coupling remains paramount in optimizing the operation of this interconnection.

# 3. Investments are planned to increase the capacity available at the most congested borders

Summary of messages:

- The congestion income generated by the allocation of interconnection capacity at the French borders reached € 475 million in 2015. The France - Great Britain (€ 194 million) and France - Italy (€ 104 million) interconnections are those who generate the most revenue, these 2 countries being those with which the price differential with France are highest.
- Investment projects were put in place on these two borders: the ElecLink company is to construct and operate a new 1,000 MW link at the France - Britain interconnection and RTE is studying with its British counterpart an additional linkage project (IFA 2); on the Italian border, the Piemonte Savoia project will increase interconnection capacity by 1,200 MW from 2019 onwards.
- The Baixas - Santa Llogaia line, commissioned in late 2015, should eventually bring the interconnection capacity between France and Spain to 2,800 MW. In addition, the feasibility of the Biscay Gulf project, linking France and Spain, is being studied. Given the scale of the proposed expenditure, continuing technical feasibility studies are a prerequisite before deciding on the appropriateness of the project, given its socio-economic evaluation. This is to ensure that the benefits are actually greater than costs.
- The French interconnection capacity accounts for more than 10% of its installed production capacity. However, given the significant changes of the electrical system, including the development of renewable energy, CRE considers it necessary to renew the thinking on the methodology of fixing the 10% threshold, which was the target set by the European Council of 2002. To avoid the risk of oversizing interconnection needs, this threshold should be defined on the basis of multiple criteria and that, in a differentiated manner according to regional circumstances

## 3.1. A high congestion income, boosted by the incomes on France - Britain and France – Italy interconnections

The congestion income corresponds to revenues from the allocation of interconnection capacity at different timeframes (income from long-term auctions, implicit day-ahead allocation[20] and intraday allocation). These revenues, which accounted for about 10% of all RTE revenues in 2015, are used to ensure the actual availability of the allocated capacity (product firmness), develop interconnection capacity through investments and reduce the tariff for the use of the transmission network.

The France – Great Britain and France – Italy interconnections, and to a lesser extent the France – Spain interconnection, are those that generate the most revenue. This has remained true since 2013

[20] Explicit allocation only at border with Switzerland.

and even before 2012 for Italy. This is due to electricity price levels being much lower on average in France than in these countries and therefore a strong interest from market stakeholders to buy and sell energy via these interconnections.

- The congestion income of the France – Great Britain interconnection is steadily rising since 2012; it reached € 194 million in 2015. In particular, it reflects the strong price differential between the English and French spot markets (€ 19.6 / MWh on average in exports over the year 2015).
- Although they have declined by 29% between 2012 and 2015, revenues for the France - Italy border are also very high, 104 M € in 2015, the average price differential between the two countries for export amounted to 15.9 € / MWh in 2015.
- The congestion income in CWE (Belgian and German borders) amounted to € 96.5 million in 2015, with a lower price differentials and a more frequent price convergence than on other interconnections.
- In 2015, revenue generated at the France - Spain interconnection accounted for € 75 million, with an average price differential for the year of € 18 / MWh for export and 11 € / MWh for import. These price differentials have increased since 2012.
- The congestion income at the interconnection with Switzerland amounted to € 9 million in 2015. This relative weakness is due to the priority and free access to interconnection capacity afforded by historical long-term contracts.

**Calculation of the theoretical congestion income**

The theoretical congestion income allows us to understand the theoretical value of interconnections in perfect market conditions. The method chosen for its calculation is to consider that the entire capacity is sold only on the day-ahead market and its value is equal to the price differential between domestic day-ahead markets (the difference between spot market price A and spot market price B). The actual congestion income differs from the theoretical congestion income by taking into account the prices paid by market participants for capacity purchased for different trading periods. The difference between actual and theoretical income is mainly explained by the inherent uncertainty of predictions by stakeholders.

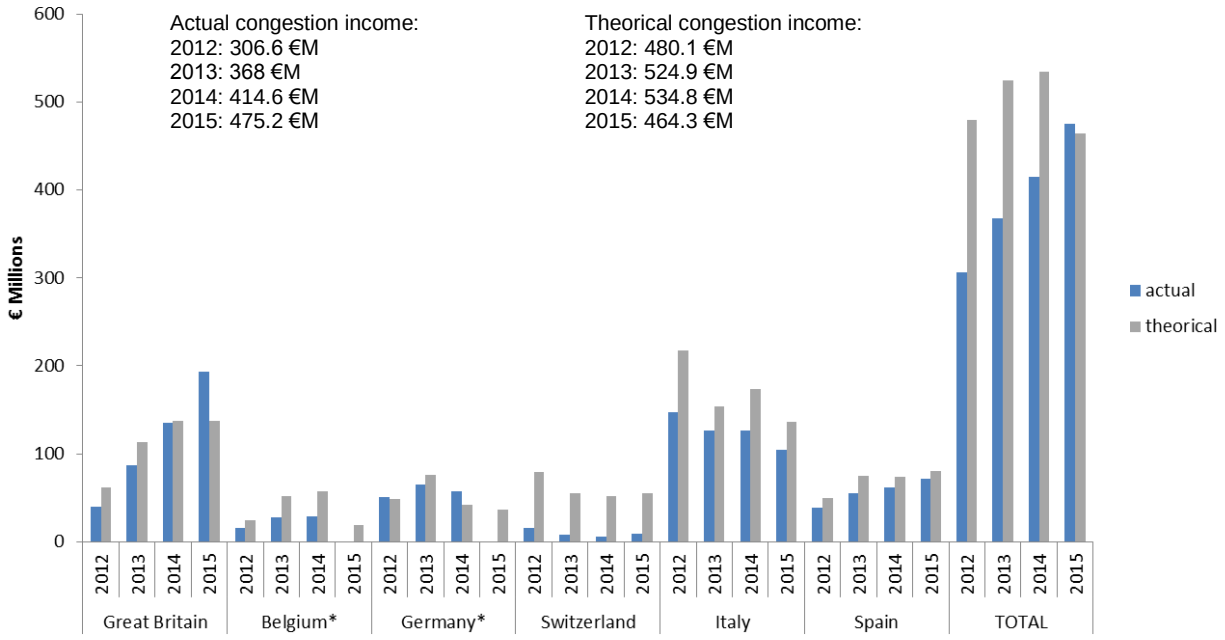
The comparison between theoretical and actual congestion income measures the difference between the congestion income actually received by the TSOs and the theoretical profitability of each interconnection. The theoretical congestion income, which does not take into account the difference between the day-ahead price and that of other trading periods, is generally higher than the actual congestion income since the price for capacity sold at long term timeframe is usually lower than the price of the day-ahead market. At certain borders and in certain years this is not the case, for example for the interconnection with Great-Britain in 2015. This reflects the anticipation of market stakeholders, who may have overestimated the price differential for the year ahead at the annual auctions. The long-term products are in fact hedging products used by stakeholders to hedge against the variability of

price differentials between the spot markets. The long term auctions are thus intended to reflect the expectations of stakeholders on the level of future price differentials.

At the border with Switzerland, the historical long-term contracts allow free and priority access for interconnection to their holders. Thus 2,590 MW of the 3,200 MW available for export and all the 1,100 MW available for import are not accessible to the market. This explains the weakness of the real congestion income at the border. The theoretical congestion income measures the shortfall for TSO and the system as a whole. With an average ratio at all borders (except Switzerland) of 83.5% between the theoretical congestion income and real congestion income, it is estimated that approximately a further € 200 million could have been collected since 2012.

Finally, note a relatively high gap between theoretical and actual congestion income on the France – Italy interconnection, because since 2013 the average price differential for export was higher than the expectations of stakeholders, which caused real congestion income to decline.

**Figure 19: Comparison of actual and theoretical congestion income 2012-2015**



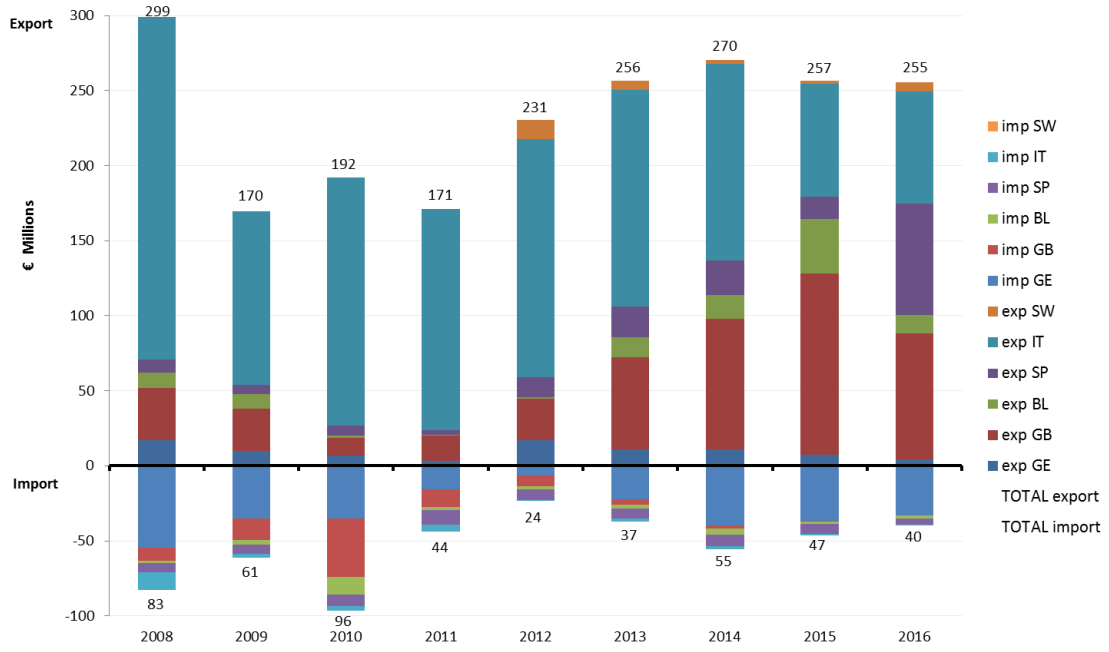

* Since the implementation of the flow based in the CWE region (May 2015), the congestion income is not calculated by border but by country. RTE income 2015 for CWE region: € 96.5 million

*Source: RTE, analysis: CRE*

**Focus on income from annual auctions**

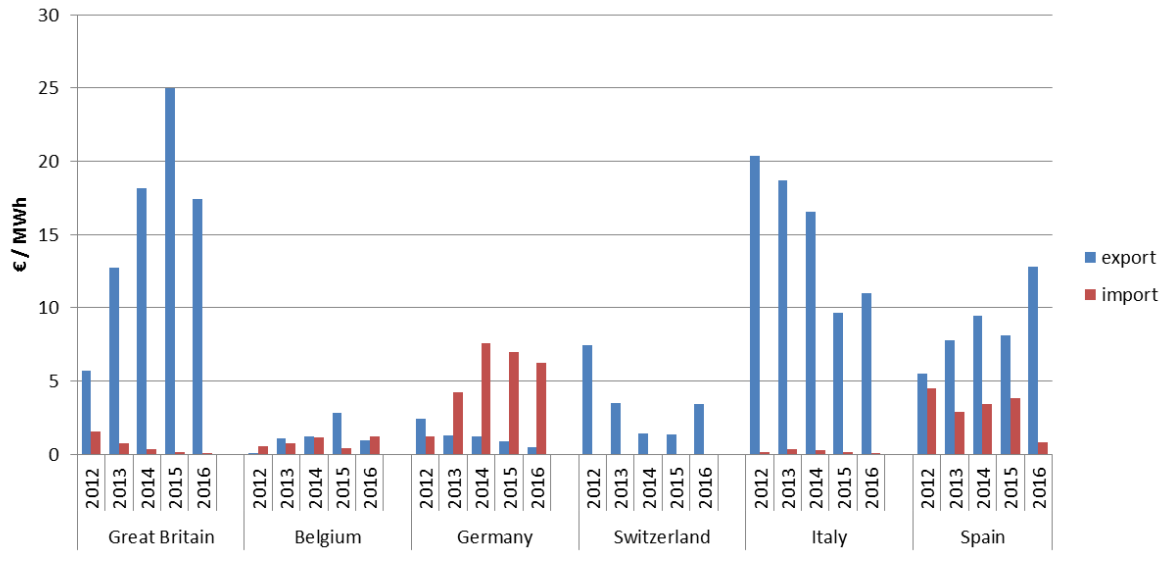
Part of the capacity is sold at long-term trading periods, including at annual auctions. These auctions are held between November and December of the year N-1, for products covering the whole of year N. They enable market participants to acquire, for every hour of the year, transmission rights between neighbouring countries (rights to use interconnection capacity on one border and in a given direction, or to collect the day-ahead market spread between spot markets, if it is positive on the border and the given direction).

**Figure 20: Income from yearly auction - 2008 to 2016**




*Source: JAO and FUI, analysis: CRE*

**Figure 21: Price of capacity allocated at yearly auction 2012 to 2016**




*Source: JAO and FUI, analysis: CRE*

In 2016 (auction taking place at the end of 2015) as in previous years, all the available capacity was allocated. The stakeholders requested on average eight times more capacity than that sold by the TSOs. The total income from the annual auctions for the year 2016 amounted to € 295 million (income divided between the two TSOs on both sides of the border) reaching a level very close to that of 2015 and 2013, but lower by 9.5% compared to 2014. Except at the border with Germany, capacity revenue at French borders is greatest in exports (86.5% of the auction revenues), which reveals that the stakeholders anticipate lower electricity prices in France than in neighbouring countries.

The congestion income received by RTE is the direct result of the number of interconnections of France and their significance in terms of volumes traded. It also reflects the high level of price differentials between the French market and that of several of its neighbours. It is on the basis of this observation that the French grid operator RTE, supported by the CRE, committed to investments to increase the capacity available to the market on the interconnections where this is necessary.

## 3.2. Projects planned for France - Italy and France - Great Britain interconnections

CRE oversees the development of interconnections with neighbouring countries, the most recent example being the commissioning in late 2015 of the new line Baixas - Santa Llogaia between France and Spain. It considers that decisions relating to the increase of interconnection capacity must be justified by a robust cost-benefit analysis, showing that the benefits of any new project actually outweigh its costs. When this analysis highlights positive externalities and particularly benefits to many European countries and stakeholders, the CRE considers that European funding or distribution cost measures in accordance with the CBCA approach (cost benefit cost allocation) should be implemented.

New projects have been decided or are in an advanced stage with the United Kingdom and Italy. The most advanced project is the Piemonte Savoia interconnection. Enjoying the status of European Project of Common Interest (PCI) (status granted in 2013 and renewed in 2015), it is to increase interconnection capacity between France and Italy by 1,200 MW for import and export. It consists of two DC cables with a capacity of 600 MW each which will connect Grande Ile, France, with Piossasco, near Turin, through the Fréjus tunnel, via the route of the A42 (France) and A32 (Italy). The total length of the link will be 190 km. The commissioning of the new interconnection is scheduled for 2019. The project was subject to a final investment decision in 2015 by RTE, which started siting in March 2015. The cost of the estimated investment for RTE taken into account by the CRE is 465 million. CRE also approved the implementation of an incentive mechanism for the Piemonte Savoia project with three components:

- A premium fixed in the light of economic utility of the project evaluated ex ante, based in particular on the scenarios of the European Ten-Year Development Plan (TYNDP) prepared by ENTSO-E;

- A variable premium based on the value of the project measured ex post, based on the actual utilization rate of the interconnection;
- A premium based on actual costs of the project, to encourage RTE to control these.

As regards interconnections between France and Great Britain, the company ElecLink Ltd is to build and operate a new link of 1,000 MW, for an estimated cost of € 400 million and commissioned in 2019. The ElecLink project was granted in 2014 an exemption decision by the CRE and its British counterpart, Ofgem. ElecLink must allocate over several years part of the capacity created through an "open season[21]". The rules of access to the ElecLink interconnection were approved by the CRE and Ofgem in the first half of 2016. Capacity allocated to long time, day-ahead and intraday timeframes will be subject to the same rules of access to those in force on the existing France - Great Britain interconnection.

RTE also studied, with the TSO National Grid Interconnector Holdings Ltd an additional link project with Great Britain ("IFA 2") with a capacity of 1,000 MW for commissioning in 2020. Seabed analyses set out a proposed route and RTE filed, on December 22, 2015, requests for the administrative permits needed for the project. The IFA 2 and ElecLink projects both have PCI status since 2013. RTE has just submitted CRE with a financial incentive request for this project, which will be examined in the second half of 2016.

### 3.3. Other projects are under study

The line Baixas - Santa Llogaia commissioning in 2015 should eventually increase interconnection capacity between France and Spain to 2800 MW. RTE and Red Electrica de España are also studying the feasibility of the Biscay Gulf project, linking France and Spain via an underwater cable which could increase the interconnection capacity between the two countries to about 5000 MW for both import and export. The total project cost is estimated at between 1.6 and 1.9 billion euros. The evaluation of the benefits of this project, conducted as part of the TYNDP published by ENTSO-E in 2014, incorporates a very high sensitivity to the results of the scenarios considered. Given the scale of the proposed expenditure, continuing technical feasibility studies is a prerequisite before deciding on the appropriateness of the project, in view of its socio-economic evaluation. This is to ensure that the benefits are actually greater than its costs.

Beyond the Biscay Gulf project, other developments were discussed in the framework of the High Level Group on the interconnections for South-West Europe set up by the European Commission following the Madrid Declaration of March 4, 2015. The CRE considers it appropriate to treat various projects in sequence, with priority given to the Biscay Gulf project. At this stage, the envisaged cross-Pyrenees linkage projects have not reached a sufficiently advanced stage to allow for meaningful

[21] An open season entails offering to market participants capacity rights on a new project, the final investment decision is then made on the basis of whether the income guaranteed by these subscriptions will provide sufficient financial security to investors.

socio-economic assessments. A review of their technical specifications, network reinforcements needed as well as cost estimates will constitute the first steps for these projects.

In addition to the previously-mentioned borders, RTE also lists in its ten-year plan additional interconnection development opportunities with Ireland, UK, Belgium, Germany and Switzerland. These projects are now under study.

**10% interconnection threshold**

In 2002, the European Council announced its objective to achieve electrical interconnection capacity equivalent to 10% of the installed production capacity for each of the EU Member States. This threshold serves as a baseline for building the internal electricity market, and it is sometimes underlined to promote new investments. But the electricity system has changed dramatically since 2002, especially with the strong development of renewable energy. CRE therefore considers it necessary to undertake further reflection on interconnection needs by developing indicators that reflect the geographical situations of the countries, production fleet features and price convergence rates.

In particular, the installed generating capacity should be adjusted according to the actual production peak, in order to avoid overestimating an ability to effectively mobilize photovoltaic and wind generation capacity. In addition, the inclusion of a single indicator does not adequately reflect the state of the electrical system. Peak consumption of each country should in particular be taken into account. Thus, in the case of France, with an installed fleet, at December 31, 2015, amounting to 129 GW and an export interconnection capacity of 13.5 GW at the end of 2015, the interconnection rate is 10.4%. Reporting instead the interconnection capacity for export corresponding to the actual production peak (94 GW in 2015) would increase this rate to 14.4%. Alternatively, relating the interconnection capacity for export to the historical peak consumption (102 GW in February 2012) gives a rate of 13.2%.

A uniform objective using a single indicator, especially when a fixed percentage of installed generating capacity is set, may lead to oversize the interconnections, and thus unnecessarily increase the costs borne by European consumers, without the benefits associated to these interconnections compensating these costs. The interconnection objectives should be defined on the basis of multiple criteria, both quantitative and qualitative, and differentiated according to regional circumstances.

# Part 3: The French gas interconnections

# 1. Assessment of gas entry and exit capacity in France: a steadily growing interconnection with Europe

Summary of messages:

- French transmission system operators have invested significantly over the past 10 years - about 3 billion euros[22], in the core of the French transmission system and interconnections. Frim entry and exit capacity of France increased in 2015 to 3,585 GWh/d and 658 GWh/d respectively against 2,345 GWh/d and 304 GWh/d in 2005, an increase of 52% in entry and 116% in exit in 10 years.
- France has significant interconnection capacities at all its borders: the French market is well interconnected with the rest of Europe. Interconnection capacity with Germany, however, has recently decreased as a result of capacity reallocations to other exit points in Germany.
- In 2015, France commissioned new interconnection capacity with Spain. At Pirineos, firm entry capacity has been increased from 165 GWh/d to 225 GWh/d in the direction of Spain to France. At this stage, the interconnection is used only from France to Spain.
- In late 2015, the new Alveringem interconnection (270 GWh/day) was commissioned. It allows for the export to Belgium of non-odorized gas imported from the Dunkirk LNG terminal or from the entry point to Norwegian fields, which will strengthen the contribution of LNG to the supply of North-West Europe and security of supply.
- The level of interconnection capacity between France and its adjacent countries allows France to fulfil the objective of integration of European markets set in the third package.

## 1.1. The interconnection capacities provide flexibility and diversity of supply to France

The French gas transmission network, one of the longest in Europe, has 7 terrestrial interconnections with neighbouring countries, a gas pipeline entry point to Norwegian fields in the North Sea, as well as four LNG terminals Fos-Tonkin[23], Fos-Cavaou, Montoir-de-Bretagne and Dunkirk LNG (of which commissioning is scheduled for September 2016). At the end of 2015, the entry capacity by pipeline to the French network thus amounted to 2,285 GWh/d[24], and exit capacity to neighbouring countries to 658[25] GWh/d (figure 22). Once Dunkirk LNG is commissioned, LNG import capacity will rise to 1,330 GWh/d (34 bcm/y[26]), which will put France in third position in Europe, behind Spain (~ 60 bcm/y) and the UK (52.3 bcm/y). France also benefits from major underground storage capacity. It has 16 storage

[22] Public consultation of 25 February 2016 of the Energy Regulatory Commission on future tariffs for use of GRTgaz and TIGF gas transmission networks and the coming usage tariffs for regulated LNG terminals

[23] Fos Tonkin regasification capacity declined since late 2014 due to the dismantling of one of the site's tanks

[24] Firm capacity in Dunkirk, Taisnières H and B Obergailbach, Pirineos

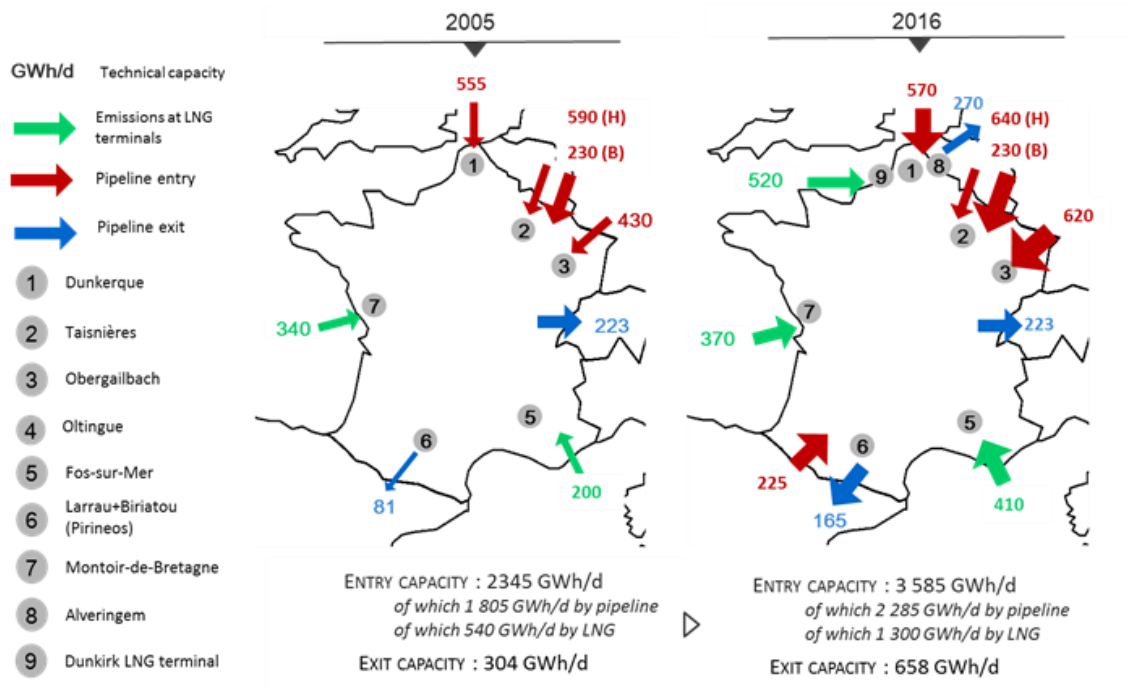
[25] Firm capacity in Oltingue, Pirineos and Alveringem

[26] Including the Dunkirk LNG terminal

sites, for an overall effective volume of 131.4 TWh[27] (the 3rd largest capacity in Europe), representing approximately 30% of the annual French gas consumption. France therefore has a strong gas system, well integrated with the rest of the European market, with robust diversity of supply.

The improvement of interconnection capacities and integration with neighbouring countries in general has been a constant concern for the CRE. Thus, in ten years, the entry capacity increased by over 52% and France more than doubled its exit capacity at borders, including doubling the output capacity to Spain and commissioning a new interconnection with Belgium, Alveringem, which will re-export gas to northern Europe. Significant investments (€ 823 million) to optimise the core French network were also decided upon and will advance the structure of the French market toward a single area in 2018.

**Figure 22: LNG interconnection and entry points (2005 to 2016)**




*Sources: GRTgaz and TIGF, CRE analysis*

[27] Storengy working gas volume: 99.2 TWh in 2015. TIGF working gas volume: 32.2 TWh in 2015

## 1.2. Interconnection upgrades underpinned by open seasons

Since 2005, the CRE relied on *open seasons* to implement investment decisions in new cross-border interconnections, especially with Germany (2005), Spain (2009 and 2010) and Belgium (2008 and 2012). Open seasons aim to design a new infrastructure based on user needs and to allocate the corresponding capacities without discrimination. These procedures also enable secure project financing, and reduce the risk for the end user with respect - via the transmission price - to costs of infrastructure that would prove to be underutilized.

CRE conducted these open seasons in accordance with European guidelines of best practices for opens seasons published by the European Regulators Group (ERGEG) [28]. Since 2005, these open seasons have created 465 GWh/d of firm entry capacity toward the French network and 135 GWh/d of exit capacity, for a total amount of € 1.3 billion (including related investments to core network improvements needed in light of capacity increases on the border with Spain) (table 1).

[28] ERGEG guidelines of best practice for open seasons (GGPOS)

**Figure 23: Open seasons held in France for 10 years and dispatchable capacity associated developments**

| Interconnection | Date of Open Season | Capacities developed | Cost at completion |
|---|---|---|---|
| **With Germany**<br>Upgrade of input capacity at Obergailbach / Medelsheim | 2005 | - *December 2008: increase in annual firm capacity of 430 GWh/d 550 GWh/d*<br>- *December 2009: creation of 70 GWh/d of annual firm capacity (total: 620 GWh/d)* | *€200 million*<br>(On the GRTgaz network) |
| **With Belgium**<br>Strengthening of entry capacity at Taisnières H | 2008 | - *December 2013: creation of 50 GWh/d of firm entry capacity at Taisnières H, bringing the total entry capacity to 640 GWh/d* | €169.7 million<br>(On the GRTgaz network) |
| **With Spain**<br>Creation of entry and exit capacity to Pirineos | 2009 et 2010 | **Entry into France:**<br>- April 2013: creation of 135 GWh/d of firm capacity, bringing the entry capacity of 30 GWh/d to 165 GWh/d<br>- December 2015: creation of 60 GWh/d of firm entry capacity, bringing total capacity to 225 GWh/day<br>**Exit to Spain:**<br>- April 2013: creation of 65 GWh/d of firm capacity, bringing firm output capacity to 165 GWh/d | € 491.4 million [29]<br>(On the GRTgaz and TIGF networks. This amount does not include upgrades in the core French network required to export / import the gas volumes corresponding to capacity increases at the border with Spain, validated during open seasons of 2009 and 2010) |
| **With Belgium**<br>Creating exit capacity to Belgium in Alveringem | 2012 | - December 2015: commissioning of 270 GWh/d of firm capacity North PEG to Belgium | € 86 million<br>(On the GRTgaz network) |

*Sources: GRTgaz and TIGF – CRE analysis*

[29] This amount includes 27 million euros of investment approved by the CRE in its deliberation of 16 July 2014 for the construction of the Sauveterre compression facility (whose commissioning is scheduled for 2017) and a 50 million European grant for the construction of the Béarn line (Artère du Béarn)

## 1.3. Entry point from Norway

France has, in Dunkirk, a direct input point for Norwegian production fields in the North Sea (Draupner platform) via the Franpipe pipeline, with a length of 840 km and a firm capacity of 570 GWh/d. This is the main gas entry point on the French network by volume: 189 TWh transited Dunkirk in 2015, equivalent to 37% of total gas imports to France. Of these volumes, some is re-exported to Spain and Italy.

## 1.4. Interconnections with Belgium

France has two interconnection points with Belgium at Taisnières, one dedicated to H gas (high calorific value) and the other L gas (lower calorific value). A third point of interconnection with a capacity of 270 GWh/d was established in Alveringem. It will ship to the north non-odorized gas from the Dunkirk LNG terminal (commissioning is scheduled for September 2016) and from the Franpipe pipeline, thus removing the obstacle posed by the odorization of gas on the main transmission network in France, while Belgium and Germany do not accept odorized gas on their transmission network.

The interconnection point of Taisnières H, with a capacity of 640 GWh/d, is the entry point for gas with high calorific value mainly from the North Sea and transiting through Belgium via the pipelines Segeo and Zeepipe, reaching the continent at the Zeebrugge hub. With 148.2 TWh in 2015, entries at Taisnières H accounted for 29% of total gas imports. Taisnières H was the second most significant entry point in France in 2014 and 2015.

With a capacity of 230 GWh/d, Taisnières B point of interconnection receives low-calorific (L gas) supplies from the Groningen field in the Netherlands. In 2015, L-gas imports amounted to 44 TWh, representing 9% of total imports of gas. L-gas is consumed exclusively in the north of France (Nord-Pas-de-Calais and Picardy), by 1.3 million customers of which 8,000 industrial, representing 10% of French natural gas consumption. With the upcoming depletion of the Groningen field, this area will be progressively converted to H-gas; the initial conversion schedule might be speed up as a result of production problems in the Netherlands.

**Groningen and conversion to H gas of the L-gas zone**

The mature gas field in Groningen is gradually entering the final period of operations (reserve of about 680 bcm in early 2015). Export contracts end between 2021 and 2030 and will not be renewed (in 2029 for France, supply begins to shrink from 2024). Since January 2014, because of the link between the exploitation of gas and seismic activity in the Groningen region, successive and more drastic production limits have been set by the Dutch government. The final decision was made on 18 December 2015 and a restriction of production order to 27 bcm / year for the 2015-2016 gas year was delivered, with the possibility of increasing the volume to 33 bcm in case of a cold year. In 2015, Groningen field production amounted to 28 bcm, or 34% less than the field production in 2014 and a half compared to production in 2013.

Although all stakeholders consider that the export contracts will be honoured, the risk of early termination of the operation of Groningen has to be taken into account. It is now necessary to prepare for the conversion to H gas of infrastructure and consumers today consuming L-gas. This particularly complex project requires strong coordination among stakeholders at a national level and between the countries concerned (supplies of L-gas in France is entirely dependent on transit through the Fluxys network).

At this stage, the ministry in charge of environment, energy and sea is piloting the project on the French side and expects a very gradual switch to H gas, ranging from 2021 to 2029. A decree of 23 March 2016 [30] relating to the natural gas network low calorific conversion project in the departments of Nord, Pas-de-Calais, the Somme, Oise and Aisne, set out the scope and timing of the gas system conversion. Many technical obstacles must be overcome by then (dealing with 1.3 million customers, conversion of the Gournay storage which is the only source of flexibility in the area...) and in the legal and financial aspects (sharing responsibilities and costs between the operators, particularly concerning interventions for end customers).

Belgium, has also started reflecting on this issue. The Belgian authorities plan for the moment to launch the transition to H gas in 2024. Under current study, Fluxys has no plans to stop L-gas transit to France before 2029.

## 1.5. Interconnection with Germany

France has an interconnection point with Germany at Obergailbach. Offering a capacity of 620 GWh/d, this interconnection is the entry point for gas imports from Russia, traveling through Germany. In 2015, entries to Obergailbach accounted for 67.6 TWh, or 13% of total gas imports. Two transmission network operators operate this interconnection in Germany: GRTgaz Deutschland, which manages about 90% of capacity on the German side of the IP, and Open Grid Europe (OGE).

There is a growing gap between the firm output capacity offered in the German side of the IP and entry capacity offered in the French system. Indeed, the method of transmission management in

[30] Decree of 23 March 2016 relating to the low calorific natural gas network conversion project in northern departments of Pas-de-Calais, the Somme, Oise and Aisne

Germany allows TSOs to reallocate unsold capacity at other points on the German network. Thus, since the second half of 2012, OGE and, to a lesser extent, GRTgaz Deutschland reduced their firm exit capacity to France, creating a gap of about 50 GWh/day with firm entry capacity sold by GRTgaz. Also, the capacity marketed by OGE has almost halved since 2011, reaching 50 GWh/d in early 2016. These reallocations, which so far are only conducted over the short term, could extend to the longer term, which would deteriorate French security of supply, especially considering the fusion of French zones[31]. CRE has expressed its concern on this issue to its German counterpart, the Bundesnetzagentur (BNetzA), and also informed the Minister in charge of energy.

## 1.6. Interconnections with Spain

France has two physical interconnection points with Spain at Larrau (technical capacity of 165 GWh/day) and Biriatou (technical capacity of 60 GWh/day). Since October 2014, they were merged into one virtual interconnection point, named "Pirineos".

Since 1 April 2013, the capacity offered in both directions increased to 165 GWh/d against 100 GWh/d in the France to Spain direction and 30 GWh/d in the Spain to France direction. They can cover almost 20% of the total gas consumption in Spain. In 2015, the capacity in the Spain to France direction was increased to 225 GWh/d. In the France to Spain direction, 60 GWh/d of interruptible capacity has been proposed to market participants since December.

The interconnection with France is a strategic point for Spain, and more broadly the Iberian Peninsula, whose gas supply is based on imports of Algerian gas and LNG. France is a transit country for Spain. A long-term supply contract was signed between Norway and Spain until 2027 with volumes close to 80 GWh/d transported via Dunkirk. In recent years, the interconnection with France has been a major source of arbitration for Spain, which relied on supplies from northern Europe when LNG was less competitive and it was advantageous to re-export to Asia. Since the interconnection with Spain was made bidirectional in 2011, flows were systematically operated in the France to Spain direction, and never in the opposite direction (Figure 31 in section 2.3.1). In 2015, 31 TWh was exported to Spain (56% average utilisation factor). The outputs to Spain accounted for 51% of exports by France.

The interconnection of Oltingue exports natural gas to Italy across Switzerland. With a capacity of 223 GWh/d, it connects the northern zone of the GRTgaz network to the Swiss network operated by FluxSwiss, itself connected to the Italian Snam Rete Gas network by Passo Gries interconnection. Exits at Oltingue accounted, in 2015, for almost 30 TWh, that is to say 49% of net volumes exported from France.

Historically, this interconnection was created to supply Italy with gas from Norway, which explained that it only operates for import. There was hitherto only a reverse flow offer (45 GWh/day). However, physical entry capacity on the GRTgaz network of 100 to 200 GWh/d will be created by 2018 in coordination with FluxSwiss. This investment of € 15 million will open access to new sources of gas

[31] See section 3.6.1 for more information on this subject

from Italy, for example from Azerbaijan via the future Trans Anatolian Pipeline (TAP). This entry capacity at Oltingue will not be fully firm (they may be discontinued when the quantities of gas transported from Taisnières and Obergailbach are too large). Given the low cost of this project, which will create a new entry point from Switzerland and Italy, the CRE approved this investment without an open season. In 2012 an open season for firm capacity did not yield results, market participants having stressed the fact that the project costs were very high[32].

[32] The investments necessary for the development of 100 GWh/d of firm entry capacity in France at Oltingue was estimated at € 258 million

http://www.cre.fr/documents/deliberations/decision/interconnexion-d-oltingue/consulter-la-decision

## 2. The supply structure of the French market

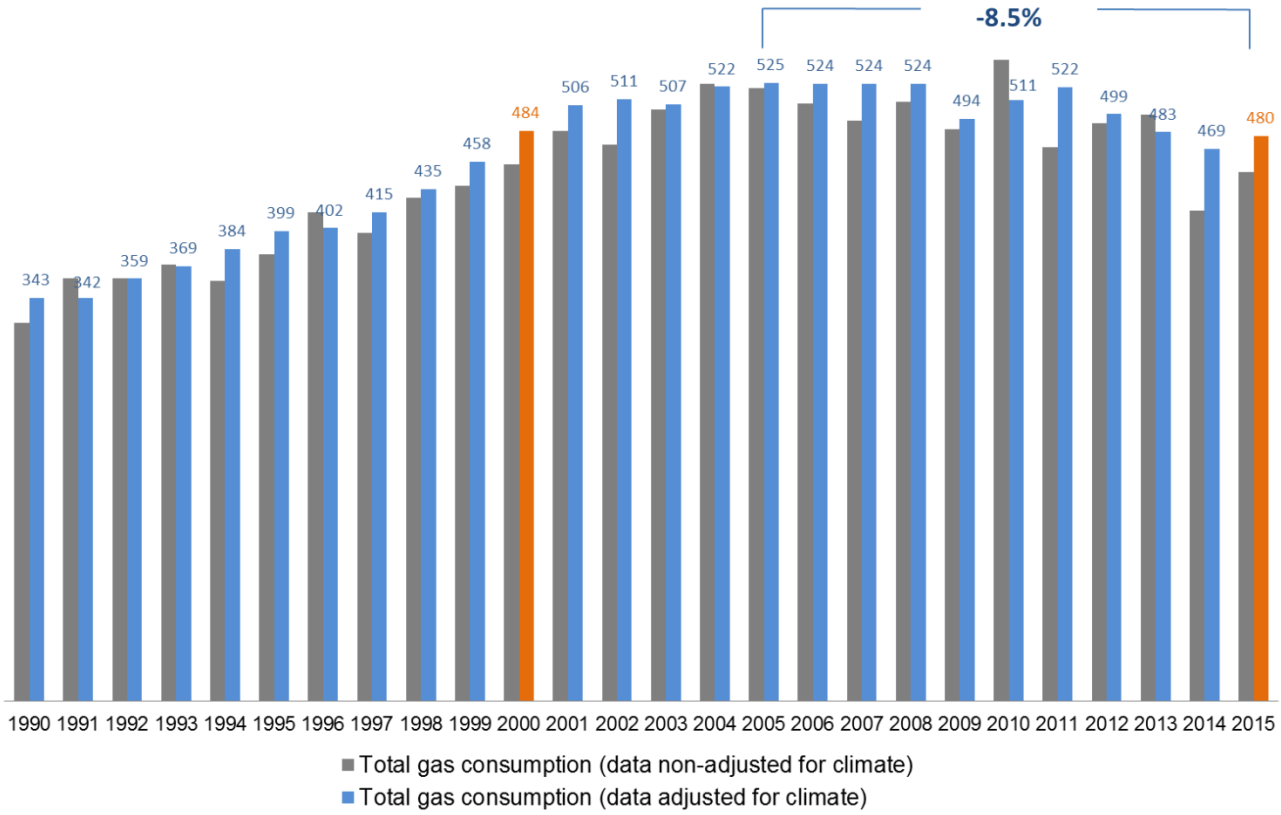
Summary of messages:

- Gas consumption in France and more generally in Europe has stagnated in recent years. Sluggish economic growth, low prices on the electricity markets, energy efficiency measures and high temperatures in 2014 and 2015 have contributed to this trend, although gas demand from power plants resumed at the end of 2015.
- The French gas supply depends mainly on long-term contracts, but more and more volumes are purchased in the short term.
- The French supply portfolio is diversified although the majority of volumes of gas is imported through pipelines. The share of LNG in the French gas supply has fallen since 2011, due to the reorientation of Europe LNG flows to Asia in the wake of the Fukushima disaster. Despite an expansion in the LNG market since the last quarter of 2014, LNG's contribution to the French gas supply mix remained stable in 2015 at around 12%. France also has major underground storage capacity, which represents nearly 30% of annual French gas consumption and contributes to the strength of the French gas system.
- The utilization rate of interconnections remained broadly stable in 2015 compared to 2014, with the exception of the interconnections with Germany and Spain. Tensions between Russia and Ukraine led to decreased demand at the Obergailbach interconnection. Exports to Spain fell by 37% following an increase of LNG transiting on Spanish networks and imports from Algeria by pipeline. Flows between France and Spain, however, remained oriented from north to south only.
- Thanks to the many interconnections ensuring a diverse supply, the North of France is well connected with the Northwest European hubs. The South of France remains dependent on LNG imports via the North-South link to meet consumption in France and Spain. The Pirineos interconnection brings flexibility to the Spanish market, while its LNG supply is less important because of the practice of transiting LNG cargos to more lucrative markets.
- To streamline the flow of gas on the North-South axis, CRE is continuing its effort to simplify the French market. Since April 2015, France is no longer split into two market areas: PEG Nord and the Trading Region South, resulting from the merger of the GRTgaz South and TIGF zones. A single marketplace in France will be implemented in 2018. In this context, the CRE has adopted a development plan which links the Val de Saône and Gascogne-Midi projects to decongest the North / South axis of the French network as of 2018.

## 2.1. Interconnections allow France to have a diversified gas supply

The total gas consumption in France (corrected for climate) decreased by 8.5% in 10 years, from 525 TWh in 2005 to 480 TWh in 2015 (Figure 24). The impact of the 2008 economic crisis on industrial production, the decline in production of electricity from gas, efforts in energy consumption and the high temperatures of the last two years explain this drop in French consumption of gas to levels close to those of the early 2000s.

**Figure 24: Total gas consumption in France from 1990 to 2015 (TWh)**
**(data corrected and uncorrected for climate)**

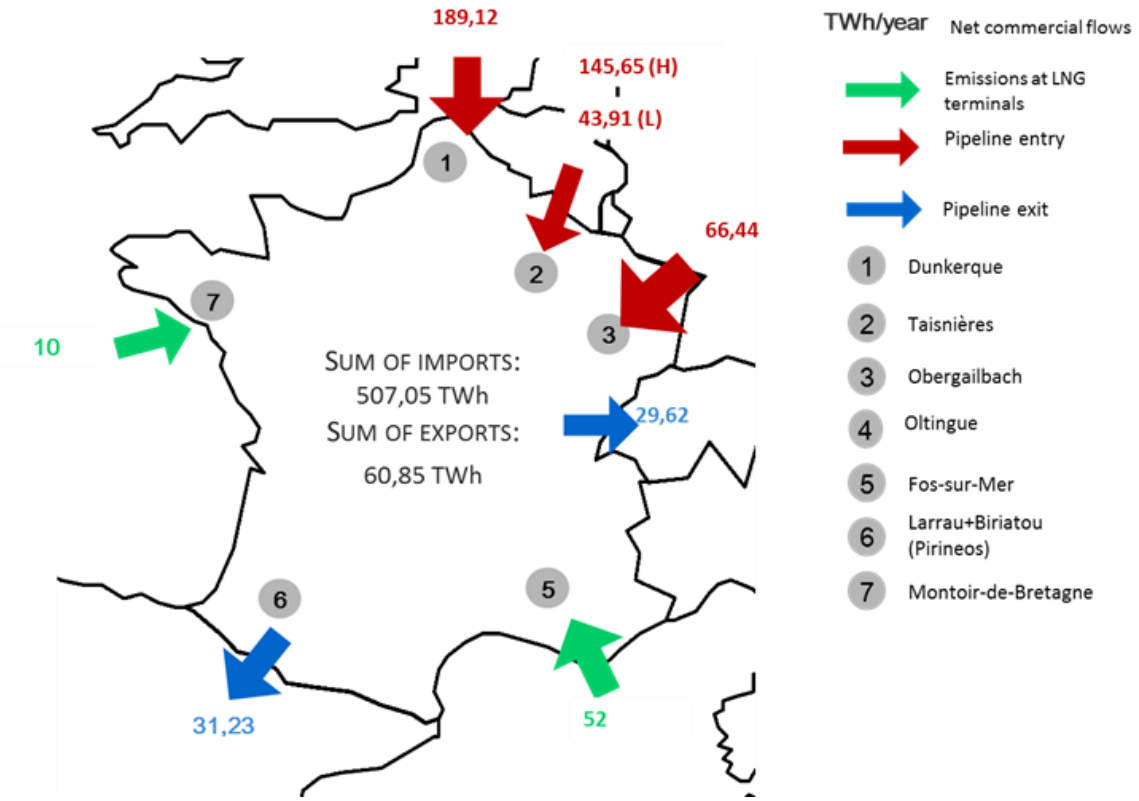



*Source: DGEC – CRE analysis*

The year 2015 is one of the warmest on record. The recovery in demand for gas power plants, which consumed 2.6 times more gas than in 2014[33], helped mitigate the climate's impact on demand, which explains the increase in total gas consumption in France to 480 TWh (+ 2.3%) (Figure 24). The 12 plants connected to the GRTgaz network all had resumed production in late 2015. This effect, combined with a slight recovery in industrial consumption at the end of the year, brought France's net import balance to 446 TWh (data non-adjusted for climate) in 2015, up 4% compared to 2014 (435 TWh) (Figure 25).

[33] On the GRTgaz network

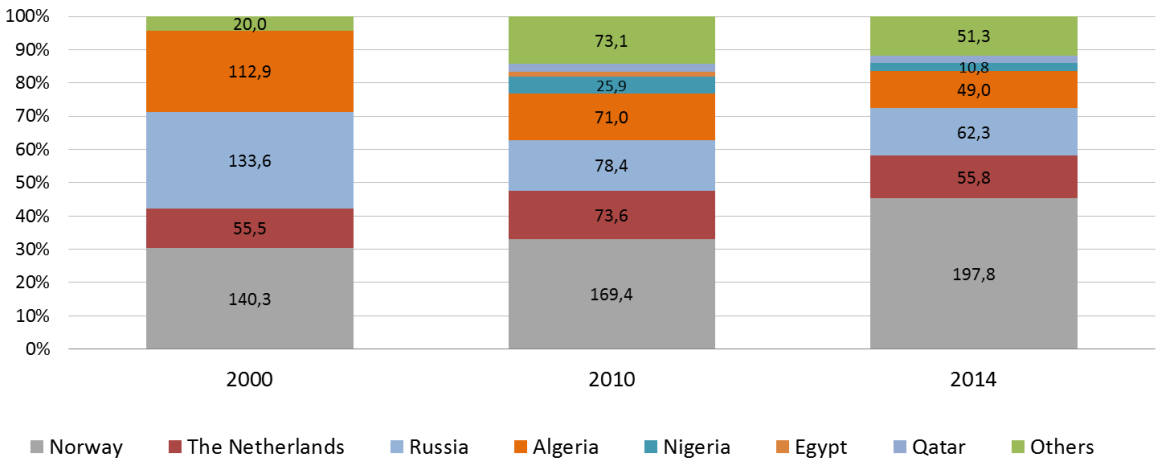
## Figure 25: Net commercial flows in 2015




*Sources: GRTgaz and TIGF*

Since 2012, there have been seven sources of gas imports to France (Figure 26): Norway, Russia, the Netherlands, Algeria, Nigeria, Egypt and Trinidad and Tobago. This diversity of supply sources enables France to be relatively protected against the risk of supply disruption. The weight of Norway in the French supply mix is significant; the volume imported from Norway amounted to approximately 40% of total volume. Russia accounted for about 15% of imports to France in 2015.

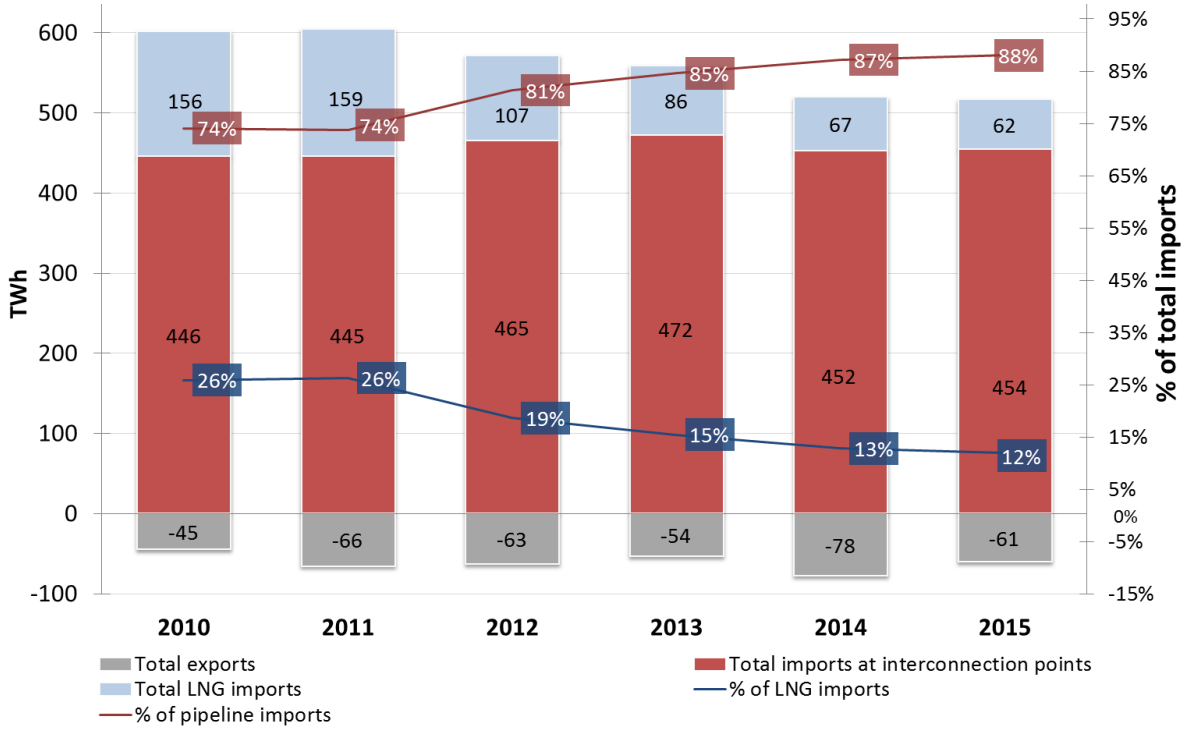
## Figure 26: Source of gas imports into France




*Source: Insee*

The vast majority of volume was imported by pipeline (Figure 27). They represented 88% of total gas imports from France in 2015. Imports by pipeline remained stable between 2014 and 2015, despite tensions between Russia and Ukraine, through which nearly 50% of Russian gas for Europe transited in 2013[34].

**Figure 27: Gas imports and exports in France (TWh)**




*Sources: GRTgaz and TIGF – CRE analysis*

Since 2010, the share of LNG in the French gas supply mix has fallen by a factor of more than two, to 12% in 2015, as against 26% in 2010 and 2011 (Figure 27). This decline in LNG imports to France, and more widely in Europe, is due to the diversion of LNG volumes to Asian markets which has become more profitable as a result of the Fukushima accident. The possibility of redirecting LNG cargoes reflects the growing importance of short-term dynamics in the LNG sector, whose flows are becoming more responsive to international price differentials.

Under the combined effects of the fall in oil prices from the third quarter of 2014 and a lower than expected LNG demand in Asia, LNG prices have largely fallen in 2015, to approach those for imports through pipelines. It is in this context of a relaxing in the LNG market that imports to Europe increased by nearly 15% in 2015 to about 40.3 bcm[35]. In the particular case of France, the increase in imports from Norway and the use of storage explain the stagnation of LNG imports in France in 2015 at to 5.51 bcm in 2015[36]).

[34] Source: International Energy Agency

[35] Source: GIIGNL 2016 - 40.3 bcm or 393.7 TWh

[36] Source: GIIGNL 2016 – 5,51 bcm or 53,8 TWh

By 2015, European LNG imports were characterised by strong disparities. While the United Kingdom and Spain were the main importers of LNG in Europe in 2015, for 12.7 bcm (+20% compared to 2014[37]) and 11.2 bcm (+11.7% compared to 2014[38]), respectively, the volume delivered to Belgium (+94%[39] to 2.3 bcm) and the Netherlands (+ 50%[40] to 0.8 bcm), also experienced significant growth.

For its imports, France is mainly reliant on long-term contracts, which represent about 80% [41] of supplies. However, the integration of European markets and proximity of the French market with the British and Dutch liquid hubs, NBP and TTF (Figure 28, showing the strong correlation between spot prices on the various gas marketplaces in Europe) explains the growth of short-term volumes imported to France. This short-term supply increased by a third in three years, from 16% of total volume imported in 2012 to 21% in 2015. This is an evolution of the functioning of the French market that affords an increasing role to the flexibility of interconnections.

## 2.2. North and South of France, contrasting situations

The French market has the distinction of being the interface between two gas regions with very different characteristics. First, the North area is on the Northwest European plate, characterized by low levels of congestion and high correlation of market prices, of which the most liquid are the NBP in the UK and the TTF in the Netherlands. On the other hand, the TRS area is on the south-western Europe plate, whose supply relies heavily on LNG.

### 2.2.1. With significant interconnections, PEG Nord enjoys proximity to the liquid hubs of Northwest Europe

PEG Nord has a dense gas network, which is based around 4 entry points via pipeline (Dunkirk, Taisnières H and B, and Obergailbach), 2 LNG terminals (Montoir and from 2016, Dunkirk LNG) and 11 underground gas storage sites (3 of which are currently mothballed, Trois-Fontaines, Soings-en-Sologne, Saint-Clair-sur-Epte). The entry capacity well exceed the needs of the North area, where gas consumption has represented, since 2010, nearly 70% of total French consumption, since all transit volume passes through this area, including for the south of France and Spain.

The Taisnières (M and B) and Obergailbach interconnections ensure the proper integration of the PEG Nord and price convergence with the liquid markets of the North West European markets, as illustrated in Figure 28 below.

[37] Source: GIIGNL 2016 – 12,7 bcm or 124 TWh

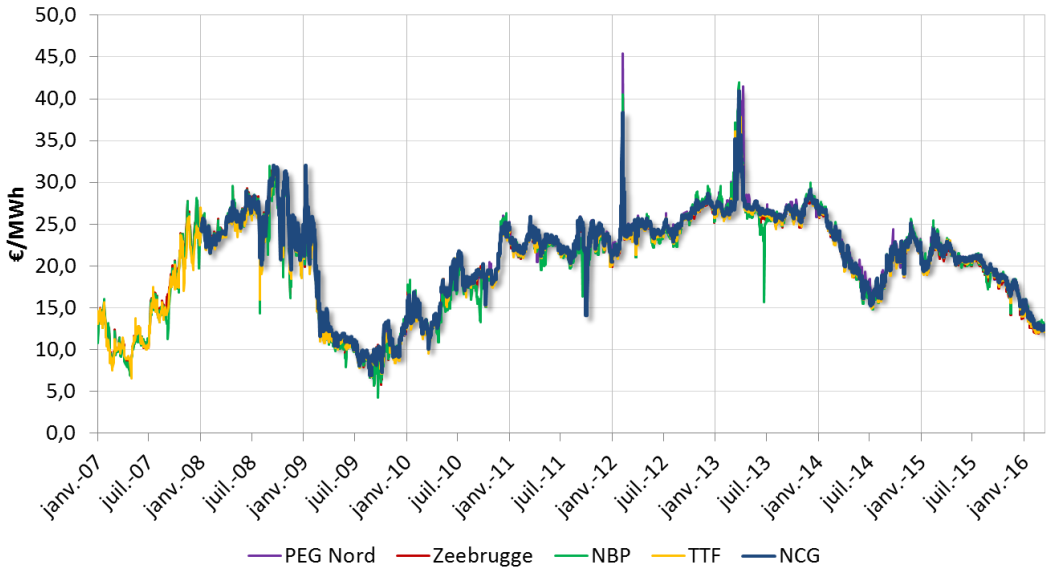
[38] Source: GIIGNL 2016 – 11,2 bcm or 109,4 TWh

[39] Source: GIIGNL 2016 – 2,3 bcm or 22,4 TWh

[40] Source: GIIGNL 2016 – 0,8 bcm or 7,8 TWh

[41] Source: MEDDE, France Energy balance 2014

**Figure 28: Gas spot prices in Europe**




*Sources: Heren – CRE analysis*

A number of indicators exist to measure the depth of these markets, particularly the number of transactions each day, negotiated and traded volumes, the size of orders and market concentration. TTF and NBP offer long-term products, which are hedging mechanisms that provide visibility to the market participants. While PEG North does not have a depth comparable to those markets, a significant increase in volumes traded there has been observed since 2007; volumes have multiplied by 12.5 in 8 years, to 316 TWh in 2015[42]. The increased traded volume and the increased number of transactions is explained in particular by the sharing of liquidity of provided by the interconnections, allowing market participants to take full advantage of the liquidity of the Northwest European hubs.

### 2.2.2. Less diversified supply routes to the south than to the north

Consumption in the TRS area has accounted for about 30% of the total gas consumption in France since 2010.

The southern supply routes from France are not very diversified. The area depends on LNG arriving at the terminals of Fos-Tonkin and Fos-Cavaou, which can inject up to 410 GWh/d to networks. Besides these regasification terminals, the southern area has two other entry points, the North-South link (215 GWh/d of firm capacity in the south to north direction and 270 GWh/d of firm capacity from north to south, plus 20 GWh/d in winter), which connects the two market areas in France, and the interconnection with Spain, Pirineos, which since December 2015, can import up to 225 GWh/d of gas from the Iberian peninsula, although no flow in this direction has been observed since 2011.

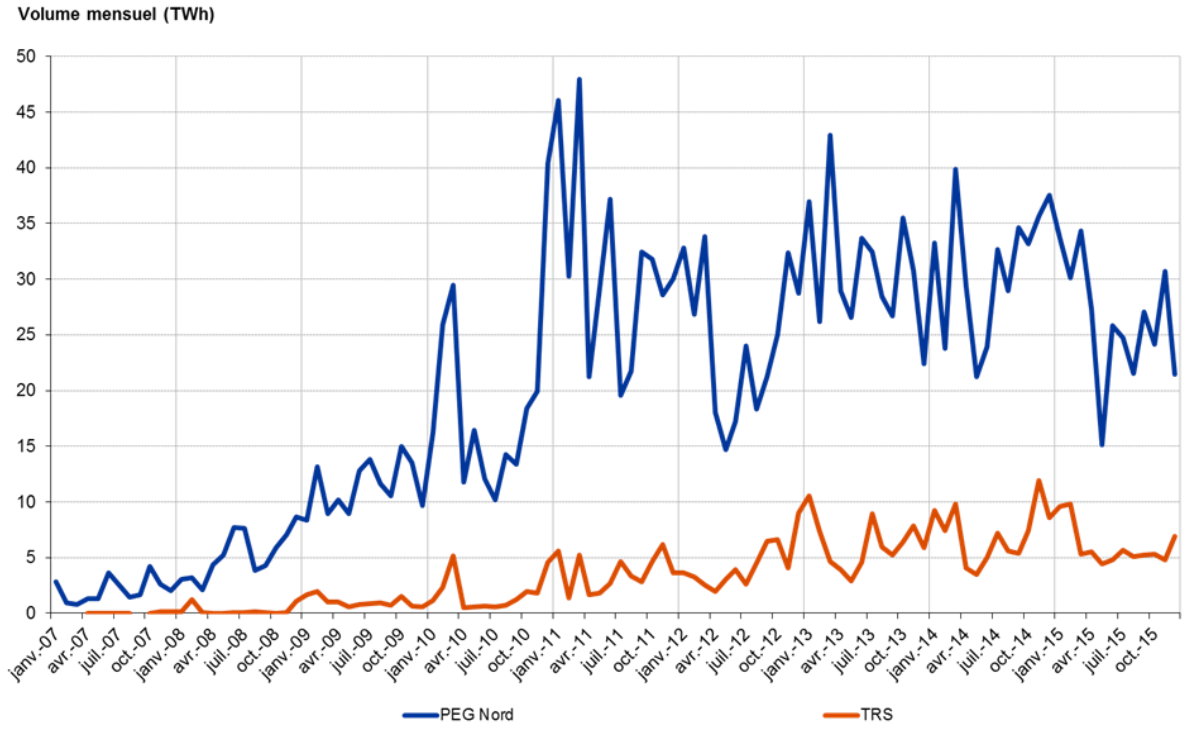
[42] Sources: GRTgaz and TIGF - CRE analysis.

More analysis of items in the 2015 CRE report on the functioning of wholesale markets for electricity, CO2 and natural gas

There also are 6 storage sites in the southern zone (Etrez, Manosque, Tersanne, Hauterives, Izaute and Lussagnet), which have a particular capacity for rapid withdrawal (storage in salt caverns). On average, over the gas winters of 2010 to 2015, the share of storage in total supply is around 20% in the north of the territory, while it can rise to 45% in the south of France. The flexibility offered by this type of storage is particularly important to ensure the continuity of the supply of gas customers in the south, especially when the supply of this area is constrained by congestion in the North-South link and the arrivals of LNG at Fos.

By virtue of its geographical position, and because of the stress on the North-South capacity, the southern area has a poorer degree of integration with liquid markets in northwest Europe than the North. Despite the disparities between PEG Nord and the Trading Region South, there is growing activity on the southern market. Exchanges, both short and long term, in the TRS, have multiplied by more than 200 since 2007 to reach 72.4 TWh [43] in 2015 (figure 29).

**Figure 29: Volumes traded at PEG Nord and TRS**




Sources: GRTgaz, TIGF – CRE analysis

[43] Source: GRTgaz and TIGF – analysis - CRE

More analysis of items in the 2015 CRE report on the operation of wholesale markets for electricity, CO2 and natural gas

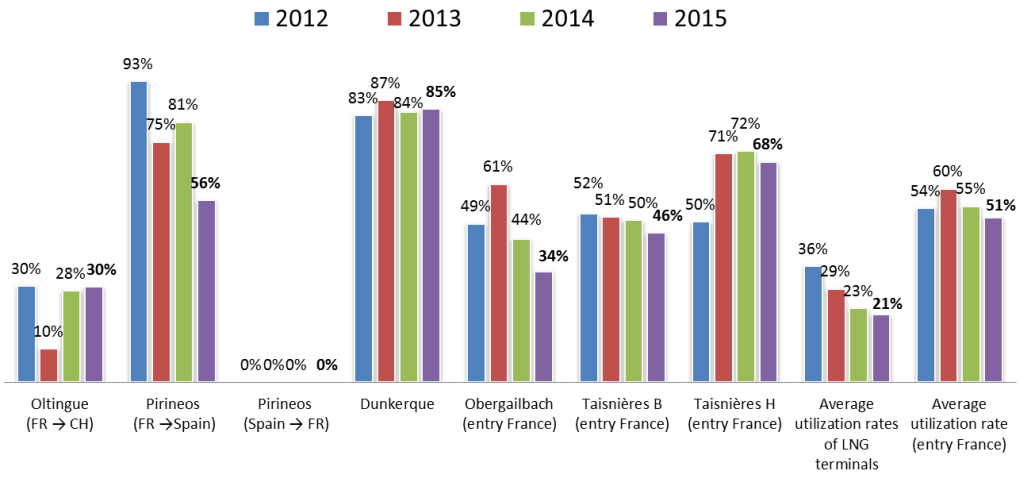
## 2.3. Analysis of Utilization rates and flow at interconnections

### 2.3.1. Heterogeneous utilization rates according interconnections

The average utilization rate of import infrastructure to France has been decreasing since 2013. In 2015, it reached its lowest level in 4 years 51% (Figure 30).

The rates of use of French interconnections are diverse. They were generally lower in 2015 compared to 2013 and 2014, with the exception of the interconnection point of Dunkirk, whose utilization rates remain high at around 85% of actual technical capacity (Figure 30). Tensions with Russia and the availability of LNG explain the bulk of changes, especially at the interconnections with Germany and Spain. This average utilization rates are a reflection of decisions made by market participants and the stagnation of French consumption.

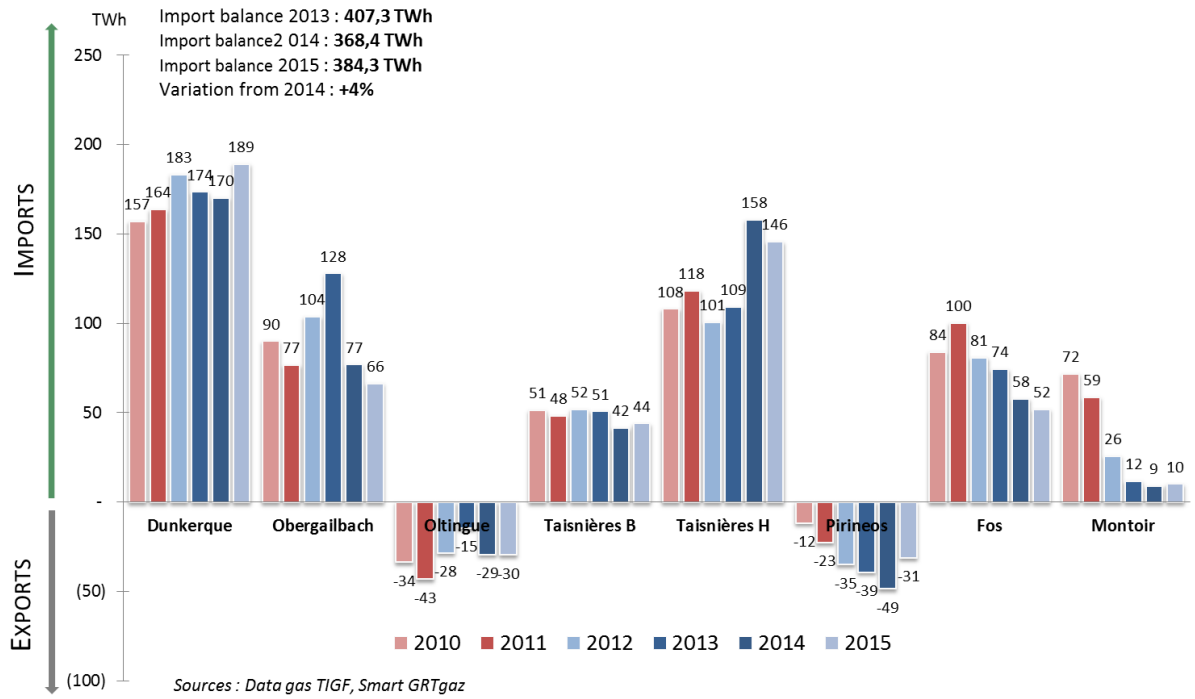
**Figure 30: French interconnection utilization rates (% of effective technical capacity)**




*Sources: GRTgaz and TIGF – CRE analysis*

Note: the interconnection of Pirineos: lower utilization rate from 93% in 2012 to 75% in 2013 is due to increase in firm capacity available to 165 GWh/d from April 2013.

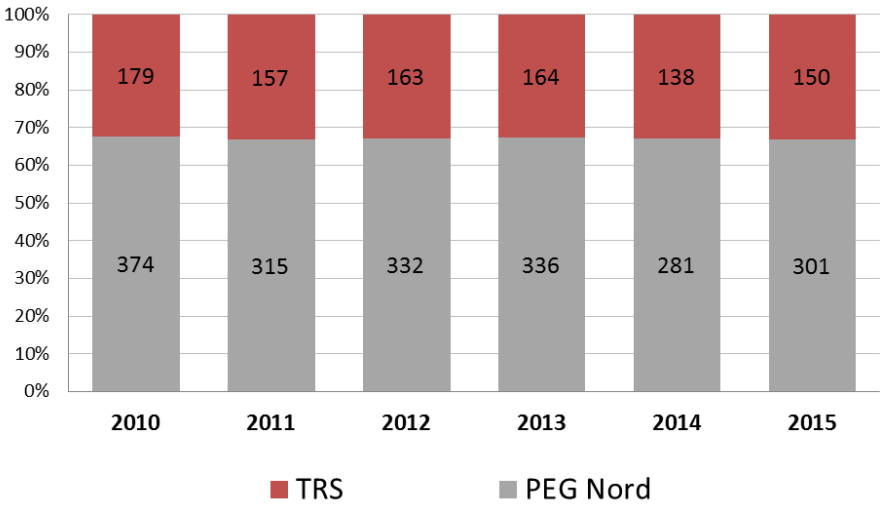
**Figure 31: Evolution of balance of imports / exports by cross-border interconnection (TWh / year)**




### 2.3.2. In the north, the interconnections with Germany and Belgium provide flexibility

The total gas consumption in the North of France (industrial, business and residential consumption) represents, since 2010, two thirds of gas consumption in France. It has seen a downward trend despite an increase in 2015 of 7% compared to 2014, up to 301 TWh. Gas consumption in the PEG Nord decreased by almost 20% in 5 years. It amounted to 374 TWh in 2010.

**Figure 32: Gas consumption in France (unadjusted climate)**




*Source: TIGF and GRTgaz, analysis: CRE*

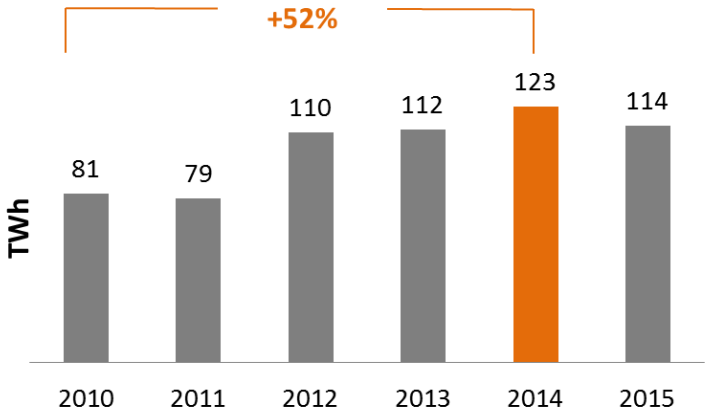
The entire supply of the North area comes from interconnections with Germany, Belgium and Norway, and LNG terminals (Figure 34). LNG contribution to supply in the North area fell by a factor of 4 in 5 years to reach 10 TWh in 2015; many cargoes were diverted to other markets. In this context, the interconnection with Germany had a very important role as illustrated by the increase in net annual flows at Obergailbach from 23% to 128 TWh in 2013 (Figure 31). Since 2014, however, imports from Germany are being replaced by those from Belgium, which reflects the trade-offs made by market participants in the face of the uncertainties of transit through Ukraine. Net flows at Obergailbach fell by half to 77 TWh in 2014 and 66 TWh in 2015. In contrast, net flows at Taisnières H increased by 45% between 2013 and 2014 to 158 TWh, before declining slightly in 2015-146 TWh (Figure 31). In 2015, the decline in Belgium imports was offset by an 11% increase in those from Norway.

Fluctuations and switching between entry points in PEG North are indicative of the effectiveness of the wholesale market, allowing market participants to decide between the different sources of supply available to them, depending on their competitiveness.

Exports to Italy via Switzerland at Oltingue, returned in 2014 and 2015, to their 2012 level (around 30 TWh), after falling by half in 2013 following a technical incident on the transit network in Switzerland. Storages in winter brings flexibility to the gas system and allows it to cope with demand peaks. In the gas winters of 2010 to 2015 (Figure 35), the contribution of storage to total supply in the North area was stable at around 59 TWh. The mild temperatures explain the very low recourse (-14%) to storage during the 2013-2014 and 2014-2015 winters.

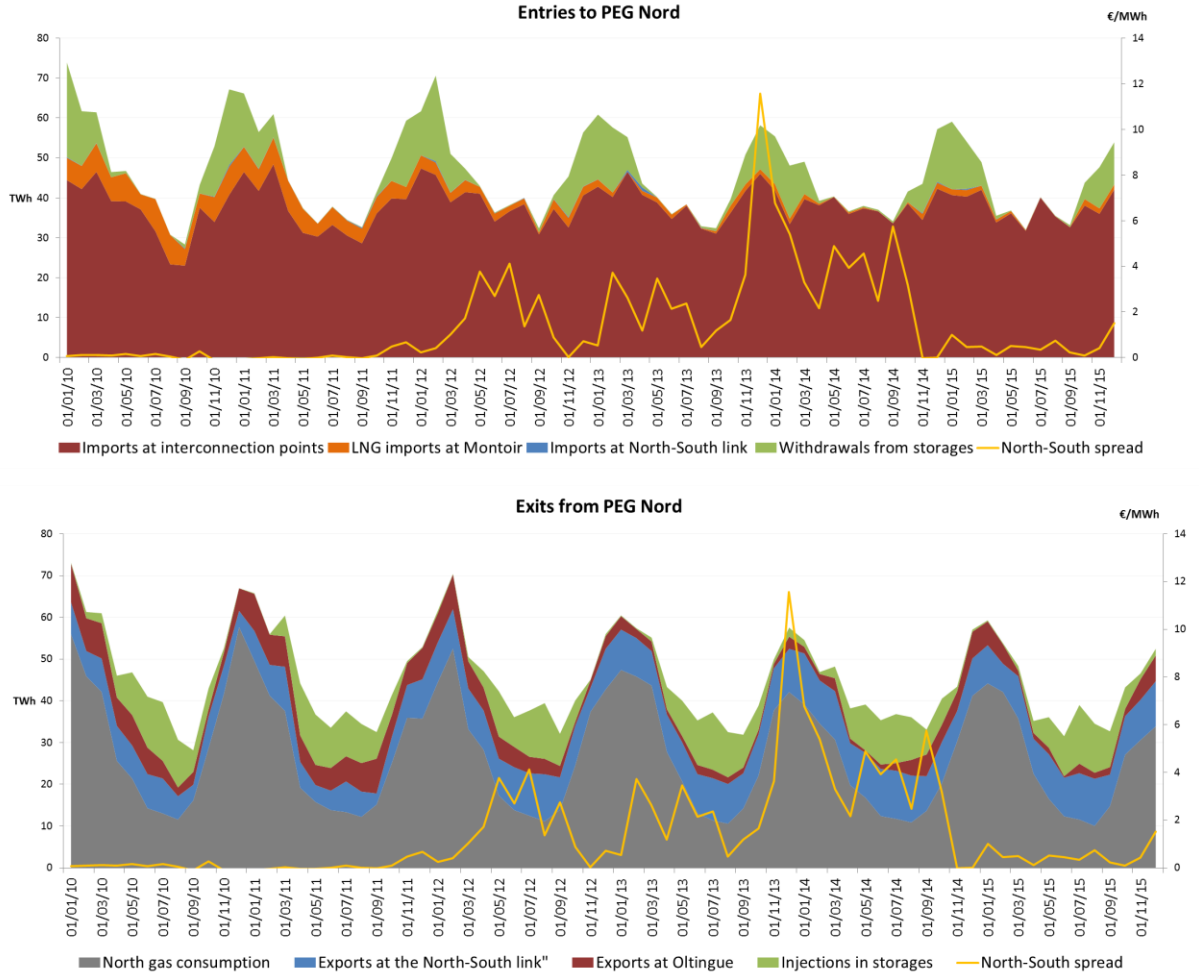
The analysis of gas flows since 2010 (Figure 34) highlights the strong demand on the North-South link, especially in the winters of 2011-2012, 2012-2013 and 2013-2014 due to the diversion of cargoes from Europe to Asia. North-South flows, close to 81 TWh in 2010, increased 52% in 4 years, to reach 123 TWh in 2014. They decreased by 7% between 2014 and 2015 to 114 TWh (Figure 33).

**Figure 33: Average annual flows at the North-South link (TWh)**



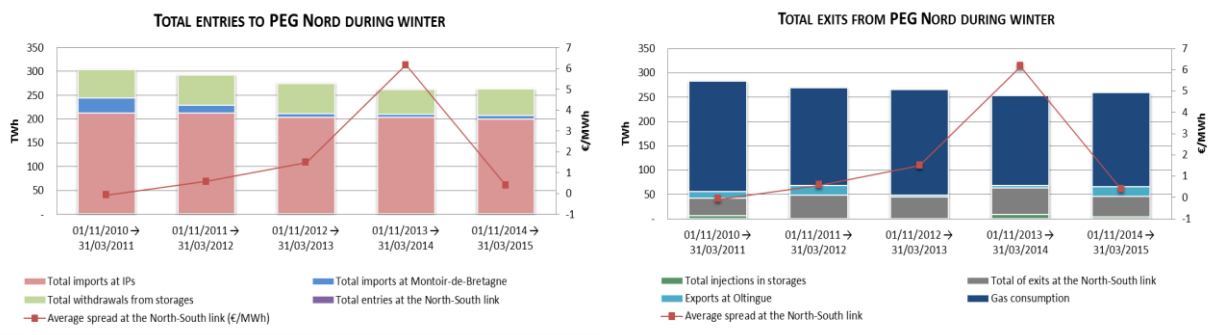

*Source: GRTgaz, analysis: CRE*

## Figure 34: Entries and exits in the north of France (2010-2015)




*Sources: GRTgaz and TIGF – CRE analysis*

## Figure 35: Structure of supply of the PEG Nord during the gas winter

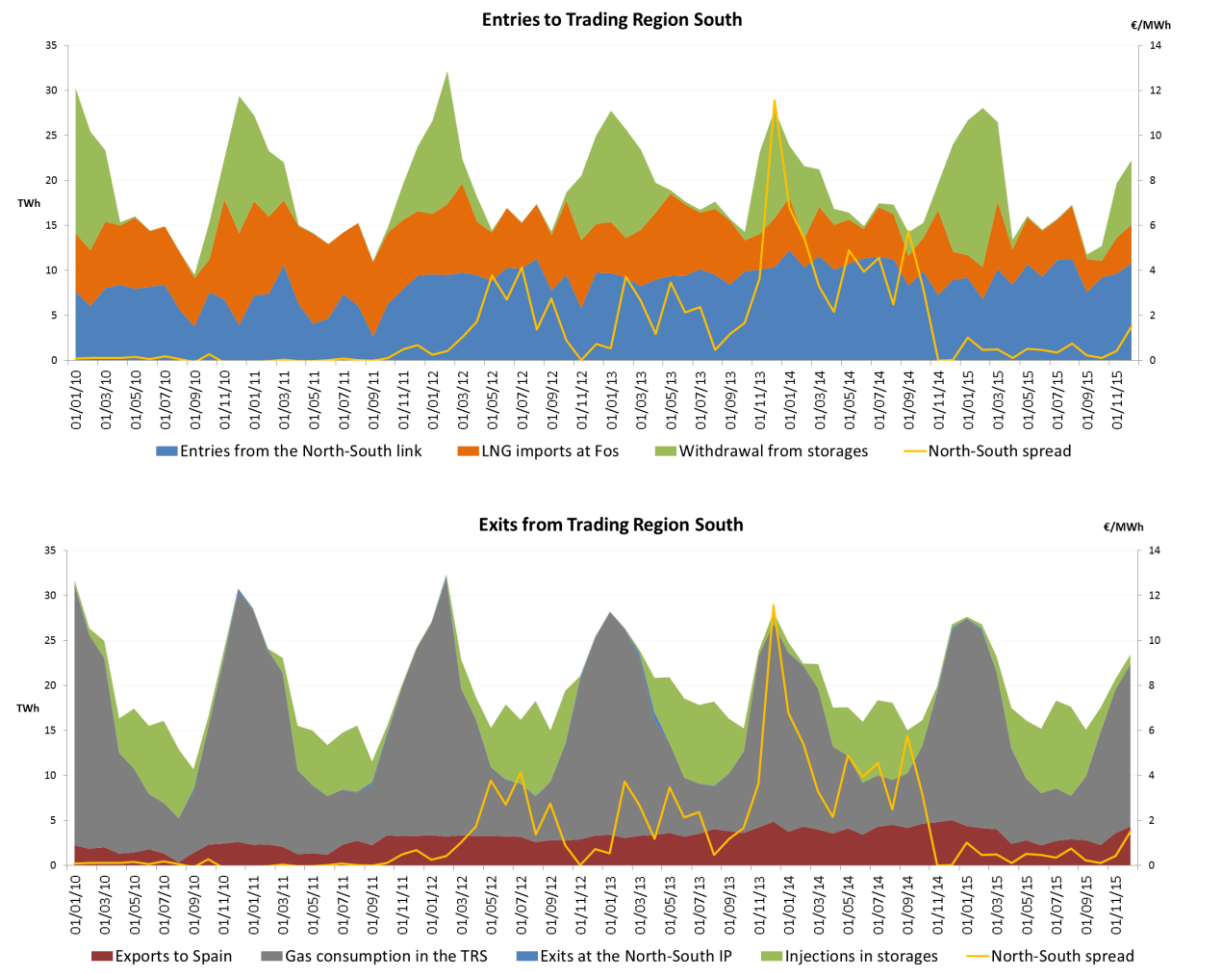



*Sources: GRTgaz and TIGF, CRE analysis*

### 2.3.3. Southern area dependent on LNG

Total consumption of gas in the Southern area (TIGF and South GRTgaz areas) represents on average one third of total French consumption over the period 2010-2015. It decreased by 23% between 2010 and 2014 (unadjusted for climate), reaching 137.8 TWh in 2014, under the triple impact of the economic crisis which hit industrial production, a very warm winter in 2014 and energy efficiency measures in individual homes (Figure 32). In 2015, the total gas consumption of the southern area increased by nearly 10% to 150 TWh, in particular thanks to the resumption of production of electricity from gas (Figure 32).

**Figure 36: Entries and exits to the south of France (2010-2015)**




*Sources: GRTgaz and TIGF, CRE analysis*

Analysis of the entries in the southern area in the past 5 years shows the net decrease in the share of LNG imports from the Fos terminals (Figure 36). LNG outputs from Fos Tonkin and Fos-Cavaou, which amounted to 100 TWh in 2011, fell by a factor of almost two in five years to 52 TWh in 2015.

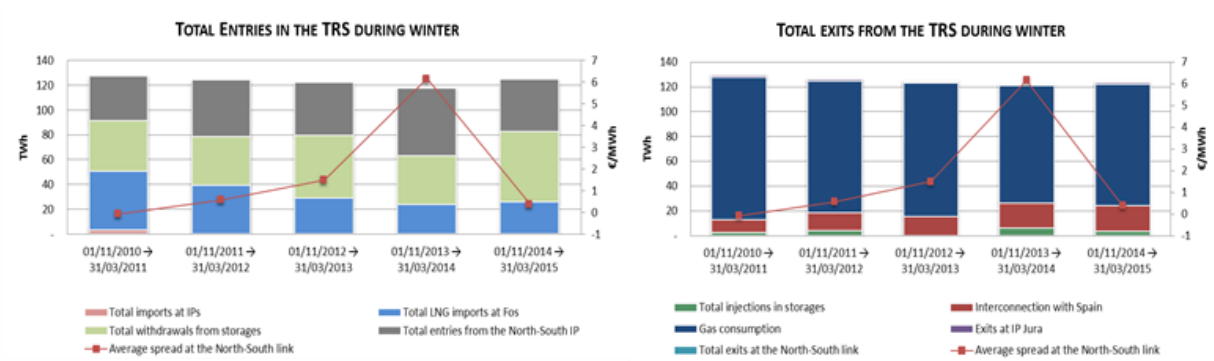
Since 2010, market configuration changes led stakeholders to use various flexibility levers offered by infrastructure in the South to provide supplies to southern customers. Despite the decline in the share of LNG in the supply mix, there have been no supply problems in South in recent years.

During the winter of 2012-2013, which was cold, utilisation of stored supplies increased by nearly 30% over the 2011-2012 winter to hit 50.43 TWh (Figure 37). Over the same period, total entries via the North-South link fell by 7% to 42.6 TWh. In a context of a strong decrease of LNG unloading in the South (-26% in one year), market stakeholders opted to withdraw gas from storage rather than transit gas from the North.

Conversely, during the winter 2013-2014, withdrawal from storage fell by 22%. To compensate for weak utilisation of storage and the substitution of LNG, stakeholders increasingly utilised the North-South link, which led to it being used to its limit - the North-South differential prices sometimes reached 16.77 € / MWh. The availability of the North-South link was however increased as compared to the previous winter. Since June 2013[44], GRTgaz has marketed a new product that improves the technical capacity of the North-South link. The Joint Transmission Storage service (JTS) allowed an offer for the sale of 6 additional TWh in 2014 and 5.4 TWh in 2015. Between 2014 and 2015, the level of take up of the JTS has varied depending on the price differential between PEG Nord and Trading Region South.

During the winter of 2014-2015, entries from the north fell by 23%. Given a high level of filling of storage facilities at the beginning of the winter compared to the previous year, market participants withdrew from gas storage rather than importing gas from the North, even as price gaps between the two regions fell sharply. The North-South maximum price gap then rose to 2.15 € / MWh, its lowest level since the winter of 2010-2011. The volumes withdrawn from storage increased by nearly 45% to represent nearly half of all entries from the south (Figure 37).

**Figure 37: Structure of supply of the Trading Region South during the gas winter**




*Sources: GRTgaz and TIGF, CRE analysis*

[44] Deliberation of 30 October 2013 on a decision concerning the marketing rules by GRTgaz for additional transmission capacity linking the North and South zones

An analysis of exits to the south highlights the fact that France plays an important role in the operation of the Spanish market, especially when the price of LNG is high. Total exports of gas to Spain were multiplied by 4 between 2010 and 2014 to 49 TWh following upgrades between France and Spain, raising capacity in both directions to 165 GWh/day (Figure 31). In 2014, they covered on average 16% of total gas consumption in Spain, at 302 TWh[45]. Because of decisions made by market participants as a result of the Fukushima disaster, supplies to southern France and the Iberian Peninsula were increasingly covered by imports from the north and storage during winter, LNG being redirected as much as possible to the Asian markets. In 2015, the decline in LNG prices in the international market led market participants to substitute imports from France with more imports of LNG and pipeline gas from Algeria. Exports in the France to Spain direction declined from 49 TWh to 37 TWh.

Nominations in the Spain to France direction were recorded, especially between the months of March and September 2015, with a record in July 2015 close to 57 GWh/d. Interconnection capacity between France and Spain, however, were used exclusively in the north to south direction, even in a context of lower LNG prices. In late 2015, nominations from South to North returned to a near-zero level.

## 2.4. The merger of market areas in France: streamlining the flow of gas on the North-South axis

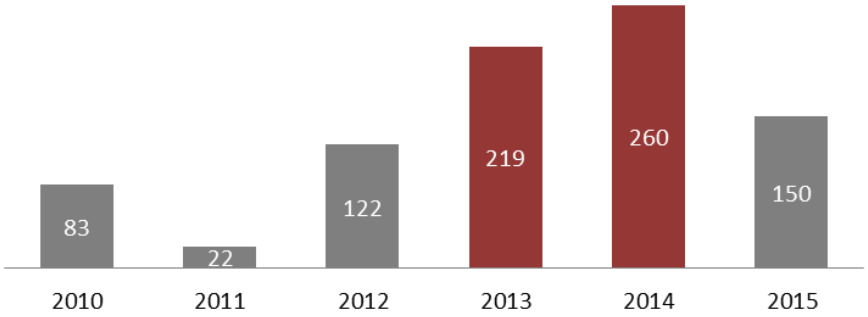
Since April 2015, the French gas market has consisted of only two market areas: PEG Nord and the Trading Region South, following the merger of the gas exchange points (PEG) South GRTgaz and PEG TIGF. There is a single wholesale price for gas in the southern region. The single market area in the South must in particular increase liquidity and contribute to a more competitive retail market. The creation of the Trading Region South is part of a movement towards reduction of the number of market places in France, initiated in 2003, in particular with the finalisation of an enlarged PEG Nord on 1 January 2009.

The evolution of the price differential between the north and the south is due to the geographic restrictions between the North and South and the different supply structures. Declining south LNG imports due to higher LNG prices, combined with low subscriptions of storage in 2013-2014 resulted in a very high utilization of the connection between the North and South GRTgaz areas. The level of physical congestion at this point reached unprecedented levels in 2013 and 2014 when the average utilization rate of the capacity was approximately 94%[46] (67% in 2011) and the capacity was used at a level higher or equal to 98% for 260 days in 2014 (22 in 2011) (Figure 38).

[45] Source: Cores 2015

[46] Source: Smart GRTgaz

**Figure 38: Number of incidents of physical congestion in the North-South link (Utilization rate >= 98%)**



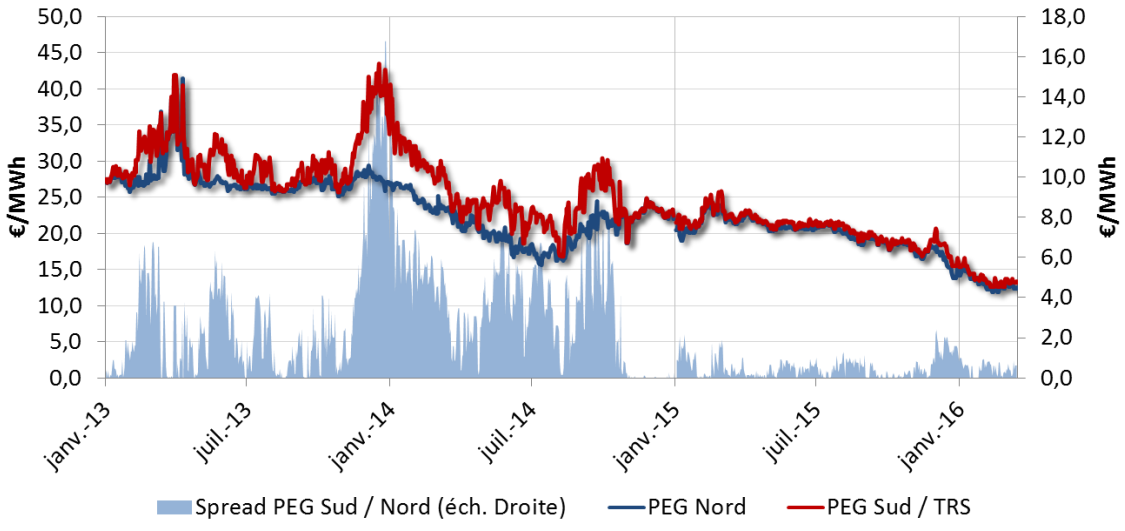

*Sources: Powernext – CRE analysis*

Congestion at the North-South link led to an increase in the price differential between the two areas. At an average of 2.9 € / MWh for 2013, the PEG North - South PEG price gap exceeded 16€/MWh for several days in the winter of 2013-2014. These price conditions in the south affected the competitiveness of industrial consumers, in particular gas intensive users.

The high filling rate of storage facilities in the south of France, the mild temperatures in early winter 2014-2015 and the decrease in exports to Spain due to lower LNG prices reduced congestion at the North-South link at the end of 2014 (Figure 38).

The evolution of price differentials between the North and South GRTgaz[47] zones illustrates this point. They averaged around 0.53 €/MWh in 2015 against 3.52 €/MWh on average in 2014. In 2015, they never exceeded 2.15 €/MWh, their lowest level since 2011 (Figure 39).

**Figure 39: Evolution of PEG North / TRS daily spread**




*Source: Powernext – CRE analysis*

[47] More analysis of items in the 2015 CRE report on the operation of wholesale markets for electricity, CO2 and natural gas

In July 2012, the CRE has set out a roadmap for reducing the number of market places in France and has set 2018 as the deadline for the completion of PEG France. The CRE commissioned a consultant to conduct a cost / benefit analysis of the investments needed to smooth the flow across the country and allow for the merger of the areas in France, and asked TSOs to carry out detailed studies to enable decision making in H1 2014.

While the decongestion of the North-South axis is a priority for the proper operation of the market, it requires significant investments in the French transport network. The existence of several entry-exit areas in France typifies the technical and physical limitations in the transfer of gas between one area's entry point and another's exit point. The investment scheme was initially identified based on the realization of the Val de Saone project, estimated at € 650 million, associated with the realization of Eridan project, estimated at € 484 million on their approval by the CRE in 2011 but the cost was revalued to € 620 million in light of additional studies.

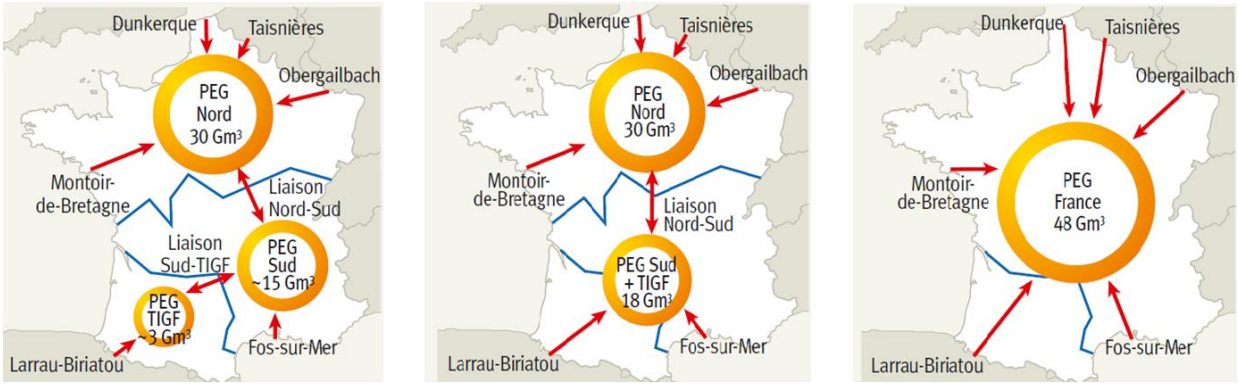
In 2013, an alternative to Eridan project was proposed by GRTgaz and TIGF. This project, Gascogne-Midi, is estimated at € 173 million [48] for both operators and could also be realized in 2018. The pipeline enables the market areas in France to be merged, but its ability to deliver more gas in the South to North direction has not been confirmed by French TSOs at this stage.

The CRE finally adopted the development plan involving the Val de Saône and Gascogne-Midi projects to decongest the French network at a much lower cost than the Eridan option. This is justified by the need to control the development of infrastructure costs, in a context of uncertainty about the evolution of gas demand in Europe. In addition, the recent tensions on the LNG market show a clear preference of market participants for capacity utilization in the North-South direction, for which the Gascogne-Midi project is sufficient.

GRTgaz has filed a cross-border allocation of costs between France and Spain for the project Val de Saône, which appeared in the list of projects of common interest published by the European Commission on 14 October 2013. In their joint decision on this request, the CRE and the Spanish regulator, the Comisión Nacional de los Mercados y la Competencia (CNMC), stressed the importance for the Iberian Peninsula to be directly connected to a marketplace of the size of PEG France. More generally, the CRE and CNMC have concluded that the creation of PEG France would go in the direction of the target model and benefit the European market as a whole.

[48] Deliberation of the Energy Regulatory Commission of 30 October 2014 concerning the decision on the incentive regulation mechanism of Val de Saône et Gascogne / Midi projects

## Figure 40: Reduction in market places in France between 2013 and 2018




**2013 : 3 Market areas**

**As of April 1st 2015: 2 Market areas (joint PEG Sud-TIGF)**

**2018: 1 Market area (PEG France)**

# 3. Evolution of capacity bookings

Summary of messages:

- CRE is actively involved in the development and early implementation of the European network codes. This is the equally case for the CAM network code relating to the allocation of gas capacity, in force since November 2015, which allows harmonization at European level of allocation methods between Member States or between two market areas within the same member State. The capacity is allocated bundled via auctions , with 5 trading periods offered (annual, quarterly, monthly, daily and intraday). In France, the rules of NC CAM are applied at interconnection points with Belgium, Germany, Spain, Switzerland and the North-South link.
- Although capacity bookings via auction is low (on average in 2015 0.11% of the volume auctioned at the French CAM points was allocated), reservation levels are high in the French interconnections and the entry point from Norway. This is explained by the long-term pre-existing contracts taken up before the implementation of the NC CAM, and by the low level of congestion in France and more widely in Europe.

## 3.1. Capacity allocation methods

The NC CAM regulates the allocation of capacity at interconnections within the European Union, whether between Member States or between two market areas in the same Member State. However, the code does not address the allocation of transmission capacity with third party countries or to LNG terminals. Thus, in France, the interconnections concerned by the NC CAM are those with Belgium (Taisnières and Alveringem), Germany (Obergailbach) and Spain (Larrau and Biriatou) and the North-South link. Although Switzerland does not belong to the European Union, the CRE has decided to allocate the Oltingue interconnection capacity according to the rules of the CAM code. It asked GRTgaz to continue discussions with the adjacent operator FluxSwiss to permit the allocation of bundled products. This code addresses both bundled capacity, which are standard for firm capacity and, when there are still differences between the available capacity on both sides of an interconnection, unbundled capacity. Interruptible capacities can also be allocated unbundled.

The NC CAM allocates firm capacity, interruptible capacity and backhaul capacity (in the opposite direction of the physical flow) with 5 trading periods:

- Annual, at the auction of the first Monday in March
- Quarterly, at the auction of the first Monday in June
- Monthly, 3rd Monday of each month
- Daily, the preceding day at 16:30
- Intraday, hourly

The implementation of auctioning for bundled products, as provided for in the European network code was made possible by the creation of a common booking platform, PRISMA platform, operational since 1 January 2013, at the initiative of 16 TSOs including GRTgaz, the German TSOs Open Grid Europe and GRTgaz Deutschland and the Belgian TSO Fluxys. On 1 January 2014, TIGF joined the shareholding of PRISMA for the implementation of auctions with Spain. In February 2015, the Spanish and Portuguese TSOs, Enagas and REN signed an association and service delivery agreement with PRISMA. Thus, the capacity of all French interconnection points is allocated on this single platform, whose features were gradually developed and guarantee a capacity allocation in compliance with all the network code provisions from 1 November 2015.

At the interconnection points where the network code applies, all capacity products are now bundled and allocated via auctions. A minimum quota of 10% of the marketable firm annual capacity is reserved for quarterly capacity auctions. A second minimum quota of 10% of annual firm capacity is dedicated to the sale of products over a period of 5 years (Article 7 (a) CAM). From the 6th to the 15th year, a maximum of 80% of capacity was sold on an annual basis.

The capacity remaining unsold at the auction is sold in shorter term capacity auctions. The CRE, which contributed to the elaboration of the CAM network code, in force since November 2015, has applied it to all interconnection points, including the North-South link, in advance of deadlines.

## 3.2. Application of the CAM network code to the North-South link

At the North-South link, capacity is sold via auction since 2014[49], as planned by the European CAM network code. Interruptible products are marketed only when 95% of the firm capacity is sold at the annual auction. The auction premium is fully redistributed to shippers who supply customers in southern France, in proportion to the consumption of these customers. Capacity requests from each sender are capped at 20% of North-South capacity auctioned to avoid monopolisation of the market in the South area and thus ensure a sufficient level of competition.

The realization of a single market place is planned for 1 November 2018, with the merger of the North and South areas of GRTgaz, thus no capacity at the link is currently marketed beyond this period. Although no delay in the merger of the areas is expected to date, shippers have to cope with some uncertainty relating, in particular, to the need to subscribe capacity for the month of October 2018 one month in advance. This is why, in its decision of 3 February 2016, CRE asked GRTgaz to market the capacity on link North-South for an additional gas year, until 30 September 2019.

## 3.3. Capacity allocation at Dunkirk

Regarding the entry points with a country outside the European Union, the implementation of the CAM network code is not mandatory. However, CRE wishes as much as possible that consistent rules are

[49] CRE deliberation of 13th February 2014

applied at all French interconnection points, which is why the CRE asked GRTgaz in its decision of 13 February 2014 to study the terms and risks associated with the implementation of the network code at Dunkirk with Norway. Part of the capacity is allocated on short time scales in order to allow new entrants access to Norwegian gas. Thus, only 80% of the firm capacity and 80% of annual interruptible capacity can be allocated on a time scale of more than one year. Multiyear capacity is offered in two Open Subscription Periods (OSP) one in September of the preceding gas year and the other in February of the current gas year.

Capacity remaining unsold at the end of the long-term OSP is added to 20% of capacity reserved for product with a period of one year as part of an OSP sale.

Annual capacity remaining unsold at the end of the OSP is allocated on a first come, first served basis until the last day of month M-2 before delivery. An OSP is then organized in M-2 to assign monthly capacity. If unsold, this capacity is allocated on a first come, first served basis until the 15th day of month M-1.

Daily capacity is allocated on a first come, first served basis from the 20th day of the month preceding delivery. Finally, GRTgaz auctions each day daily any firm capacity still available.

Since 2011, the average annual rates for capacity bookings at Dunkerque has been close to 100%.

## 3.4. Overview of capacity auctions results

Since the launch of the PRISMA platform, more than 5 000 auctions, for all trading periods, were undertaken at different French interconnection points and on the North-South Link.

In total, since 2013, only 11% of auctions in France led to a capacity allocation. This low level was noted throughout Europe; it is explained by the significant level of pre-existing long-term contracts and the low level of congestion. In an environment where the market is at overcapacity, market participants mostly subscribe daily capacity according to their needs.

The North-South link is an exception: it alone accounts for 40% of auctions which resulted in bookings in France since 2013. The congestion between the north and the south of France since 2012, following the reduction in LNG unloading in the southern territory largely explains this singularity.

### 3.4.1. Auctions results at interconnections in 2015

The proportion of auctions which ultimately resulted in a capacity booking in 2015 remained stable at 11%. This low level is accompanied by low booking volume. On average in 2015, 0.11% of the volume offered at auction was booked.

In 2015, several trends emerge from the auction results, which includes all trading periods (excluding intraday auctions) held on Prisma.

**Figure 41: Auction resulting in a capacity booking in 2015 during CAM auctions**

| | Number of auctions resulting in a capacity booking *( % of auctions launched on PRISMA)* | | | |
|---|---|---|---|---|
| | March 2015 annual auctions | June 2015 quarterly auctions | Monthly auctions | Daily auctions |
| **Obergailbach** | 5% | 0% | 7% | 10% |
| **Taisnières H** | 14% | 0% | 32% | 15% |
| **Taisnières B** | 0% | 0% | 7% | 0% |
| **Oltingue** | 0% | 0% | 0% | 0% |
| **Pirineos** | 3% | 50% | 19% | 3% |
| **North-South link** | 89% | 50% | 13% | 26% |

*Source: PRISMA – CRE analysis*

In general, almost all auctions at interconnection points across all trading periods closed at the reserve price, with the exception of 6 daily auctions at Obergailbach[50]. Of the 3,815 auctions held in 2015 on the French Prisma interconnection points (excluding intraday auctions), only 304 resulted in a booking, or 8% of the total.

Little capacity booking was recorded at annual auctions: only 5 auctions, including 4 at Taisnières H, resulted in a capacity allocation. Market stakeholders also showed little interest for quarterly capacity, except for the interconnection with Spain where half of auctions resulted in a capacity allocation. Indeed, 500 MWh / d of capacity of bundled and 250 MWh / d of unbundled capacity was allocated for the 4 quarters, and was sold exclusively in the France to Spain direction.

Similarly, monthly auctions were very poorly booked, only 15% of auctions resulted in an allocation of capacity. At the Taisnières H interconnection, 12 auctions out of 37 led to allocations of small amounts of capacity (3.12 MWh / day of unbundled input capacity on the GRTgaz network from February to December 2015).

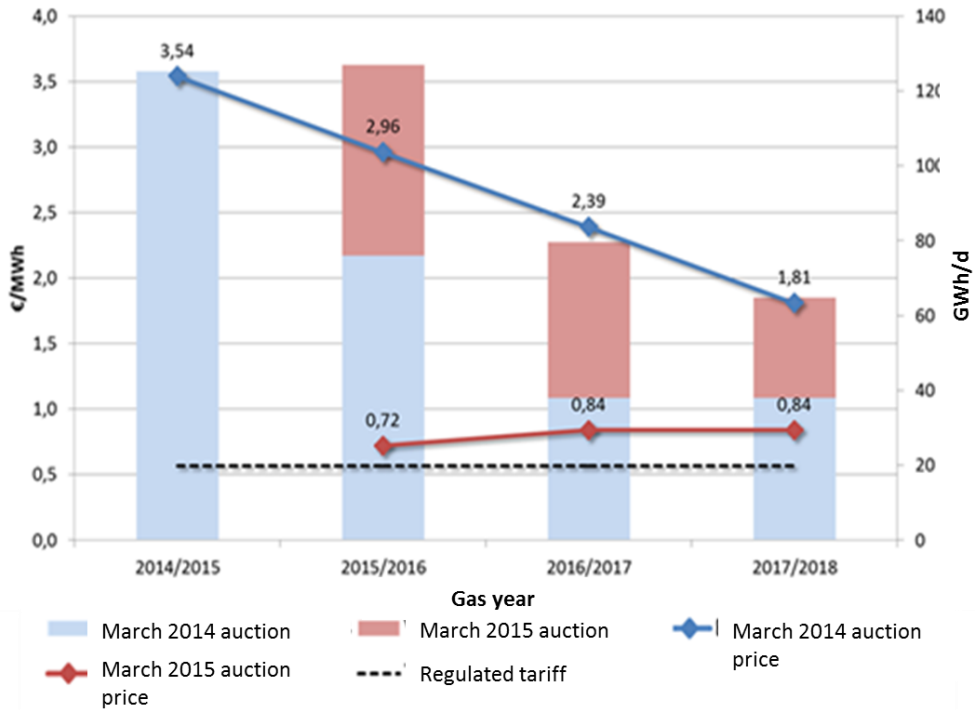
Most capacity take up was for daily trading periods. 88% of successful auctions – 268 auctions – were for daily capacity. However, the contracted volumes remain low in relation to the capacity offered. On average, the daily capacity allocated amounted to 1.5 GWh/d in Pirineos, 3.3 GWh/d at Taisnières H and up to 16 GWh/d at Obergailbach, mainly in the reverse direction.

### 3.4.2. Auction at the North-South link in 2015

Despite lower the price differential between PEG Nord and TRS in 2015, volume allocated in 2015 at the North-South link remained high. As in 2013 and 2014, auctions at the North-South link represented 40% of total auctions resulting in a capacity allocation; 90% of auctions closed at a premium in 2015 in France. The comparative analysis of the annual auction in March 2014 and March 2015 shows a decrease in the booking price. The auction premium, which reached 2.46 €/MWh in 2014, reached only 0.22 €/MWh in 2015.

[50] 3 auctions for "backhaul" capacity in August and September 2015 and 3 auctions on February 11, 2015

**Figure 42: Evolution of volume allocated in the 2014 and 2015 auctions at the North-South link**




*Source: PRISMA – CRE analysis*

**Figure 43: Capacity auction results in 2015 at French points on which CAM is applied**

| | March 2015 annual auctions | | | June 2015 quarterly auctions | | |
|---|---|---|---|---|---|---|
| | Number of auctions launched | Number of auctions resulting in a capacity booking | Number of auctions allocated with a premium | Number of auctions launched | Number of auctions resulting in a capacity booking | Number of auctions allocated with a premium |
| **Obergailbach** | 44 | 2 | 0 | 20 | 0 | 0 |
| **Taisnières H** | 28 | 4 | 0 | 12 | 0 | 0 |
| **Taisnières B** | 9 | 0 | 0 | 8 | 0 | 0 |
| **Oltingue** | 19 | 0 | 0 | 8 | 0 | 0 |
| **Pirineos** | 31 | 1 | 0 | 16 | 8 | 0 |
| **North-South link** | 9 | 8 | 5 | 8 | 4 | 0 |

| | Monthly auctions | | | Daily auctions | | |
|---|---|---|---|---|---|---|
| | Number of auctions launched | Number of auctions resulting in a capacity booking | Number of auctions allocated with a premium | Number of auctions launched | Number of auctions resulting in a capacity booking | Number of auctions allocated with a premium |
| **Obergailbach** | 45 | 3 | 0 | 1325 | 131 | 6 |
| **Taisnières H** | 37 | 12 | 0 | 795 | 117 | 0 |
| **Taisnières B** | 15 | 1 | 0 | 363 | 0 | 0 |
| **Oltingue** | 22 | 0 | 0 | 306 | 0 | 0 |
| **Pirineos** | 26 | 5 | 0 | 686 | 20 | 0 |
| **North-South link** | 24 | 3 | 0 | 702 | 180 | 35 |

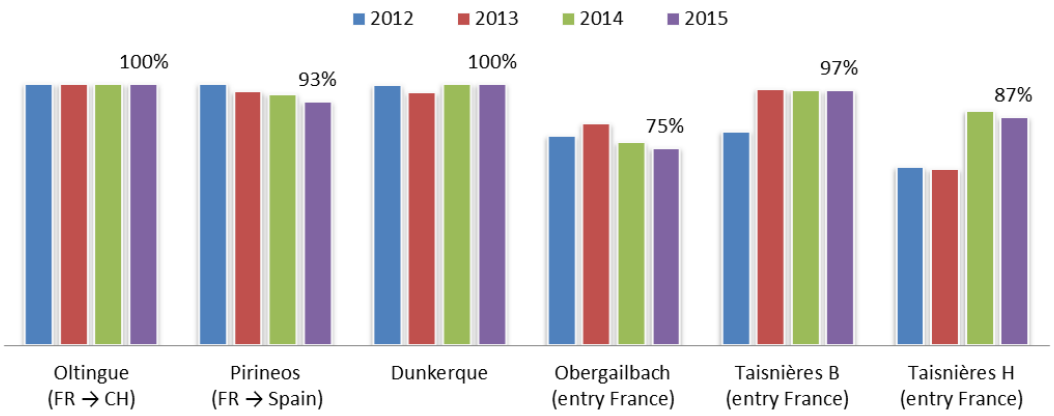
*Source: PRISMA – CRE analysis*

## 3.5. Long-term bookings remain high in France, in a context of generally weak gas demand

The subscription rate of annual firm capacity at French interconnections since 2012 was stable and high, reaching up to 100% of firm capacity offered in Oltingue, for exit to Switzerland, and at Dunkirk. They were very close to their maximum in Pirineos to Spain and Taisnières, originating from Belgium. Booking rates in entry at Obergailbach were stable at around 75%, but still lower than at other French interconnections.

Except in Dunkirk where net inflows were close to the maximum physical capacity of the interconnection, booking levels are well above the capacity utilization rate.

**Figure 44: Firm capacity bookings at French interconnections (% of firm capacity offered)**



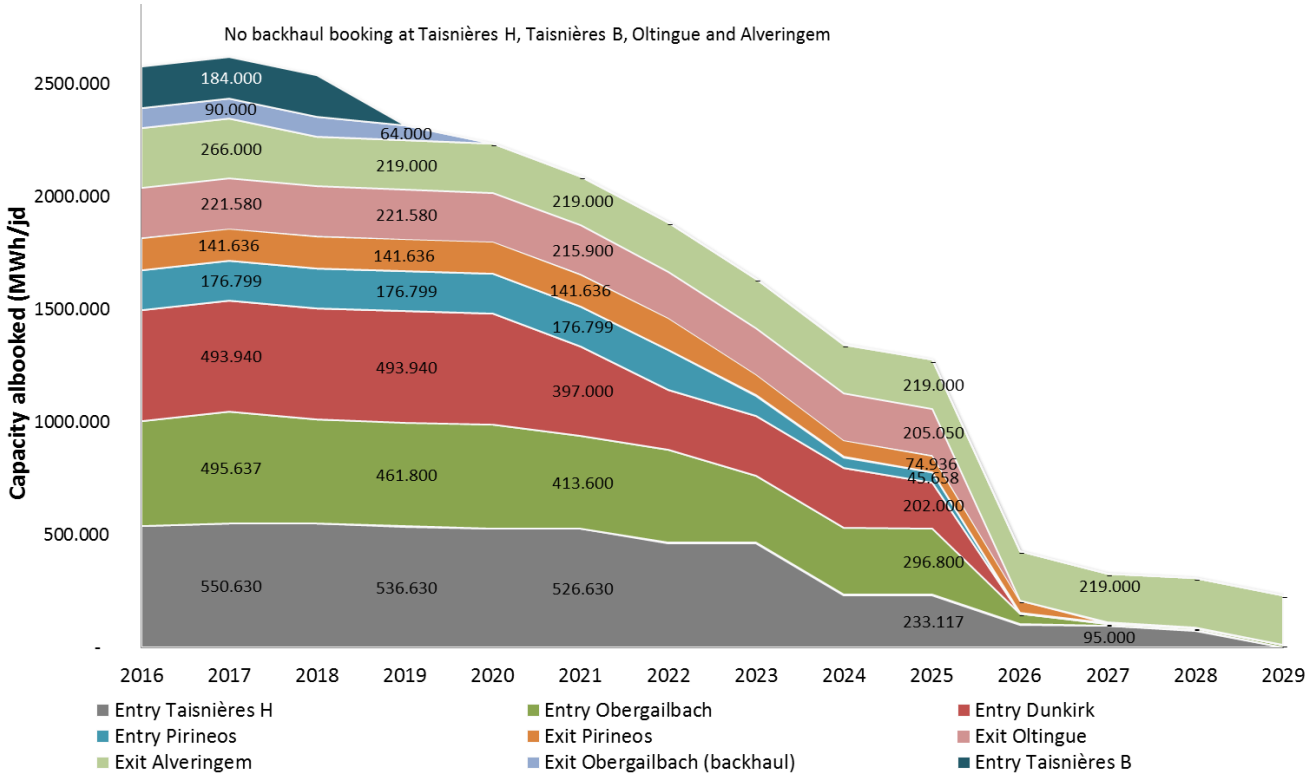

*Sources: GRTgaz and TIGF*

For 10 years, the integration of the European markets has necessitated the construction or upgrading of interconnections. In France, the CRE, by validating the TSOs development plans, endorsed the many construction projects facilitating the gas trade between France and adjacent countries. In total, an amount equivalent to € 3 billion was invested between 2005 and 2015 by the French TSOs. To ensure that these projects actually meet a demand on the part of market participants and do not constitute sunk costs for the gas system, their development has been coupled with firm long term bookings (Figure 45). These long-term reservations are also used to promote a certain price stability. CRE remains strongly committed to the principle that investment must be contingent upon a high level of long-term reservations in the open seasons procedures, and considers that they are necessary to ensure the economic viability of the gas system and to avoid the final consumer having to bear the costs associated with the development of capacity that may be underutilized.

In the coming years, the development of long-term bookings will be carried out in successive steps corresponding to the end of former long-term commitments. The decrease in reservations for French interconnections, which will begin in 2021 and will grow in 2025, should induce a significant change in market operation. While long-term contracts allow for a secure supply route, the integration of European markets led stakeholders to buy directly on the markets and over shorter-term periods. This shift of sales towards the short term should be accompanied by greater price instability depending on booking levels at interconnections.

Considering the level of reservations to date, for example, the reservation rate at Pirineos in the France to Spain direction is to fall from 86% to 45% from 2024, coinciding with the end of capacity contracts resulting from open seasons in 2013. Similarly bookings are to fall by half, from 80% to 40% in 2023 and 20% in 2026 in the Spain to France direction. At Taisnières B, at the entry to the French network, no more capacity is to be purchased from 2019, which means that bookings are likely to be made over shorter-term periods.

**Figure 45: Long-term capacity bookings at the French interconnections**




*Sources: GRTgaz and TIGF – CRE analysis*

## 3.6. Analysis of bookings for TSOs at the border

The situation of over-capacity in the gas market has led some stakeholders to express a desire to withdraw part of their long-term capacity reservations, which they consider to be sunk costs. These stakeholders would thus benefit from additional opportunities in booking short-term firm capacity provided by the CAM network code.

Unlike the French context, the legal framework of some adjacent countries authorized shippers to withdraw all or part of their capacity contracts. This has led to significant price instability and redistribution of network costs between stakeholders. As a result, there are now different booking levels on both sides of certain interconnection points.

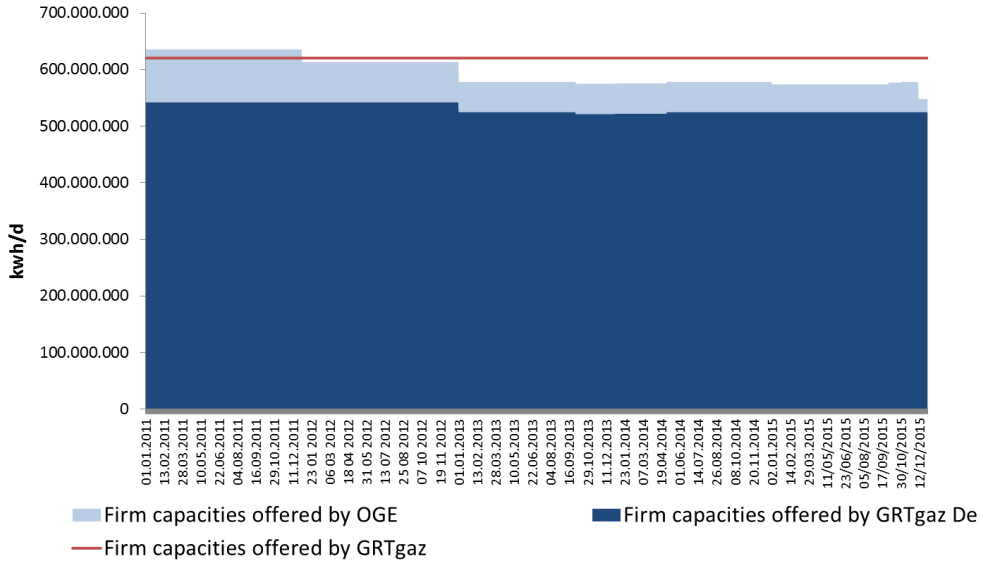
### 3.6.1. Obergailbach / Medelsheim

At the Obergailbach / Medelsheim interconnection, German federal law offers the possibility of withdrawal of long-term bookings when transport prices rise more than inflation. Withdrawals occurred, while in 2005-2006, Open Grid Europe (OGE) and GRTgaz jointly launched a capacity development project. In France, about €200 million was invested to bring firm entry capacity to 620 GWh/day on the French side in late 2009. The firm capacity released on the German side was reallocated by the German transmission system operators, OGE and GRTgaz Deutschland and, from late 2012, to other points on their networks for which demand was stronger. These reallocations, which until now were

only assigned in the short term could also be extended to longer-term trading periods if the capacity at this point is no longer in demand. This greatly concerns the CRE, which cooperates with its German counterpart to reconcile France's security of supply concerns and the legal obligation of the German TSOs to dynamically optimize their supply capacities.

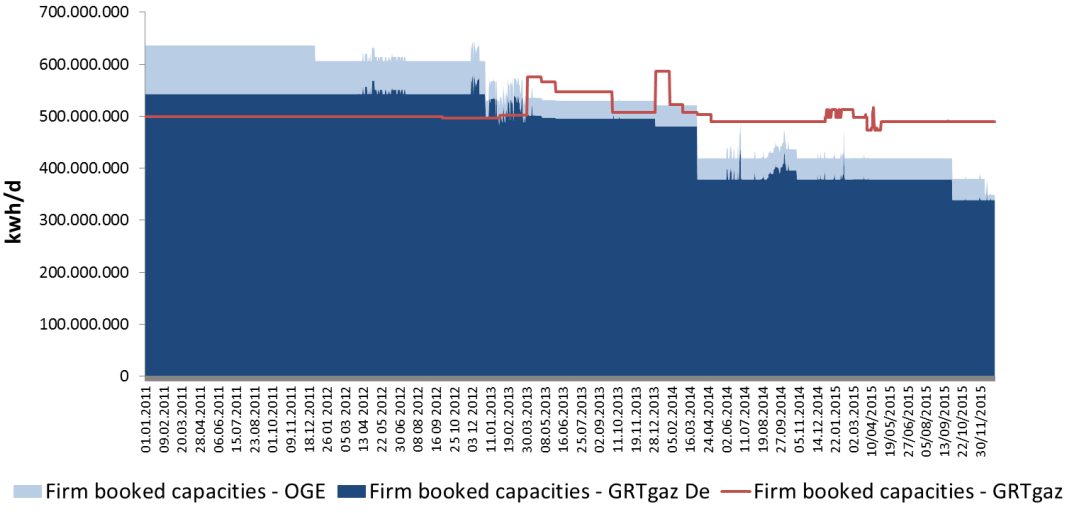
Germany capacity reallocations are reflected both by a mismatch between the firm capacity offered on both sides of the interconnection, and by asymmetric bookings. In late December 2015, the capacity offered by GRTgaz entry into the French transport network was approximately in excess of 50 GWh/d compared to that offered by OGE and GRTgaz Deutschland originating from Germany. Firm capacity booking was greater than 84 GWh/day on the French side compared to firm capacity booking originating from Germany.

**Figure 46: Evolution of firm capacity offered at Medelsheim / Obergailbach**




*Sources: OGE, GRTgaz Deutschland, GRTgaz – CRE analysis*

**Figure 47: Evolution of firm capacity bookings at Medelsheim / Obergailbach**



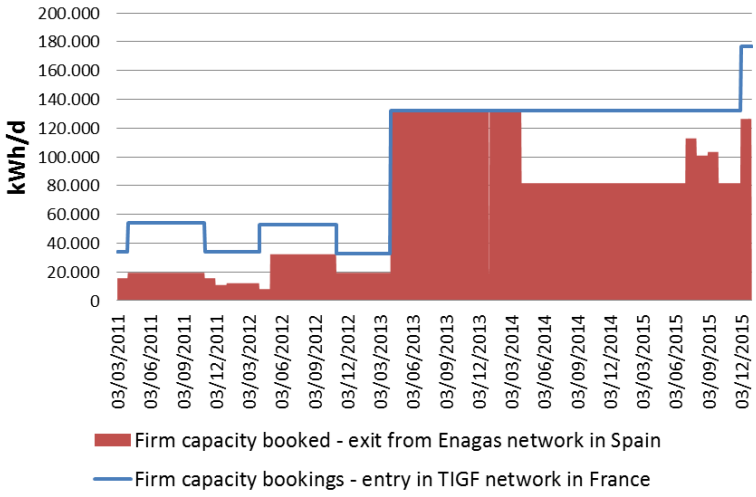

*Sources: OGE, GRTgaz Deutschland, GRTgaz – CRE analysis*

These reallocation decisions for long-term interconnection capacity, when taken unilaterally, are contrary to the spirit of cooperation promoted by the Third Package and degrade the security of European supply. The import potential from Germany is now guaranteed only up to about 570 GWh/day, which could be problematic after the creation of a single market area in France in 2018. Indeed, the cost-benefit study on the creation of a single area in France estimates at 65 TWh per year until 2022 additional flows that may result from investments undertaken as part of the merger of the areas, of which 80% is expected to come from the countries of Northwest Europe. In this perspective, long-term stable capacity at the interconnection with Germany is essential to secure supply for the French market and to prevent the new single market area becoming disconnected from the North West European markets.

### 3.6.2. Pirineos

The investments decided upon in 2009 and 2010 helped to increase the capacity of the interconnection to 165 GWh/day in both directions in April 2013 and to 225 GWh/d in the Spain to France direction in December 2015. The investment decisions were based at the time on long-term capacity bookings, in either the Spain to France or the France to Spain direction. Since 2011, the gas market has undergone major contextual changes with a shift in LNG trading toward the Asian market and a falling demand for gas in Spain and France. The scenario of gas flows from South to North was therefore more credible and the capacity from Spain to France no longer interested the market. In this context, some shippers chose to withdraw from the Spanish side, by March 2014, some of their capacity bookings in the Spain to France direction, since the regulations allow this measure. In late December 2015, the firm capacity bookings in entry in the TIGF network exceeded by 50 GWh/d the bookings in exit side of the Enagas network. Since withdrawal from long-term contracts is no longer permitted in Spain, this situation should not be repeated.

**Figure 4810: Difference between the firm capacity booked in exit from the Enagas network and entry into the TIGF network**




*Sources: TIGF, Enagas – CRE analysis*

This asymmetry in firm capacity bookings does not suggest that new investment in interconnection with Spain on the basis of market demand is reasonable. The unbooked capacity on the Spanish side should first find buyers before any such decision.

# 4. The development of new interconnection capacity

Summary of messages:

- For border capacity developments, CRE has always used open seasons procedures. The draft amendment to the network code on capacity allocation (CAM) for incremental capacity itself includes this principle of an economic assessment to validate an investment based on the level of demand.
- The numerous investments undertaken in France and at interconnections mean that the French gas system currently has a high resilience to various possible supply crises.
- As regards infrastructure projects that may contribute to security of supply in Europe, and for which market demand is too low to justify an investment, CRE considers that a cost-benefit analysis should be conducted in reaching the decision. Also, if cross-border infrastructure projects are developed for the purposes of security of supply across Europe, CRE considers that a cost-sharing effort should be made on the part of beneficiary countries of the project.

## 4.1. The role of open seasons procedures

CRE, which validates the development plans of the French TSOs, determines with them the infrastructures necessary to complete the internal market. In all cases, the identification of projects and investment decision is done in close collaboration with other operators and regulators involved as part of a dialogue with market participants to ensure that projects are sized to needs as far as possible.

Regarding projects to improve integration with neighbouring markets, an open season procedure prior to the investment decision was undertaken by the TSOs. This requires, for new infrastructure, the development of transport capacity according to the needs expressed by users, ensuring a sufficient level of coverage of costs through long-term bookings and aiming to ensure that consumers do not, by way of transmission tariffs, bear the cost of unnecessary infrastructure.

For ten years, all capacity increases at borders have been made in the context of *open seasons*. Conducted in two phases, they offer market stakeholders capacity for periods of at least 10 years; the investment decision is then made on the basis of an economic assessment which compares the value of capacity reservations and development costs. Investment is decided upon where the target level of financial coverage set out in the economic test during the open season procedure is reached. New procedures will soon be in place providing for changes to the CAM network code and the network code on the harmonization of tariff structures, which will provide for a procedure known as "incremental capacity," which codifies the open seasons in order to create new interconnection capacity. These new rules, which are part of the same approach as the open season procedures conducted in France for 10 years, should come into force in 2017.

**Amendment to the CAM network code on incremental capacity**

The amendment to the CAM network code on incremental capacity will base investment decisions on market demand. Incremental capacity will be offered along with existing capacity. This amendment to the CAM network code build at the European level on the principles of open seasons, especially the principle of an economic test to validate an investment according to the level of demand.

Market participants and Member States welcome the amendment to the code, which should be revised in comitology in the second half of 2016.

## 4.2. Development of projects relating to security of supply

The numerous investments in France over 10 years have created a flexible and well-interconnected French gas system. Market stakeholders may switch between the different gas sources available and hereby address potential changes in flow patterns. It is no longer necessary to devote investment to security of supply in France.

Regarding infrastructure projects that contribute to strengthening the security of supply in Europe, where the market demand is too weak to justify the investment, CRE is of the view that a cost-benefit analysis should be conducted in all cases before reaching a decision. Such analysis is necessary to avoid investments which are poorly matched to the objectives pursued, especially in a context of stagnation or even decline in gas consumption in Europe by 2050. In France, for the period 2015 to 2024, GRTgaz anticipates an annual drop in consumption of about 0.3% per year, mainly from the decline in consumption in residential areas (-0.8% per year) and industry (-0.7% per year); in this scenario, the declines were partially offset by a recovery in gas consumption for electricity generation from 2017 to 2018[51]. TIGF meanwhile anticipates lower gas consumption of about 0.1% per year, mainly due to lower consumption in the residential sector (-0.3% per year), partially offset by an increase in industrial consumption in the south of France[52]. In addition, the Law of 17 August 2015 on the energy transition for green development provides for a reduction in the primary consumption of fossil fuels of 30% in 2030, as compared to 2012.

Also, if cross-border infrastructure projects are developed for the purposes of security of supply across Europe, CRE considers that a cross border cost allocation (CBCA) should be made on the part of beneficiary countries of the project.

## 4.3. Interconnection capacity development projects

Two possible projects are listed in the development plans of GRTgaz and TIGF - a project to create output capacity to Germany and the MidCat project between France and Spain

[51] GRTgaz Decennial Plan

[52] TIGF network prospective development plan

### 4.3.1. MidCat project between France and Spain

Following the open seasons procedures in 2009 and 2010, interconnection capacity between France and Spain has risen sharply to 165 GWh/d in both directions as of 1 April 2013, and then to 225 GWh/day (60 GWh/d of firm capacity in the Spain to France direction and 60 GWh/d of interruptible capacity in the France to Spain direction) as of December 2015. Capacity commitments from shippers in these open seasons were not sufficient to pursue the MidCat project, which aims to create a third point of interconnection between France and Spain in the eastern Pyrenees.

Capacity increases undertaken in 2013 and 2015 already provide a good level of interconnection of the French and Spanish markets. Thus, a certain amount of capacity in both directions remains unsold and a significant portion of capacity booked is not used, especially in the Spain to France direction. In addition, the interconnection was used constantly in the France to Spain direction. Moreover, the available capacity should increase in the coming years as existing long-term bookings expire. Unless new requests from market participants are made, resulting in firm commitments through an open season, the CRE considers that the existing interconnection capacity can satisfy the market and security of supply needs of regional and more generally European markets.

As part of the MidCat project, the development of firm capacity of up to 230 GWh/d in the Spain-France direction and 160 GWh/d in the France-Spain direction would require, in addition to the new interconnection itself, upgrades to the internal French network, in particular through the implementation of the Eridan and Est Lyonnais projects. The total cost of investment required on the French side is estimated by the TSOs at over 2 billion euros.

Given the very high cost of such developments, the French and Spanish transmission system operators have studied the nature and volume of capacity that could be created by a smaller set of development works that on the French side would include only the pipeline between Barbaira compressor stations and Perthus, on the TIGF network.

The joint study of the TSOs concludes that, in this case, only interruptible capacity could be created. In particular, internal constraints on the Spanish and French networks mean that the effective availability of additional interconnection capacity between France and Spain depends on levels transiting to LNG terminals at Fos and Barcelona. Thus, the capacity in the North to South direction would be interrupted in case of excessive use of the Barcelona terminal and vice versa, the capacity in the South to North direction would be interrupted in the case of excessive use of the Fos terminal.

In the event of a supply crisis requiring the use of significant additional LNG imports, current levels of regasification capacity in Europe[53] and interconnection capacity between France and Spain appear sufficient in view of the expected availability of LNG on the global market: if the recovery in LNG imports continues, following a period since 2013 in which the average utilisation rate of terminals was

[53] In 2015, regasification capacity in Europe totaled 203 bcm. These capacities theoretically could satisfy around 40% of European gas demand. (Source GLE)

less than 20%[54], current European regasification infrastructures would be able to import at least twice as much LNG as the previous record of 2011. The North European terminals appear also to be the preferred destinations for LNG arrivals, both during normal operation of the market (because they are more liquid than other markets in Europe) and in the event of a supply crisis, where volume is routed to the nearest area of need. However, even assuming that Fos and Barcelona were significantly called upon to deal with such a crisis, interruptible interconnection capacity between France and Spain created by a reduced set of projects would then be effectively interrupted, thus bringing no special benefit, neither for France nor for Spain.

CRE considers that, given the capacity of the French system to cope with supply crises, MidCat contributes nothing to security of supply in France.

### 4.3.2. Development of exit capacity to Germany

The possibility of facilitating physical flows from France to Germany, amounting to 100 GWh/d of firm exit capacity at the Obergailbach interconnection point was studied by GRTgaz. Such a project would require, in addition to infrastructure to be constructed to allow the creation of capacity, changes in odorisation practices. Several options are being considered, including a shift towards decentralized odorisation. The total cost of investments needed for the implementation of decentralized odorisation across the GRTgaz network and the construction of structures necessary for the reversal of flow to Germany is estimated at around € 600 million.

A pilot facility is being implemented by GRTgaz on two sites, at Etroeungt and Bas Lieu (North) to assess in greater detail the technical feasibility and cost of this solution.

Given the time required for the construction of the works, the project could not be envisaged before 2022.

In addition, GRTgaz is studying alternative solutions based on the deodorisation of gas flows in order to lower the cost of export capacity. The establishment of a firm monthly capacity product to Germany on 1 April 2017 will test the usefulness of this capacity for the market.

If the needs of market participants appear insufficient, and in the absence of advantages for France in terms of security of supply, CRE is of the view that this project could not be implemented without a cross-border allocation of costs as provided for by Regulation 347/2013, if other Member States conclude that such a project would benefit their security of supply.

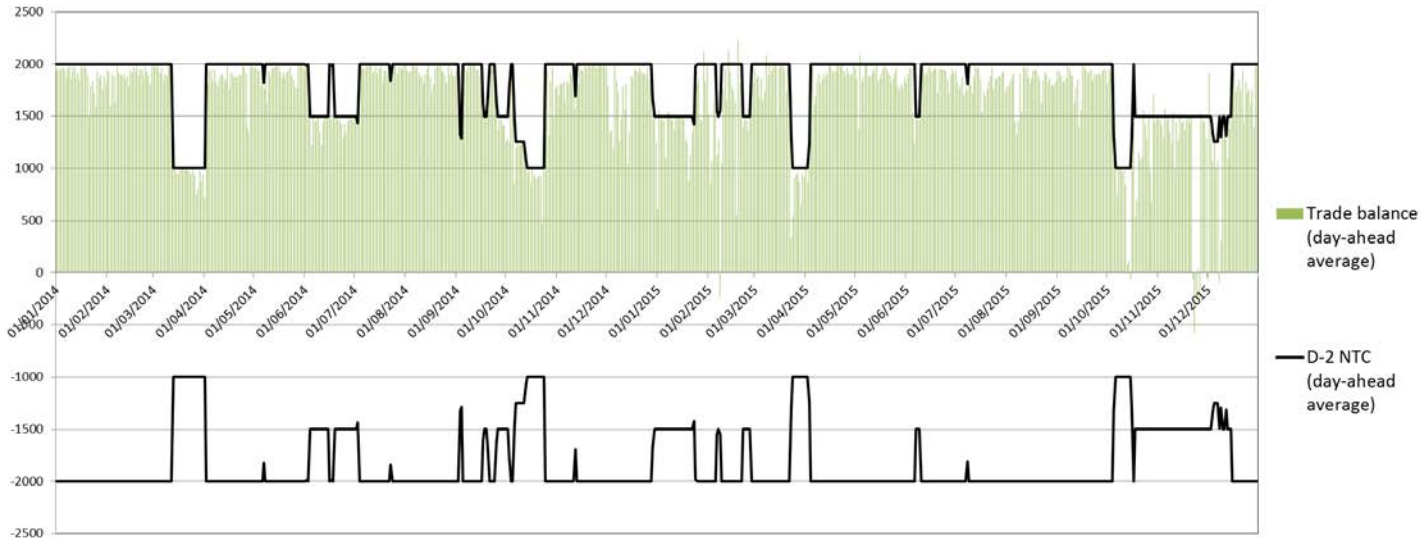
[54] Source GLE

# Index

## CAPACITY & FLOWS

**- Average capacity recorded in 2015 in the France – Great Britain direction:** 1,800 MW

**- Average capacity recorded in 2015 in the Great Britain – France direction:** 1,800 MW




**- Net import balance with France**: 14.1 TWh

**- Percentage of time the interconnection is used for export**: 97%

## CALCULATION AND ALLOCATION OF CAPACITY AT EACH TIMEFRAME

**Long term**

| | |
|---|---|
| Platform and allocation rules | CMS and EU HAR |
| Firmness regime | Specific firmness regime (compensation at initial price of auction or at spread with a double cap) |
| Capacity calculation | Non applicable |

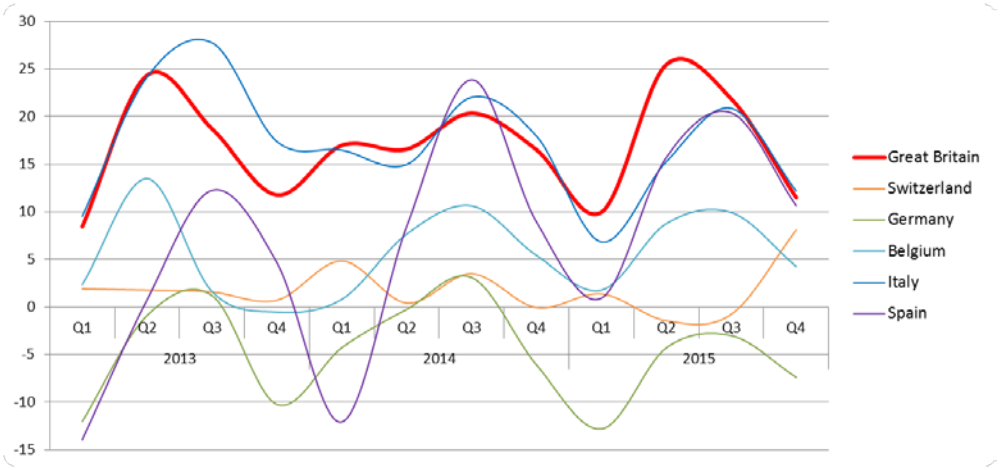
**Day-ahead**

| | |
|---|---|
| Allocation | Implicit (implementation of market coupling in February 2014) |
| Capacity calculation | No capacity calculation: thermal capacity of cable is allocated |

**Intraday**

| | |
|---|---|
| Allocation | Explicit |
| Capacity calculation | Residual capacity after day-ahead auction |

## SPREAD & CONVERGENCE




**- Average spread in 2015**: 17.22 €/Wh

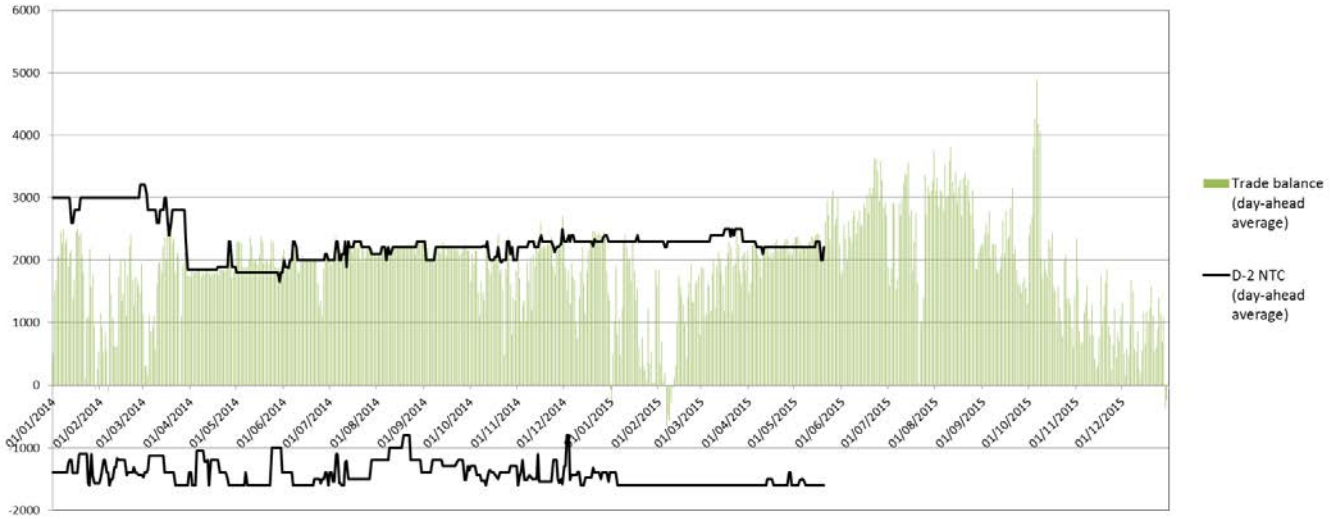
## INVESTMENTS

**2019:** Foreseen commissioning of a new 1,000 MW link by the company ElecLink Ltd.

## CAPACITY & FLOWS

**- Average capacity recorded in 2015 in the France – Belgium direction:** 2,300 MW[1]

**- Average capacity recorded in 2015 in the Belgium – France direction:** 1,600 MW[1]




**- Net import balance with France**: 16.5 TW

**- Percentage of time the interconnection is used for export**: 96%

## CALCULATION AND ALLOCATION OF CAPACITY AT EACH TIMEFRAME

**Long term**

| | |
|---|---|
| Platform and allocation rules | JAO and EU HAR |
| Firmness regime | HAR harmonised firmness regime |
| Capacity calculation | Non coordinated |

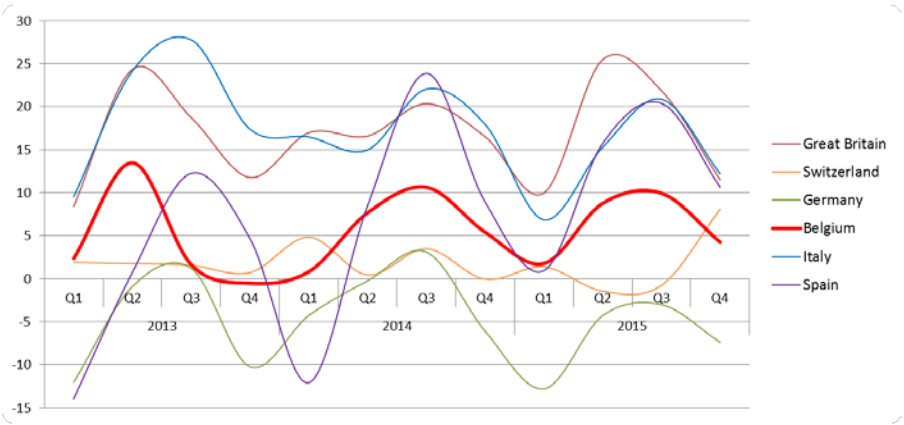
**Day-ahead**

| | |
|---|---|
| Allocation | Implicit (implementation of market coupling in 2007) |
| Capacity calculation | *Flow based* |

**Intraday**

| | |
|---|---|
| Allocation | Improved prorata-based allocation up to 2015, continuous explicit since early 2016, continuous implicit expected for September 2016 |
| Capacity calculation | Residual capacity after the day-ahead auction with common re-evaluation (since March 2016) |

## SPREAD & CONVERGENCE




**- Average spread in 2015**: 6.2 €/MWh

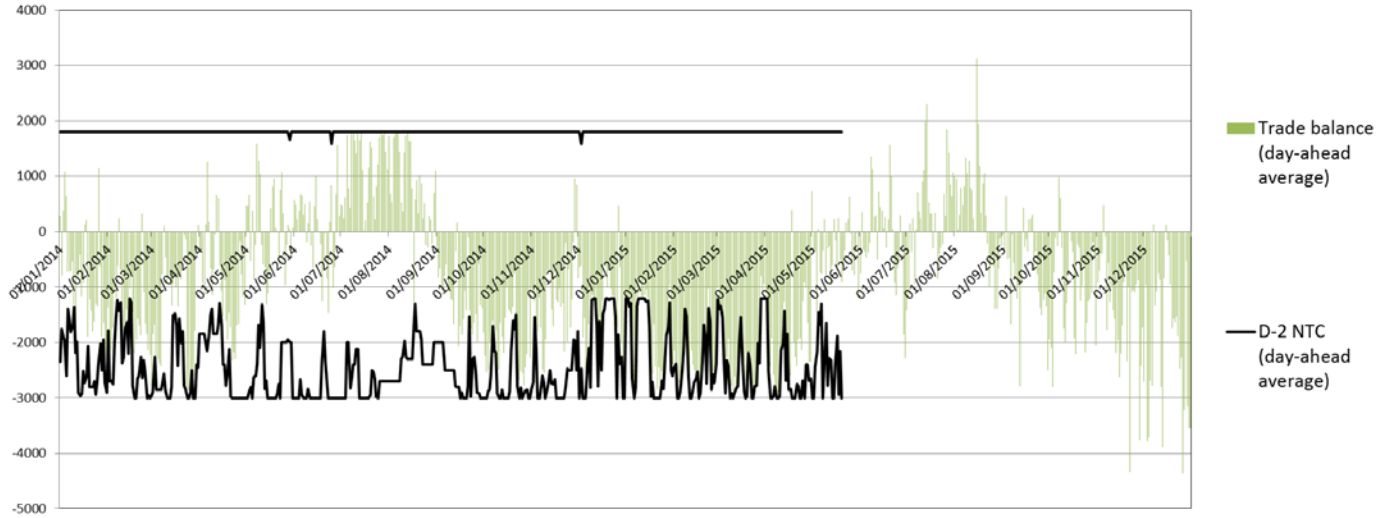
**- Price convergence in 2015**: 43.6% of the time

[1] Average values until the implementation of Flow Based, on 21 May 2015 (low seasonality of capacity)

## CAPACITY & FLOWS

**- Average capacity recorded in 2015 in the France - Germany direction:** 1,800 MW[1]

**- Average capacity recorded in 2015 in the Germany - France direction:** 2,400 MW[1]




**- Net export balance with France:** 9.4 TWh

**- Percentage of time the interconnection is used for export:** 24%

## CALCULATION AND ALLOCATION OF CAPACITY AT EACH TIMEFRAME

**Long term**

| | |
|---|---|
| Platform and allocation rules | JAO and EU HAR |
| Firmness regime | HAR harmonised firmness regime |
| Capacity calculation | Non coordinated |

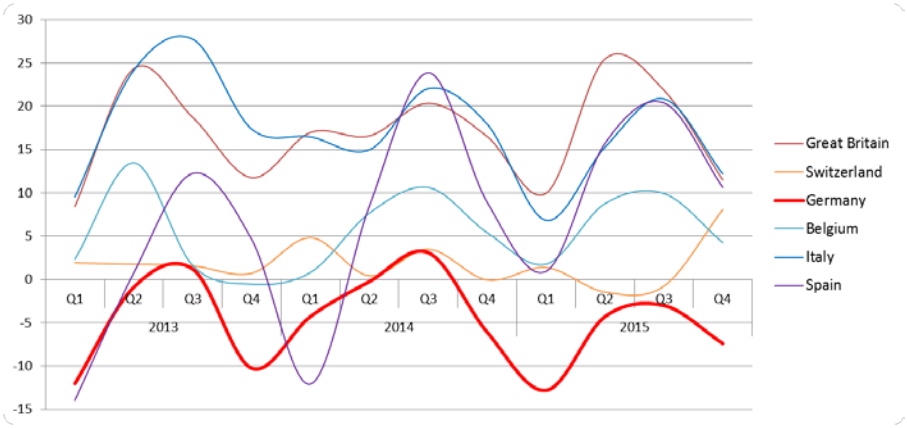
**Day-ahead**

| | |
|---|---|
| Allocation | Implicit (implementation of market coupling in 2010) |
| Capacity calculation | *Flow based* |

**Intraday**

| | |
|---|---|
| Allocation | Continuous implicit (coupling) & continuous explicit |
| Capacity calculation | Residual capacity after the day-ahead auction, with common re-evaluation (since March 2016) |

## SPREAD & CONVERGENCE




**- Average spread in 2015:** -6.85 €/MWh

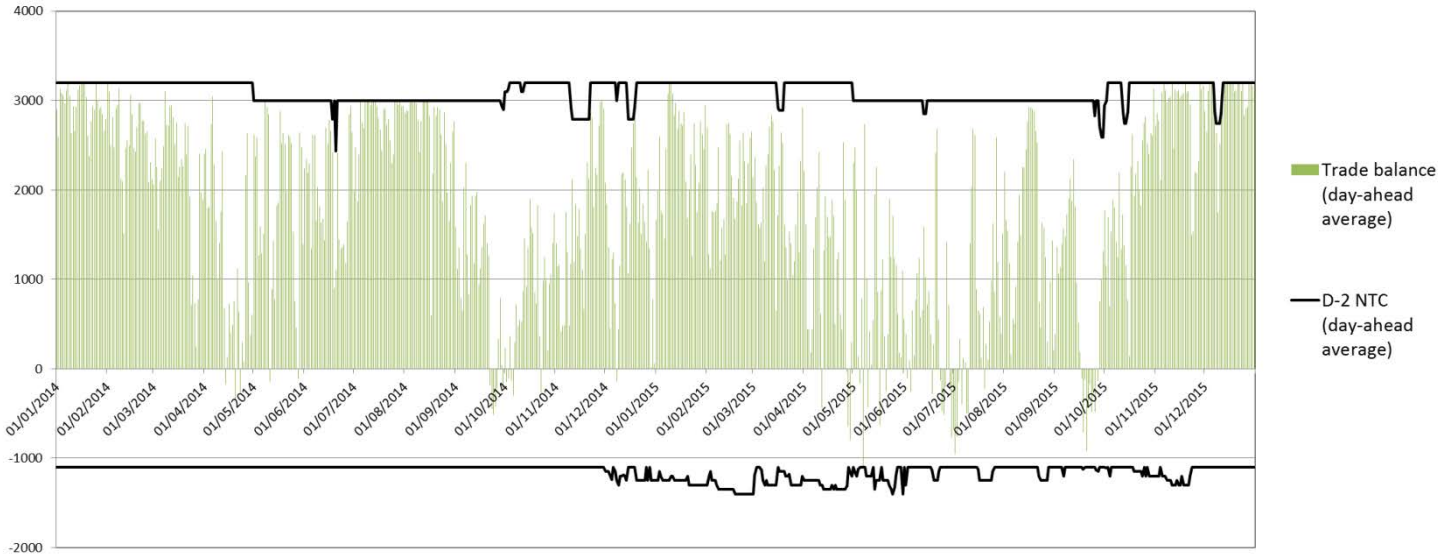
**- Price convergence in 2015:** 27.4% of the time

[1] Average values until the implementation of Flow Based, on 21 May 2015 (low seasonality of capacity)

## CAPACITY & FLOWS

**- Average capacity recorded in 2015 in the France – Switzerland direction:** 3,100 MW

**- Average capacity recorded in 2015 in the Switzerland – France direction:** 1,200 MW




**- Net import balance with France**: 14.2 TWh

**- Percentage of time the interconnection is used for export**: 83%

## CALCULATION AND ALLOCATION OF CAPACITY AT EACH TIMEFRAME

**Long term**

| | |
|---|---|
| Platform and allocation rules | JAO and EU HAR |
| Firmness regime | Specific firmness regime (compensation of 100% or 110% of the initial auction price) |
| Capacity calculation | Non coordinated |

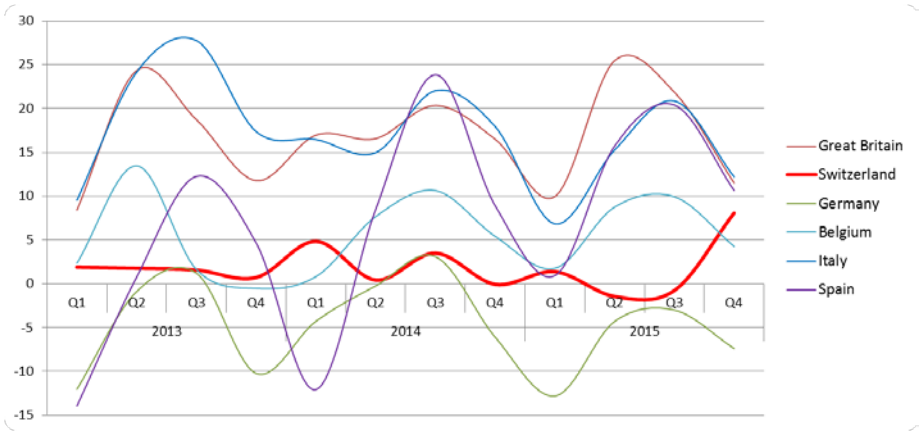
**Day-ahead**

| | |
|---|---|
| Allocation | Explicit (no market coupling) |
| Capacity calculation | Specific methodology related to long-term contracts |

**Intra-day**

| | |
|---|---|
| Allocation | Continuous implicit (coupling) & continuous explicit |
| Capacity calculation | Residual capacity after the explicit day-ahead auctions |

## SPREAD & CONVERGENCE



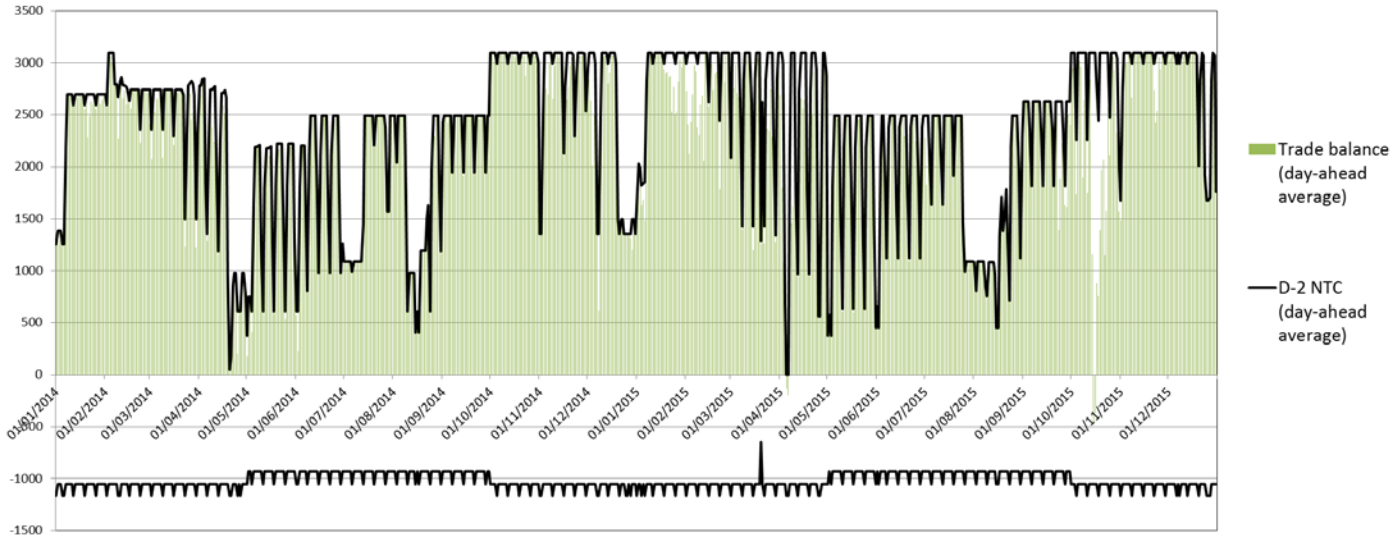

**- Average spread in 2015**: 1.82 €/MWh

**- Price convergence in 2015**: 0.3% of the time

## CAPACITY & FLOWS

**- Average capacity recorded in 2015 in the France – Italy direction:** 2,500 MW

**- Average capacity recorded in 2015 in the Italy – France direction:** 1,000 MW




**- Net import balance with France**: 19.7 TWh

**- Percentage of time the interconnection is used for export**: 98%

## CALCULATION AND ALLOCATION OF CAPACITY AT EACH TIMEFRAME

**Long term**

| | |
|---|---|
| Platform and allocation rules | JAO and EU HAR |
| Firmness regime | HAR harmonised firmness regime |
| Capacity calculation | Coordinated |

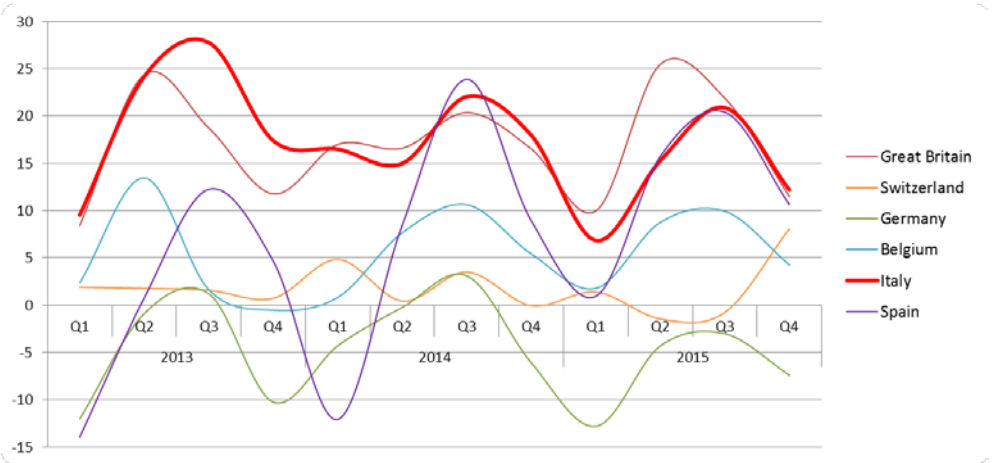
**Day-ahead**

| | |
|---|---|
| Allocation | Implicit (implementation of market coupling in February 2015) |
| Capacity calculation | Coordinated NTC (since February 2016) |

**Intraday**

| | |
|---|---|
| Allocation | Explicit |
| Capacity calculation | Residual capacity after the day-ahead auction |

## SPREAD & CONVERGENCE




**- Average spread in 2015**: 13.83 €/MWh

**- Price convergence in 2015**: 1.2% of the time

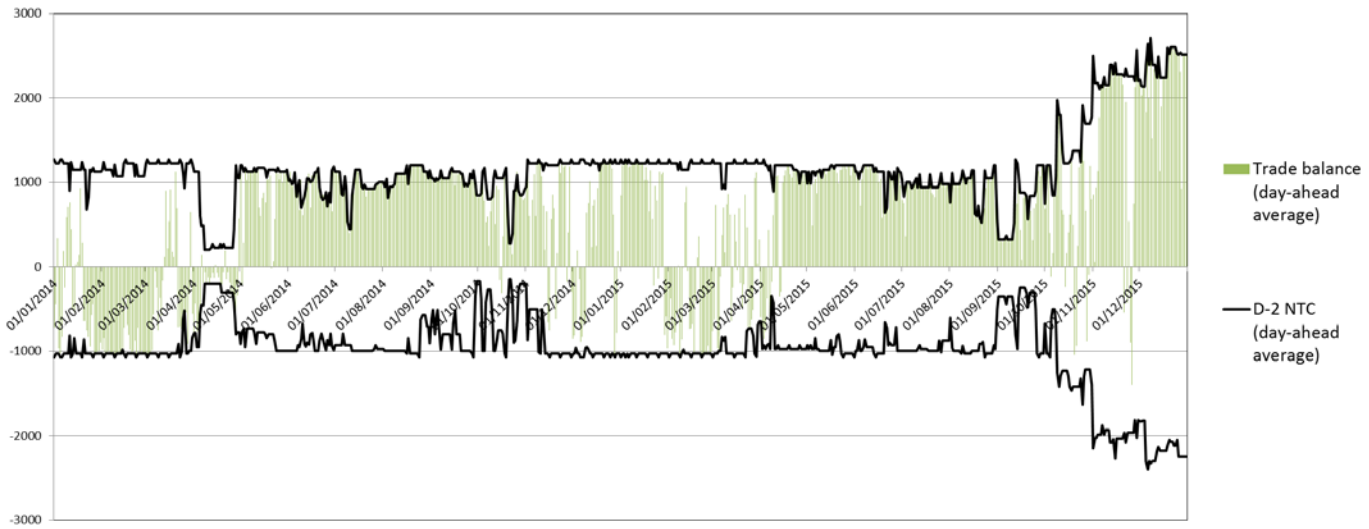
## INVESTMENTS

**2019:** Foreseen commissioning of a new link “Piemonte Savoia” (1,200 MW)

## CAPACITY & FLOWS

**- Average capacity recorded in 2015 in the France – Spain direction:** 2,000 MW[1]

**- Average capacity recorded in 2015 in the Spain – France direction:** 1,800 MW[1]




**- Net import balance with France:** 7.4 TWh

**- Percentage of time the interconnection is used for export:** 82%

## CALCULATION AND ALLOCATION OF CAPACITY AT EACH TIMEFRAME

**Long term**

| | |
|---|---|
| Platform and allocation rules | JAO and EU HAR |
| Firmness regime | HAR harmonised firmness regime |
| Capacity calculation | Non coordinated |

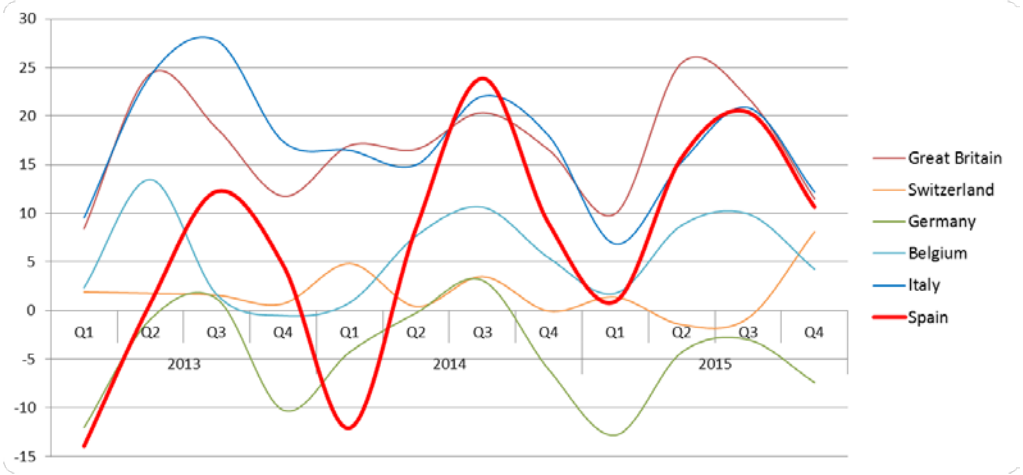
**Day-ahead**

| | |
|---|---|
| Allocation | Implicit (implementation of market coupling in May 2014) |
| Capacity calculation | Non coordinated NTC |

**Intraday**

| | |
|---|---|
| Allocation | Explicit |
| Capacity calculation | Residual capacity after day-ahead auction |

## SPREAD & CONVERGENCE




**- Average spread in 2015**: 11.98 €/MWh

**- Price convergence in 2015**: 12.7% of the time

## INVESTMENTS

**5 October 2015:** Implementation of new Baixas Santa Llogaia line (2,000 MW DC line)

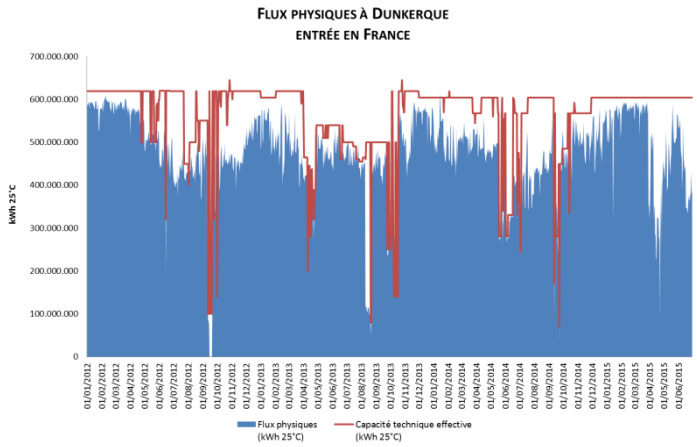
[1] Average values following commissioning of Baixas – Santa Llogaia line

## CAPACITY

**Norway-France direction:**

- **570 GWh/d** entry capacity

## PHYSICAL AND COMMERCIAL FLOWS AT DUNKERQUE




*Dunkirk is the entry point within the French transmission system where flows are greatest.*

*Norwegian gas accounted for about 40% of gas imports into France.*

*Imports from Norway via Dunkirk:*

- 2012 : 179 TWh
- 2013 : 168 TWh
- 2014 : 167 TWh
- 2015 : 186 TWh

*In 2015, flows from Norway via Dunkirk rose 11%, they offset the decline in imports from Belgium and Germany*

## LEVEL OF PHYSICAL USE

*Average annual utilization rate:*

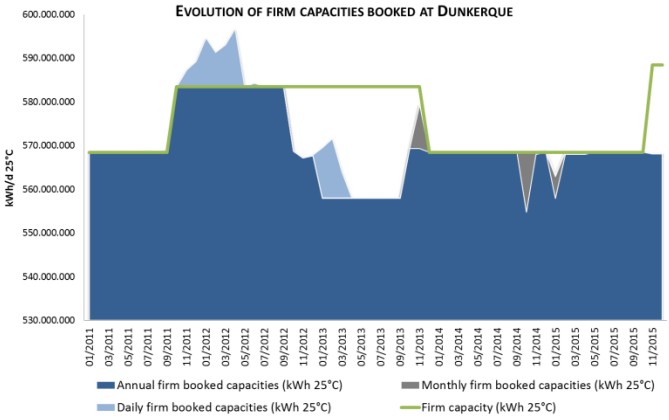
- 2012 : 83%
- 2013 : 87%
- 2014 : 84%
- 2015 : 85%

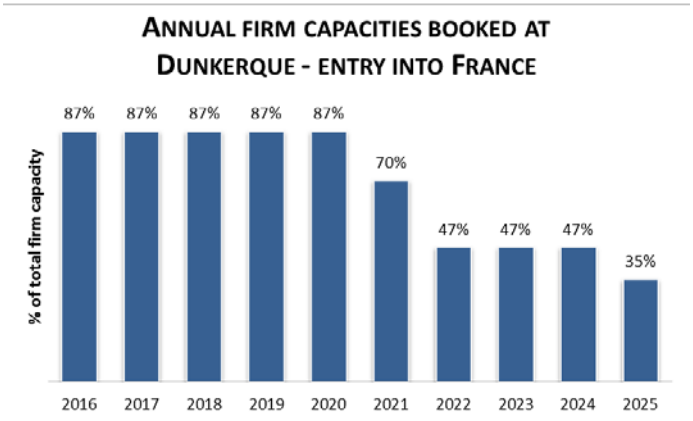
*Number of days the utilization rate exceeded 98%:*

- 2012 : 17 days
- 2013 : 43 days
- 2014 : 32 days
- 2015 : 8 days

*Physical congestion incidents were reduced by a factor of 4 between 2014 and 2015, following an increase in capacity sold by GRTgaz of 20 GWh / d, in the form of monthly products from November 1, 2015 to March 31, 2016.*

## CAPACITY TAKE UP LEVEL




*Average annual booking rate:*

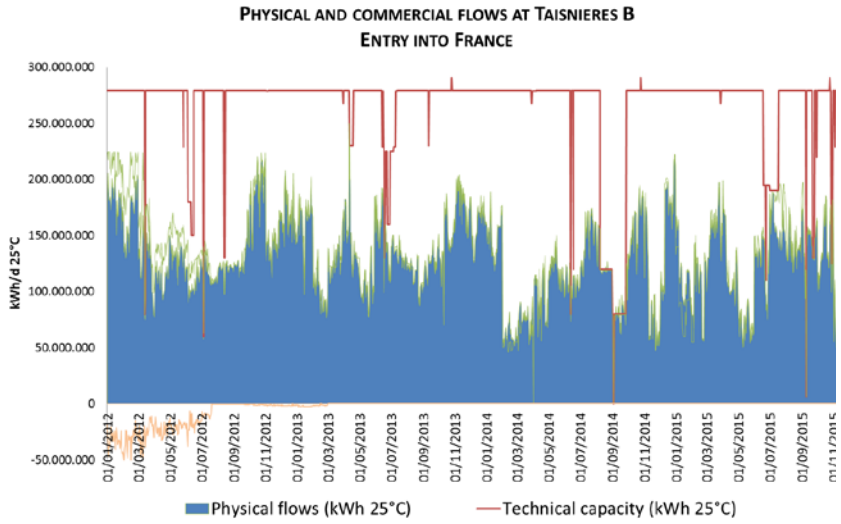
- *2012 : 85%*
- *2013 : 89%*
- *2014 : 85%*
- *2015 : 86%*

*Annual firm bookings decline from 2021 and gradually decrease until 2025.*
*As of 2026, no annual firm capacity is currently booked*

## CAPACITY

- **230 GWh/d** of firm capacity in the Belgium > France direction

## PHYSICAL AND COMERCIAL FLOWS AT TAISNIÈRES B




*L-gas imports from Belgium:*

- 2012 : 51.9 TWh
- 2013 : 50.7 TWh
- 2014 : 42.1 TWh
- 2015 : 43.6 TWh

*The interconnection at Taisnières B is the only L-gas entry point in France*

- Gas imports from Taisnières B accounted for 10% of total imports at interconnections;
- Entries from that point supply an area focused mainly in the north of France (Nord-Pas-de-Calais and Picardy) distributed to 1.3 million customers, including 8,000 industrial actors.

*The Groningen field (Netherlands), from which L-gas originates, is entering its final operational period:*

- Export contracts end between 2021 and 2030 and will not be renewed;
- A series of earthquakes related to operations at the deposit has led the Dutch government to reduce production;
- In 2015, the peak of production of the Groningen field amounted to 30 billion cubic meter, or 30% less than production in 2014;
- In France, GRTgaz and GrDF are preparing to convert zones fueled by L-gas to H-gas.

## LEVEL OF PHYSICAL USE

*Stable annual average utilization rate:*

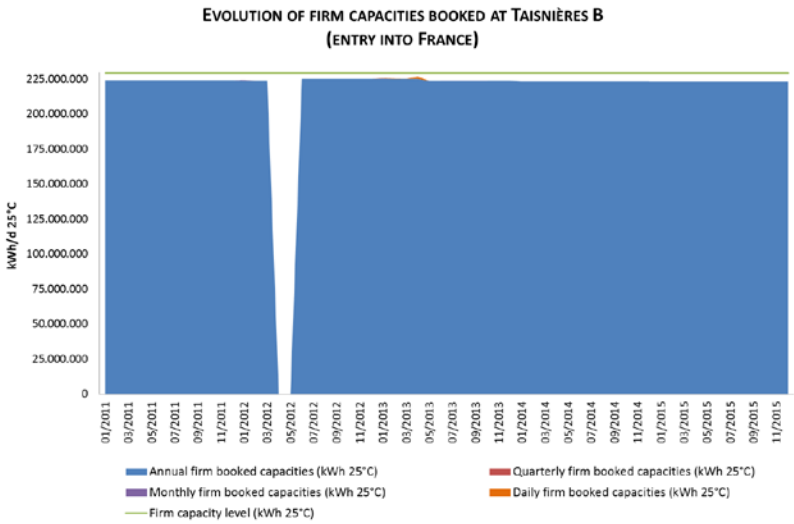
- 2012 : 52%
- 2013 : 51%
- 2014 : 50%
- 2015 : 46%

*The physical congestion incidents in 2014 were attributable to a decrease in the effective technical capacity between July and August 2014*

Number of days the utilization rate exceeded 98%:

- 2012 : 1 day
- 2013 : 0 days
- 2014 : 33 days
- 2015 : 8 days

## CAPACITY BOOKING LEVELS

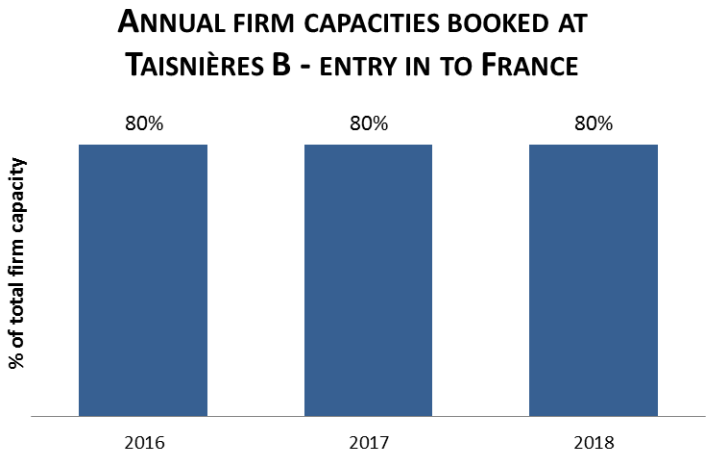



*Average annual booking rate*

- 2011 : 98%
- 2012 : 82%
- 2013 : 98%
- 2014 : 97%
- 2015 : 97%

*Almost all capacity booked was long-term.*

*In 2015, no PRISMA bid resulted in capacity allocation.*




*No more capacity is booked for entry into France at Taisnières B as from 2018*

## CAPACITY

**Belgium > France direction:**

- **640 GWh/d** of firm capacity

**France > Belgium direction:**

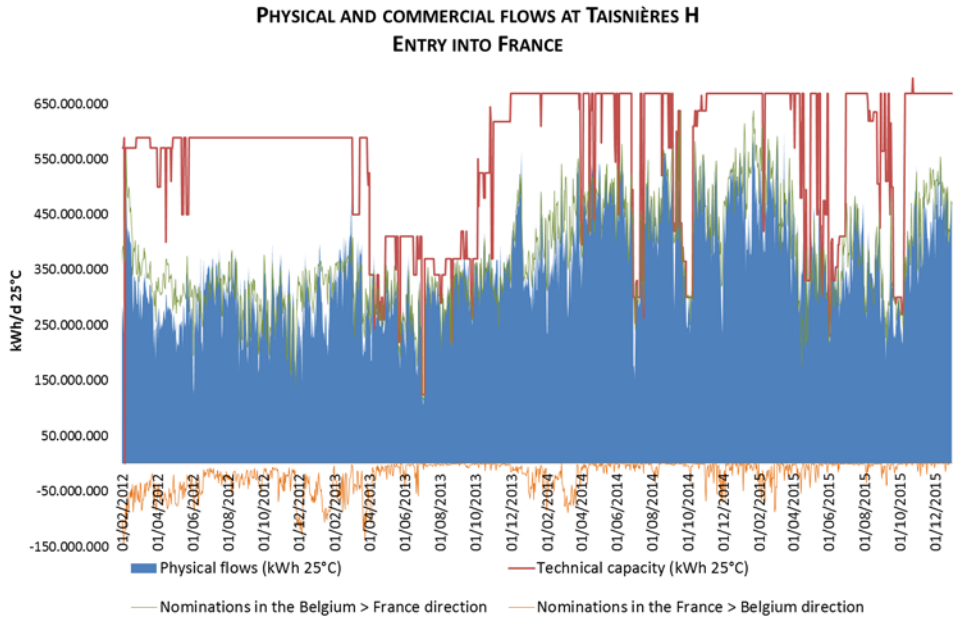
- **200 GWh/day** of backhaul capacities (virtual)

## INVESTMENTS

**December 2013:**

- Increase in entry capacity from Belgium of 50 GWh/day;
- Completion cost: 169.7 million euros.

## PHYSICAL AND COMMERCIAL FLOWS AT TAISNIÈRES H




*Imports from Taisnières H:*

- 2012 : 101 TWh
- 2013 : 109 TWh
- 2014 : 158 TWh
- 2015 : 146 TWh

*Since 2014, imports from Belgium can compensate for the decline in imports from Germany*

## LEVEL OF PHYSICAL USE

*Average annual utilization rate:*

- 2012 : 50%
- 2013 : 71%
- 2014 : 72%
- 2015 : 68%
-

*Number of days the utilization rate exceeded 98%:*

- 2012 : 0 days
- 2013 : 13 days
- 2014 : 24 days
- 2015 : 16 days

*Increase in physical congestion incidents in 2014:*

Taisnières H was heavily used in 2014 to offset the decline in LNG imports and as substitution for Obergailbach flows.

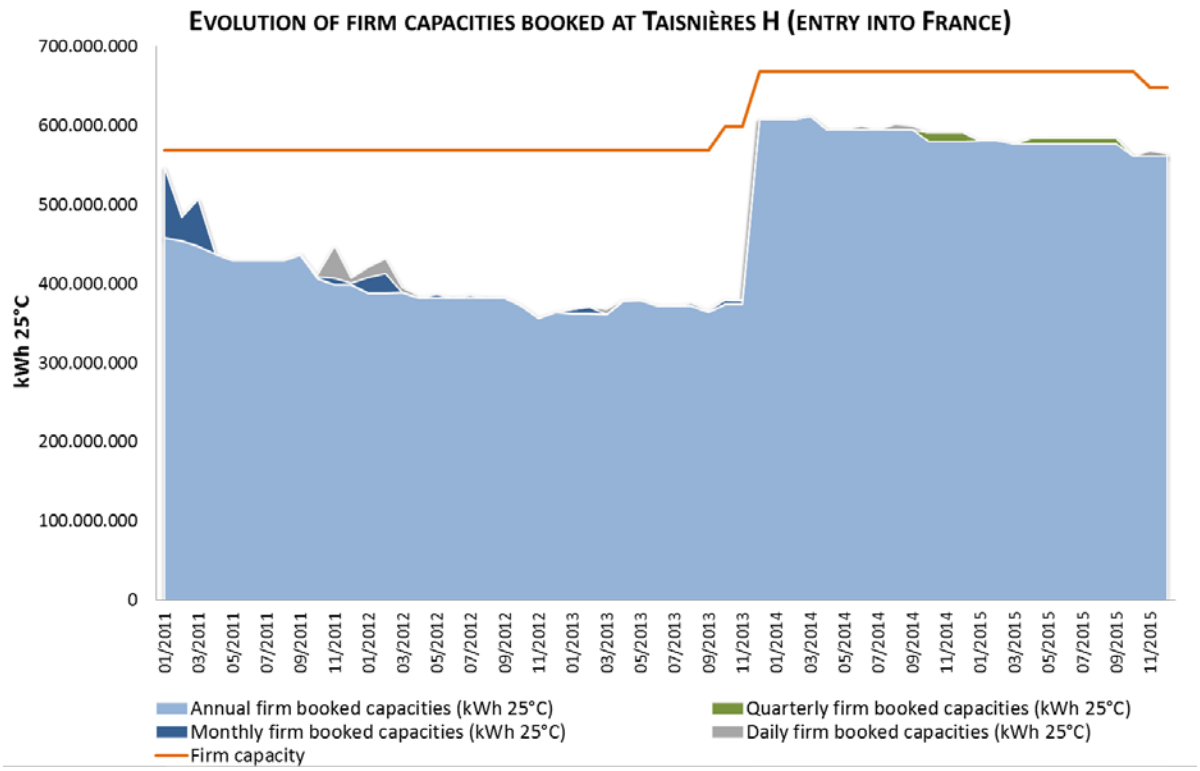
## CAPACITY BOOKING LEVELS

*Average annual booking rate:*

- *2011 : 79%*
- *2012 : 68%*
- *2013 : 67%*
- *2014 : 90%*
- *2015 : 87%*

*Increase in the annual average take up rate since 2014, due to the commissioning of capacity booked during the 2008 open season:*

- Open season 2008 has validated the increase in entry capacity from Belgium;
- During the open season, market participants reserved almost 340 GWh/d of capacity for 10 years;
- This capacity was commissioned in December 2013.


EVOLUTION OF FIRM CAPACITIES BOOKED AT TAISNIÈRES H (ENTRY INTO FRANCE)
kWh 25°C
700.000.000
600.000.000
500.000.000
400.000.000
300.000.000
200.000.000
100.000.000
0
01/2011
03/2011
05/2011
07/2011
09/2011
11/2011
01/2012
03/2012
05/2012
07/2012
09/2012
11/2012
01/2013
03/2013
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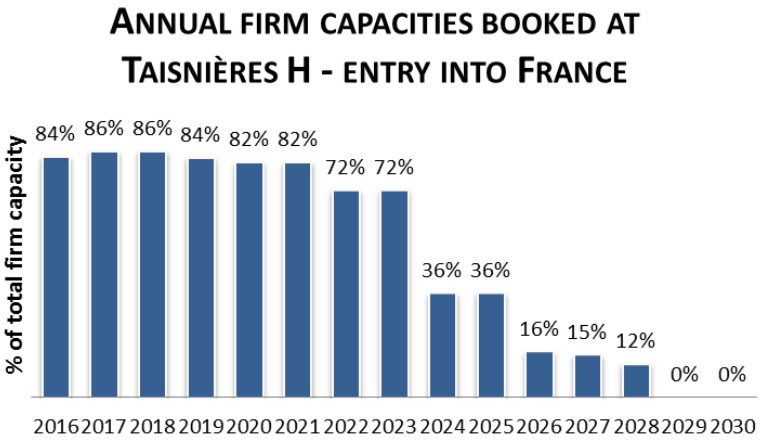
11/2013
01/2014
03/2014
05/2014
07/2014
09/2014
11/2014
01/2015
03/2015
05/2015
07/2015
09/2015
11/2015
Annual firm booked capacities (kWh 25°C)
Monthly firm booked capacities (kWh 25°C)
Firm capacity
Quarterly firm booked capacities (kWh 25°C)
Daily firm booked capacities (kWh 25°C)


ANNUAL FIRM CAPACITIES BOOKED AT TAISNIÈRES H - ENTRY INTO FRANCE
% of total firm capacity
84% 86% 86% 84% 82% 82% 72% 72% 36% 36% 16% 15% 12% 0% 0%
2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030

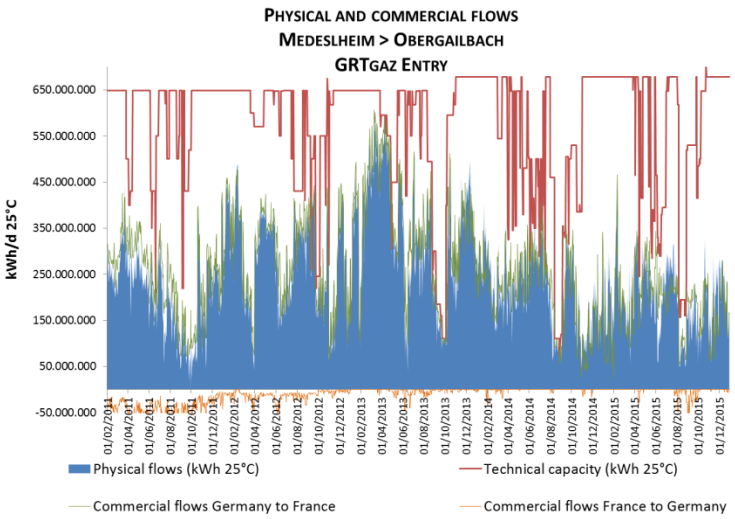
## CAPACITY

- **620 GWh/d** of firm entry capacity into France
- **30 GWh/d** of interruptible capacity into France
- **150 GWh/d** of backhaul capacity, to Germany

## INVESTMENTS

- **2008:** Increased entry capacity on the GRTgaz transmission network of 430 GWh/d to 550 GWh/d of firm physical capacity
- **2009:** Increased entry capacity on the GRTgaz transmission network 550 GWh/d to 620 GWh/d of firm physical capacity and creation of 30 GWh/d of interruptible capacity
- **Cost at completion of these projects:** Nearly 200 million euros

## PHYSICAL AND COMMERCIAL FLOWS AT OBERGAILBACH




*Gas imports from Germany:*

- 2011 : 76.6 TWh
- 2012 : 103.7 TWh
- 2013 : 128 TWh
- 2014 : 76.9 TWh
- 2015 : 66.4 TWh

The interconnection with Germany is the entry point for gas from Russia. It plays an important role in security of supply from France, that role could be strengthened with the creation of the single market area in 2018.

In 2012 and 2013, interconnection with Germany was increasingly sought to offset the decline in LNG imports in France. Between 2011 and 2013, the flow increased by 60%.

In 2014 and 2015, the return of LNG in Europe and tensions between Russia and Ukraine resulted in a sharp drop in flows from Germany, falling by 43% in two years to return to levels close to those in 2011.

## LEVEL OF PHYSICAL USE

*Average annual utilization rates declining for 2 years*

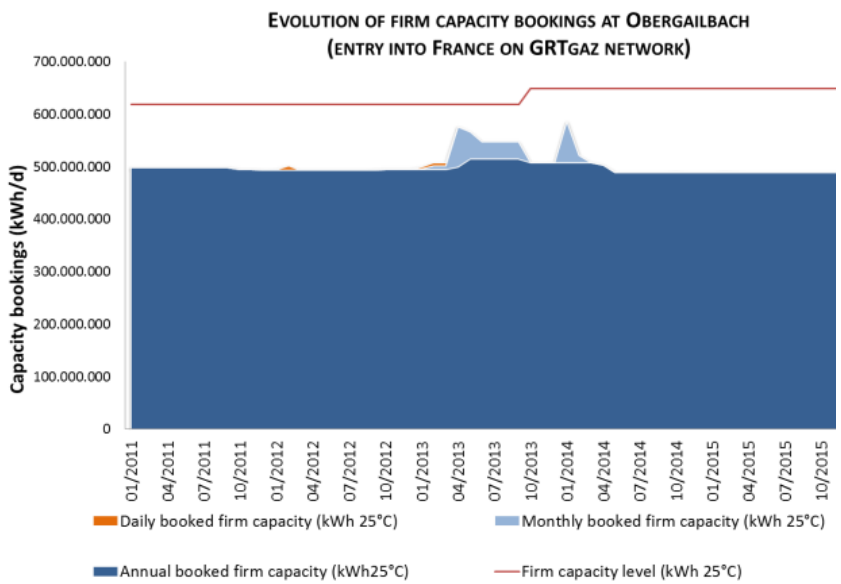
- 2011 : 35%
- 2012 : 49%
- 2013 : 61%
- 2014 : 44%
- 2015 : 34%

*Little physical congestion incidents*

Number of days the utilization rate exceeds 98%:

- 2011 : 0 days
- 2012 : 0 days
- 2013 : 10 days
- 2014 : 6 days
- 2015 : 0 days

## CAPACITY OOKINGS LEVEL



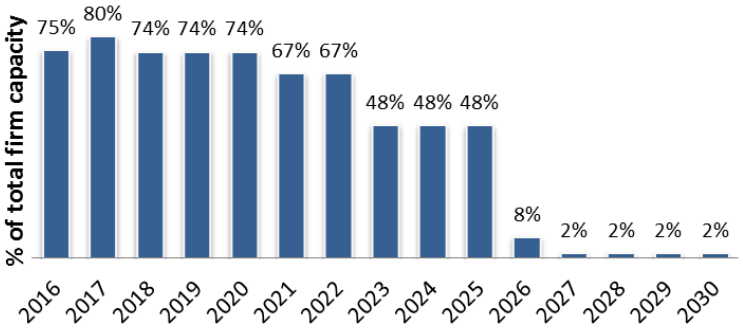

*Average annual booking rate:*

- *2011 : 80%*
- *2012 : 80%*
- *2013 : 85%*
- *2014 : 78%*
- *2015 : 75%*

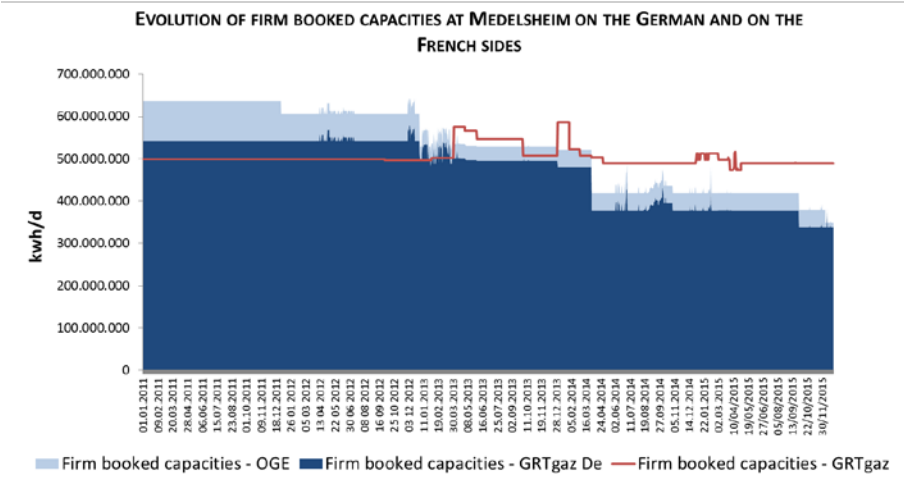
*The rate of average annual bookings have been high in recent years, despite the decline in flows at Obergailbach for 2 years*

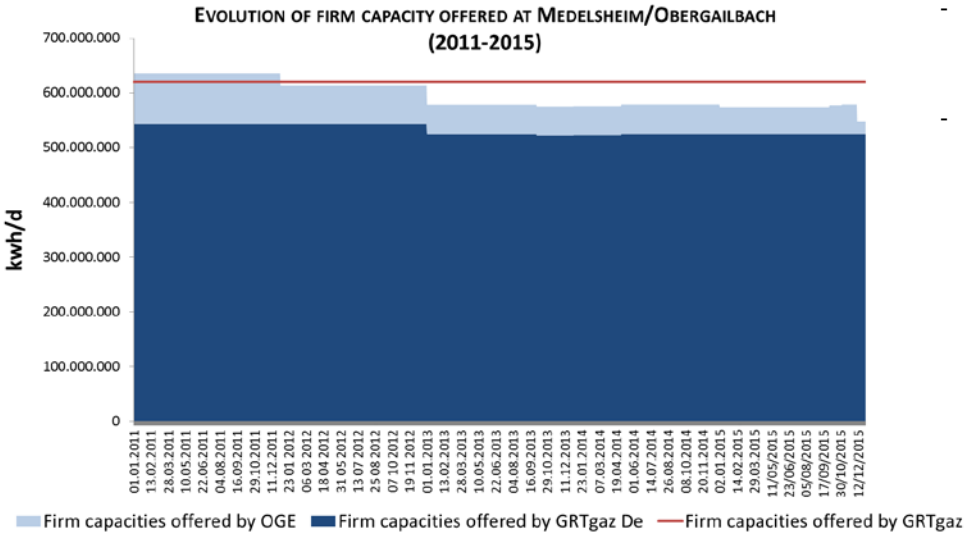
- Almost all of the booked capacity is contracted long term
- In 2015, 136 daily auctions on PRISMA resulted in a capacity allocation, but at low levels (on average 16 GWh/d, mainly in the backhaul direction)

## ANNUAL FIRM CAPACITIES BOOKED AT OBERGAILBACH - ENTRY INTO FRANCE




## ASYMMETRIC BOOKING LEVELS




*Despite recent joint developments, interconnection capacity with France out of the German system has been reduced:*

- German TSOs allowed, since the second half of 2012, according to a federal law, some senders to withdraw part of their contracts;
- These withdrawals on the German side led to a discrepancy of about 80 GWh / d between the exit capacity booked out of Germany, and those booked entering the French network;
- Capacity provided for in Germany were reallocated unilaterally by the German TSOs to other points of their networks. This led them to reduce their offer of firm exit capacity to France;
- There is a shortfall of about 50 GWh / d in firm exit capacity offered from Germany and those offered for entry into France;
- In late 2015, German TSOs again offered a (small) part of the capacity that had been reallocated to public distribution, for exit to France.

## CAPACITY:

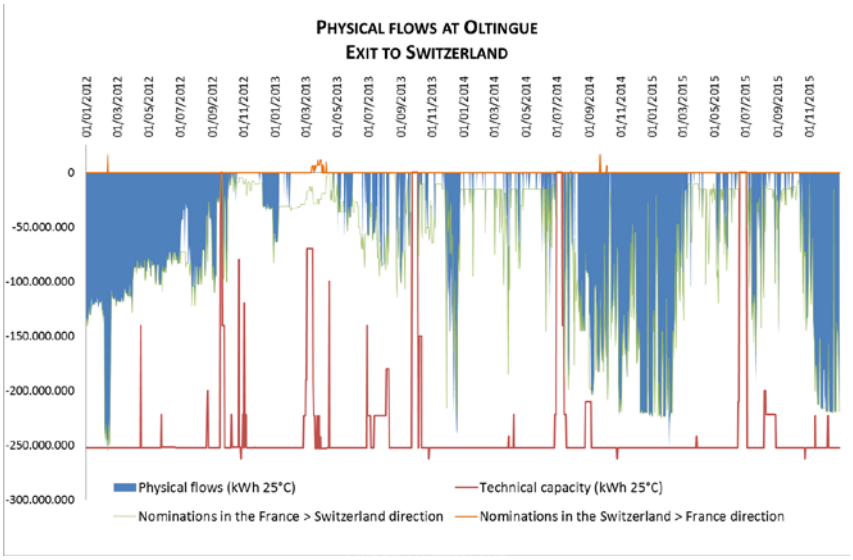
- **223 GWh/d** of firm capacity in the France > Switzerland direction
- **45 GWh / d** of virtual backhaul in the Switzerland > France direction

## INVESTMENTS

**Creation of backhaul capacity in 2018:**

- Commissioning of 100 to 200 GWh/d of semi-interruptible entry apacity in France that will bring gas from Italy;
- Estimated budget: 15 million euros (validated in 2015).

## PHYSICAL AND COMMERCIAL FLOWS AT OLTINGUE




*Exports to Italy via Switzerland:*

- 2012 : 28 TWh
- 2013 : 15 TWh
- 2014 : 29 TWh
- 2015 : 30 TWh

## LEVEL OF PHYSICAL USE

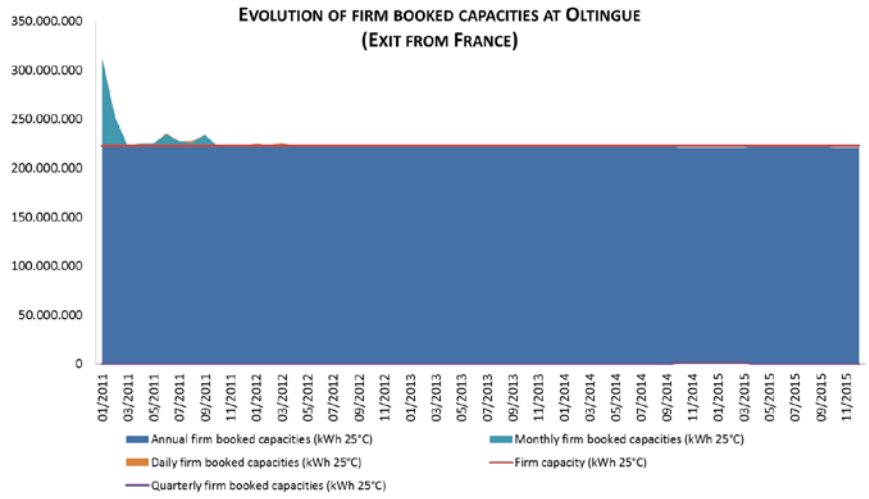
*Average annual utilization rate:*

- 2012 : 30%
- 2013 : 10%
- 2014 : 28%
- 2015 : 30%

*Number of days the utilization rate exceeded 98% :*

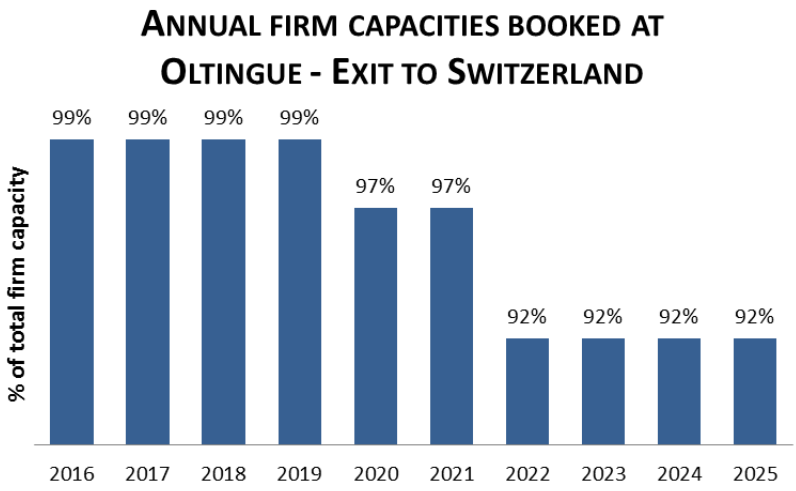
- 2012 : 5 days
- 2013 : 0 days
- 2014 : 0 days
- 2015 : 2 days

## CAPACITY BOOKING LEVEL




*Average annual booking rate (France-Switzerland direction)*

- 2011 : 106%
- 2012 : 100%
- 2013 : 100%
- 2014 : 100%
- 2015 : 100%


ANNUAL FIRM CAPACITIES BOOKED AT OLTINGUE - EXIT TO SWITZERLAND
% of total firm capacity
99%
99%
99%
99%
97%
97%
92%
92%
92%
92%
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025

## CAPACITY

**France > Spain direction:**

- **165 GWh/d** of entry capacity
- **60 GWh/d** of interruptible capacity

**Spain > France direction :**

- **225 GWh/d** of entry capacity

## INVESTMENTS

**April 1st, 2013:**

- The capacity offered in both directions Increased to 165 GWh/d as against 100 GWh/d in the France to Spain direction and 30 GWh/d in the Spain to France direction calculated previously.

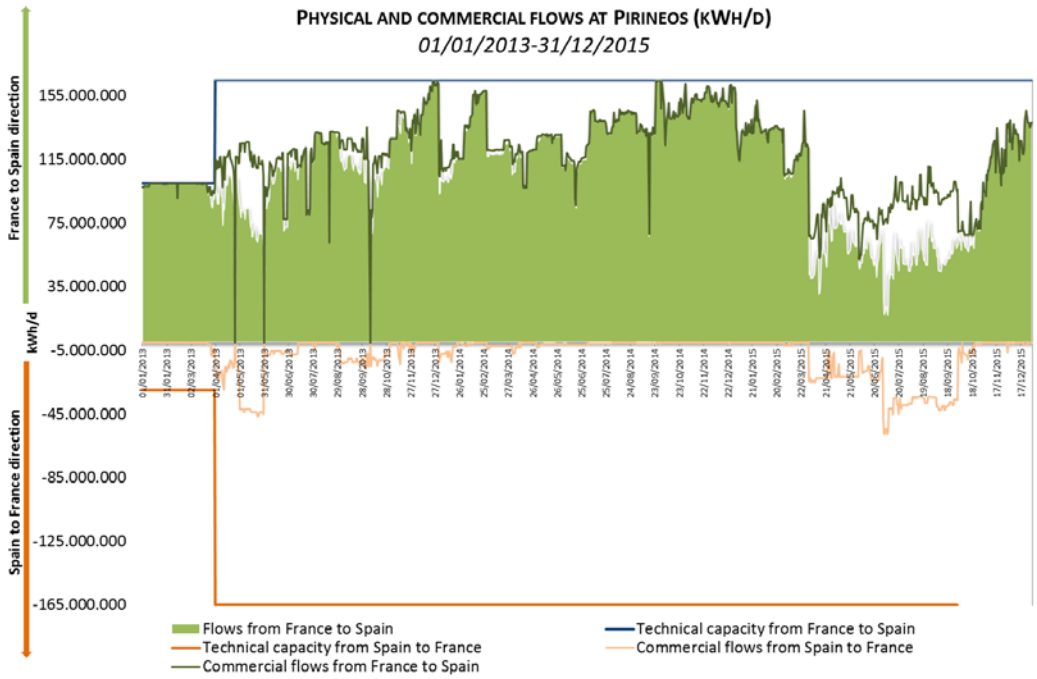
**December 2015:**

- Capacity in the Spain to France direction and the France to Spain direction increased to 225 GWh/day

Total investments on the French transportation network: **EUR 491.4 million**

This amount does not include reinforcements in the core French network required to export / import the gas volumes corresponding to increases in capacity at the border with Spain, validated during open seasons in 2009 and 2010.
This amount includes EUR 27 million of investment approved by the CRE in its deliberation of 16 July 2014 for the construction of the Sauveterre compression facility (commissioning is scheduled for 2017) and a EUR 50 million European grant for the capacity the Béarn line (Artère du Béarn.

## PHYSICAL AND COMMERCIAL FLOWS AT PIRINEOS




*Exports to Spain:*

- 2010 : 11,71 TWh
- 2011 : 22,73 TWh
- 2012 : 34,98 TWh
- 2013 : 39,24 TWh
- 2014 : 48,63 TWh
- 2015 : 31,23 TWh

Physical flows have always been oriented in the France-Spain direction since 2011, whatever the market conditions. In 2014, flows from France covered about 20% of Spanish requirements. In 2015, the increase in LNG imports from Algeria and Spain lowered average daily flows to 85.6 GWh/d as against 133 GWh/d in 2014.

## LEVEL OF PHYSICAL USE

*High rates of annual average use, but down in 2015:*

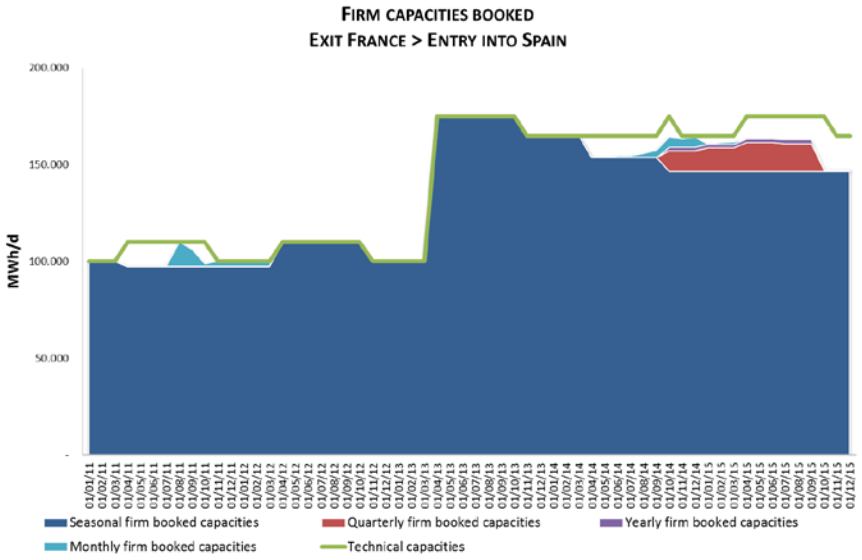
- 2012 : 93%
- 2013 : 75%
- 2014 : 81%
- 2015 : 56%

*Number of days the utilization rate exceeded 98%:*

- 2012 : 176 days
- 2013 : 55 days
- 2014 : 18 days
- 2015 : 0 day

*The increase in capacity, to 165 GWh / d in April 2013, divided in three the number of physical congestion incidents in the France-Spain direction*

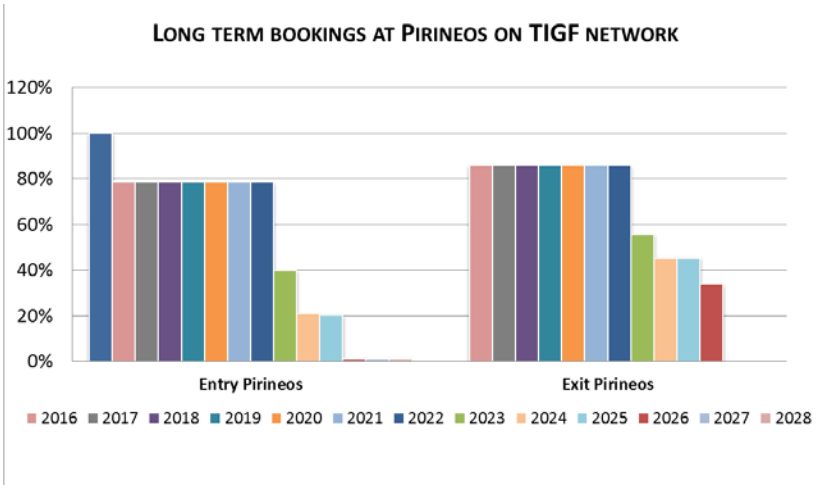
## CAPACITY BOOKING LEVEL



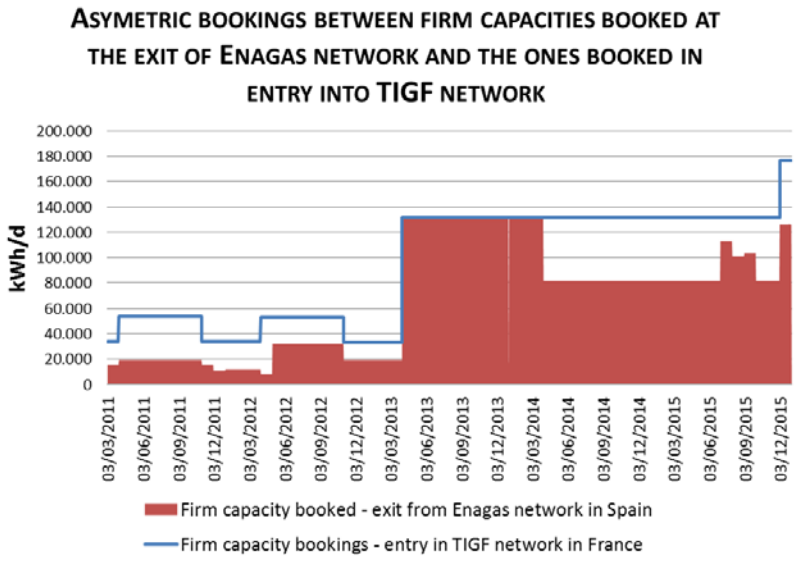

| Annual average subscription rate | | |
|---|---|---|
| | France to Spain direction | Spain to France direction |
| 2012 | 100% | 97% |
| 2013 | 97% | 82% |
| 2014 | 96% | 77% |
| 2015 | 93% | 77% |

*High long-term booking rates: 80% (input to France) and 90% (output to Spain) of the long-term capacity is booked*

Long term bookings are higher in the France-Spain direction than in the Spain-France direction
From 2023 bookings plummeted, both for entry and exit, and marked the end of commitments reached during the open seasons in 2009 and 2010.




## ANALYSIS OF ASYMMETRIC BOOKINGS




Some market players who have booked capacity in Spain to France had the opportunity to terminate their contracts on the Spanish side, which is reflected in the Spain to France direction by a difference between the capacity booked for exit from the Enagas network and that entering the TIGF network of about 50 GWh/d.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