Study on cross-border market integration

Macroeconomic Analysis of the CEE region

Final Report

June 28, 2012

E-Bridge
competence in energy

Study on cross-border market integration

Macroeconomic analysis of the CEE Region

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1. Introduction

In February 2011, the European Council underlined its commitment to achieve a fully functioning, interconnected and integrated internal energy market by 2014. Against this backdrop, it called for an enhanced cooperation between ACER, national regulators, TSOs and other stakeholders with the aim to speed up the implementation of existing legislation.

Given the involvement of a high number of stakeholders, the interdependence of existing and yet to be developed framework guidelines as well as the required cooperation at different political levels, CEER had already been asked in autumn 2010 to start a consultation for the development of a conceptual model for the future internal gas market with the aim to clarify and streamline the integration process. The discussions in the workshops centered on different forms of market integration and their suitability taking into account the current structure of European gas markets and the current practice in cross-border trade. Following an intensive dialogue, CEER recommended different sets of actions in its conclusion paper presented in December 2011. The first set aims at ensuring functioning wholesale markets. This shall be done by assessing the current market liquidity and if regarded insufficient, additional measures such as mandatory release programmes, restructuring of entry-exit zones as well as partial (trading regions) or full mergers of market areas shall be considered in the framework of regional initiatives. Based on the CEER recommendations, ten pilot projects were defined in the work programme of the Gas Regional Initiative for the South-South East European region, amongst which, one focuses on the future market architecture in the region by evaluating cost and benefits of implementing different market integration models.

In the light of the above, E-Control has commissioned E-Bridge Consulting to carry out a study on cross-border market integration in the CEE region with special focus on Austria and its neighbouring countries. The purpose of this study is two-fold.

First, the current capacity utilization at major interconnection points of the European gas network is assessed. The analysis is based on a comparison of physical flows with indicated technical capacities in 2011. Sufficient physical cross-border capacities are one important prerequisite for enhanced market integration, since trade liberalization is likely to increase gas flows from low price areas to high price areas which are subject. For those flows to materialize, sufficient physical capacities must be available at cross-border points.

The second part of the report is devoted to the assessment of the potential economic benefits resulting from cross-border market integration of two regions. One region covers the markets of Austria, the Slovak and Czech Republic and one region covers the markets of Austria and Italy. The potential benefits are analyzed on the basis of the expected gain in social welfare in the regions as well as the expected convergence of the prices in the coupled market. Also, the secondary effects on competition, resulting from a growing number of competing market parties and reduced transaction costs for cross-border trade, will be qualitatively analyzed. The results of the second part of the report shall help E-Control to assess the attractiveness of potential market integration either with the Slovak and Czech Republic or with Italy. Please note that the analysis is focusing on the economic effects of market integration and does not provide any recommendation or guidance on the conceptual design of market integration or its implementation path.

2. Capacity utilization at major European interconnection points

2.1 Overview of the approach

The "European Gas Target Model" aims at creating functioning wholesale markets. One way to increase the liquidity of wholesale markets is to further optimize/improve the use of cross-border capacities in Europe. To this end, ACER suggests a variety of measures such as implementing mandatory release programs, merging of market areas, creating trading regions and implicit auctioning of cross-border capacities.

A better allocation of cross-border capacities will increase gas flows from high price areas to low price areas leading to price convergence between market areas. For those flows to materialize, sufficient physical capacities must be available at cross-border points. Therefore, the level of physically available capacities at the European IPs is one important prerequisite for improving the functioning of wholesale markets and, ultimately, to a successful completion of the European internal gas market.

This section gives an overview on the current capacity utilization in Europe. The purpose of the analysis is to identify regions with available excess capacities, for which the above mentioned prerequisite is met and physical bottlenecks, which might constrain the effectiveness of the suggested liquidity measures.

The assessment of the capacity utilization is based on a three-step approach:

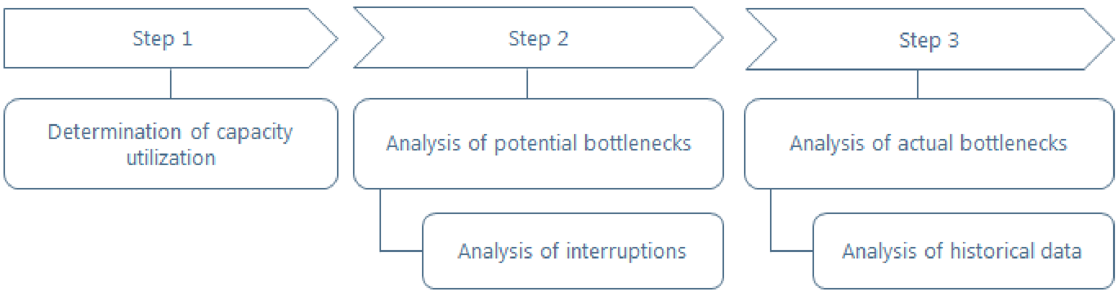


Figure 1: Three-step approach for assessment of capacity utilization

First, the capacity utilization is determined for each interconnection point. Since enhanced market integration might contain the bundling of IPs or the merging of market areas, physical flows and capacities are also aggregated across IPs for each market area and the respective capacity utilizations are determined. In a second step, depending on the obtained results, IPs that are highly used are further analyzed. This is done by looking at interrupted volumes, if data is available and/or informal interviews with the respective TSOs in case no data on actual interrupted volumes is available or no interruptible capacities are sold capacities. If interruptions occurred, the historical utilization was also analyzed as to check whether there is any systematic pattern of interruptions in the past. In other words, whether interruptions were of a permanent nature or whether they were temporary due to exceptional events in the considered period of time.

The analysis was based on publicly available data for the time period of January 2011 to 2012. This time period was chosen as to maximize the geographic coverage of the analysis, since, according to the transparency requirements set out in Regulation (EC) No 715/2009, TSOs are obliged to publish detailed data on flows and capacities at all relevant interconnection points as of 2011. Historical data was not available for all interconnection points.

Given the high number of interconnection points in Europe, only major interconnection points were analyzed.

2.1 1 Determination of physical capacity utilization

The focus of the analysis lies on the actual capacity utilization of the physically available capacity at the interconnection points. It does not take into account commercial aspects such as the contractual situation at the given interconnection point.

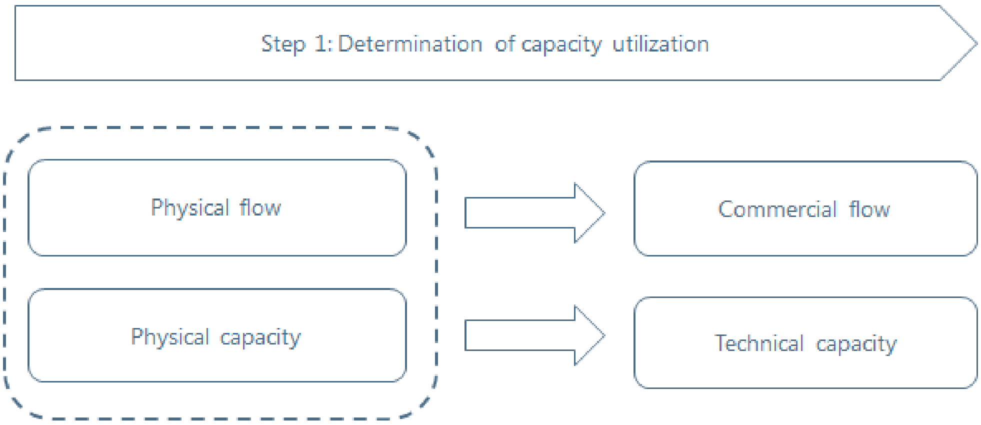


Figure 2: Step 1: Determination of capacity utilization

Figure 2 shows the methodology used for determining the capacity utilization at the interconnection points. The physical capacity utilization would be most exactly measured by comparing physical flows with the physically available capacities.

Data on physical flows is published by all TSOs. In some cases, the published physical flows are based on commercial flows and are not the actually measured quantities at the interconnection point. Even though there might be differences between commercial and physical flows, in case of missing data on measured flows, commercial flows represent the next best proxy for actual physical flows.

The actual physical capacities at interconnection points are not published by TSOs, since they depend on the flows and pressures in the connected networks, which vary on a daily basis given the prevailing demand and supply conditions. However, TSOs are required to determine technical entry and exit capacities for each relevant IP based on demand and supply projections. This technical capacity is defined as "the maximum firm capacity that the transmission system operator can offer to users taking into account of system integrity and the operational requirements of the network" (Regulation (EC) 715/2009). Since it relates to the amount of firm capacity, the network model used by TSOs is usually based on conservative assumptions as regards likely flows, pressures as well as demand and supply conditions. The actual physical capacities are likely to vary above the level of technical capacities over the year depending on the accuracy of supply and demand forecasts. In general, the technical capacity can be considered a conservative but solid approximation of the actual physical capacity. Since there is no common methodology for the determination of technical capacities, the comparability of the results is limited to the degree that the adopted approaches differ between TSOs. In the light of the above, datasets of adjacent TSOs were compared as to control for significant discrepancies. If data for one and the same interconnection point differed significantly, the apparent differences were discussed with the TSOs on a bilateral basis.

2.1 2 Analysis and assessment of the capacity utilization

Based on the obtained results, interconnection points with high capacity utilization in 2011 were analyzed further since they potentially represent bottlenecks.

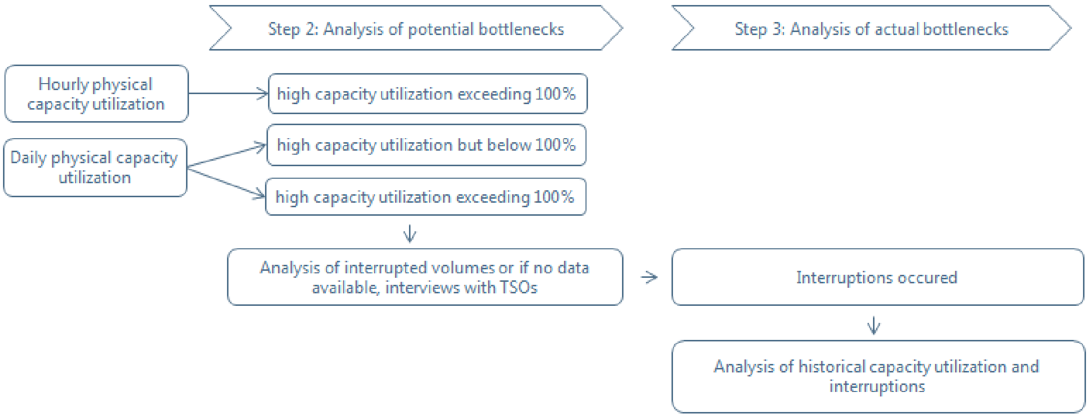


Figure 3: Step 2 and 3: Analysis of bottlenecks

For the respective interconnection points, the frequency and volumes of actual interrupted capacities were examined. If data on actual interrupted volumes was not available, either since TSOs did not publish the data or since no interruptible capacities were offered at the interconnection point, the capacity situation was discussed with the TSOs in informal interviews.

As regards interconnection points, for which hourly data was available, given the high detailedness of the data, the above described assessment was done when the capacity utilization exceeded 100%. If only daily data was available, interconnection points at which the capacity utilization frequently exceeded 90% were also analyzed further as to take account of the fact that the utilization rate might be subject to fluctuations within the day.

In case interruptions occurred and historical data on physical flows, technical capacities and interrupted volumes were available, the capacity situation in 2011 was compared to previous years as to examine whether the occurred physical congestions are of a more permanent nature or whether they might have occurred due to exceptional circumstances. The results were also discussed with the concerned TSOs.

Selection of IPs and geographical coverage

The study covers cross-border interconnection points between EU Member States with significant transmission capacities. Due to limited data availability, the Baltic States were excluded. Altogether, 34 interconnection points were selected. The study covers 82 % of the overall European cross-border capacity volume.

2.2 Observed capacity utilization of interconnectors in Europe

2.2 1 Overview of European interconnectors

Figure 4 below provides an overview on the capacity utilization in Europe from January 2011 to January 2012.

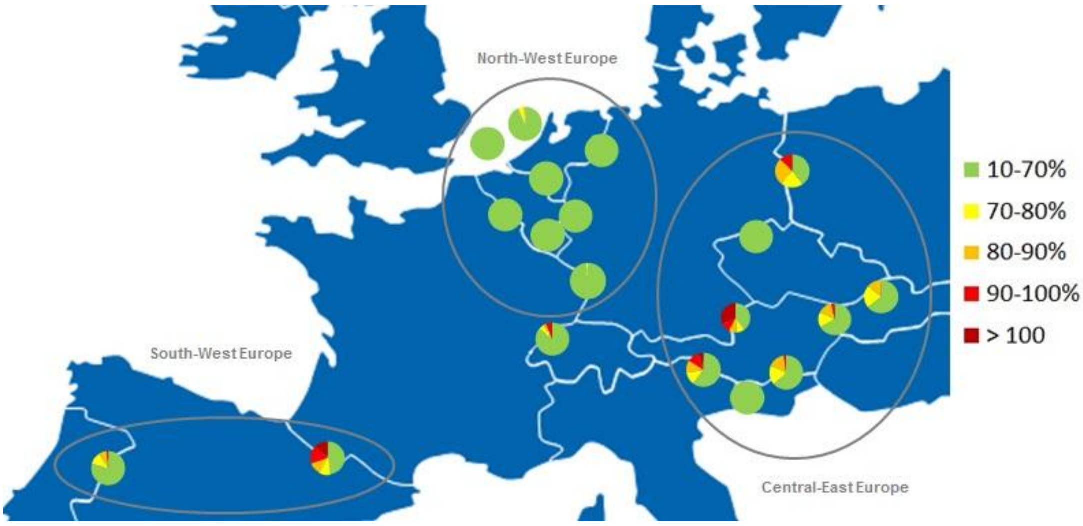


Figure 4: Capacity utilization in Europe in 2011

The obtained results (see Figure 4) suggest that three different regions can be distinguished in Europe:

- The North-West European region, which has significant excess capacities compared to today's utilization.
- The South-West European region, where cross-border capacities between France and Spain were highly used in 2011.
- The Central-East European region around Austria, which is relatively highly loaded, but still significant capacities are available at many interconnection points.

2.2 2 South-West Europe

The analyzed data sample for the South-West European region covers the interconnection points between France and Spain at Larrau and between Spain and Portugal at Bajadoz/Campo Maior. For both interconnection points, daily data of physical and technical capacities were available. The overall interconnection capacities between France and Spain and Spain and Portugal amount to about 454 GWh/d. The considered interconnection points represent about 82 % of the overall cross-border capacities.

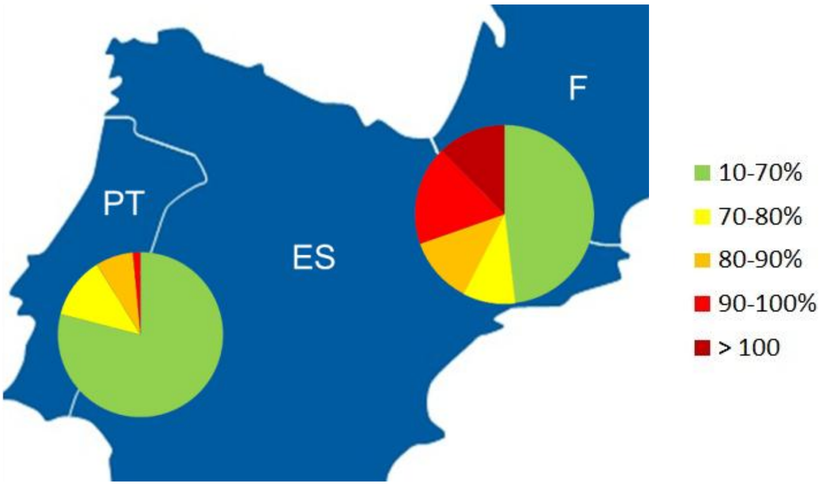


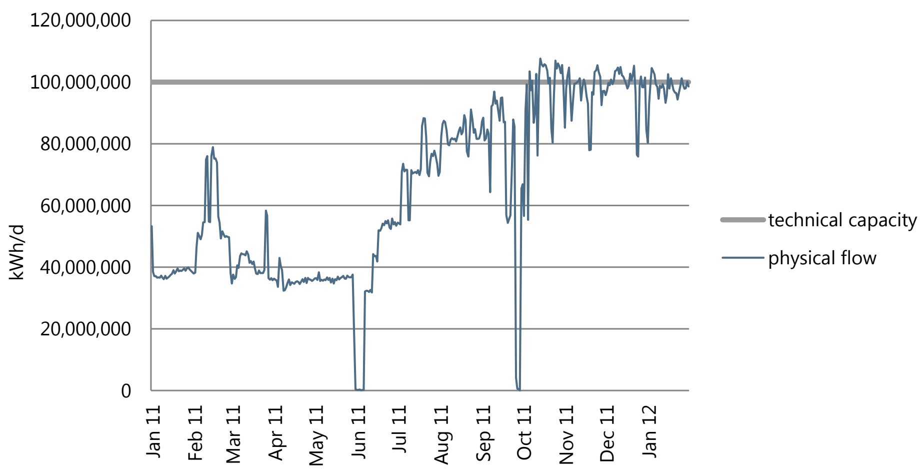
Figure 5: South-West Europe capacity utilization from Jan 2011 to Jan 2012

Source: REN; TIGF

At the interconnection point Bajadoz/Campo Maior the capacity utilization was in about 80% of all days below 70% of the determined technical capacities. On only 6 days during the considered period, the capacity utilization exceeded 90% with a maximum utilization rate of 97%. The figures show/suggest that there are substantial excess capacities available at the cross-border point.

Larrau

At the interconnection point Larrau, the capacity utilization was very high in 2011 and physical congestions occurred during winter time. On a third of all days, the capacity utilization exceeded 90%, while on 12% of all days (50 days in total) it was higher than 100% of the technical capacities.

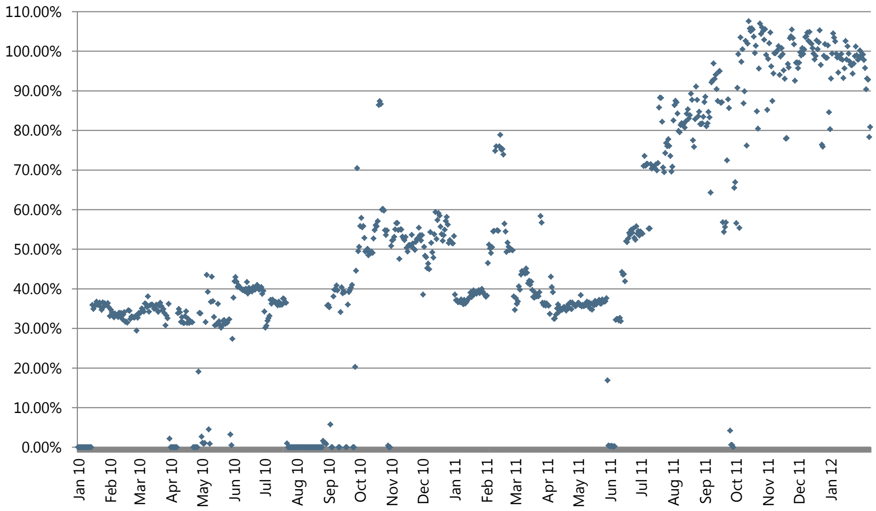


Source: TIGF

Figure 6: Larrau: Daily physical capacity utilization Jan 2011 to Jan 2012

A more detailed analysis showed that the shippers' demand was especially high during October 2011 and January 2012. The figures suggest that there are insufficient physical cross-border capacities between France and Spain. Since no interruptible capacities were offered at the IPs, no data neither on the frequency of interruptions nor the interrupted volumes was available. According to TIGF, the occurred imbalances were resolved in the framework of the OBA.

Figure 7 shows the capacity utilization as of 2010. Compared to the previous year, the utilization rates were higher in 2011. In particular, the capacity utilization during the winter period 2011/2012 was exceptionally high compared the two previous winter periods.



Source: TIGF

Figure 7: Larrau: physical capacity utilization Jan 2010 – Jan 2011

2.2 3 North-West Europe

The analyzed data sample for the North-West European region includes the major interconnection points between France, Belgium, the UK, the Netherlands, Luxemburg and Germany. For all IPs, hourly data was published except for the interconnector between Juliandorp (NL) and Bacton (UK), for which daily data was available. The 17 considered IPs cover 90 % of the cross-border capacities of the considered countries.

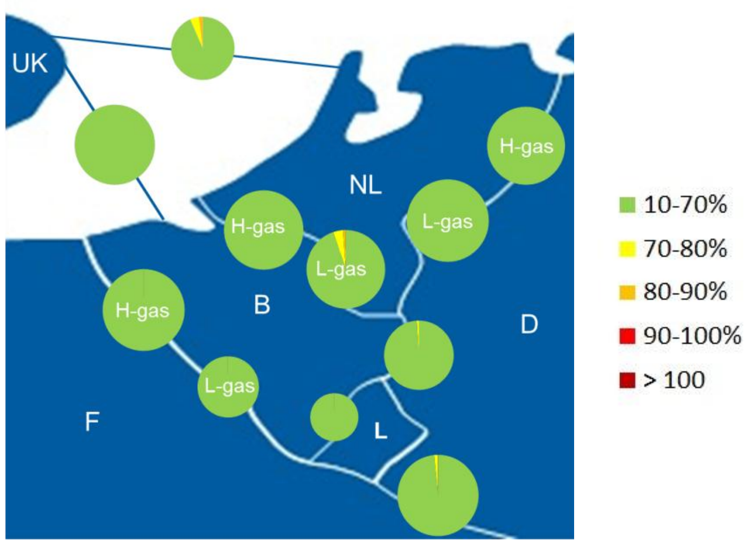
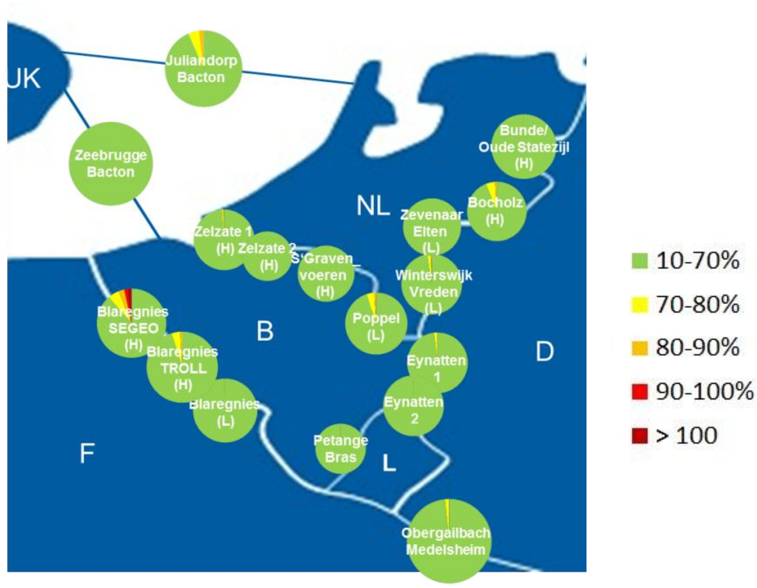


Figure 8: North-West Europe: capacity utilization (aggregated capacities) Jan 2011 – Jan 2012



Source: BBL, Fluxys, GRTgaz France, OGE, Wingas

Figure 9: North-West Europe: capacity utilization: Jan 2011 – Jan 2012

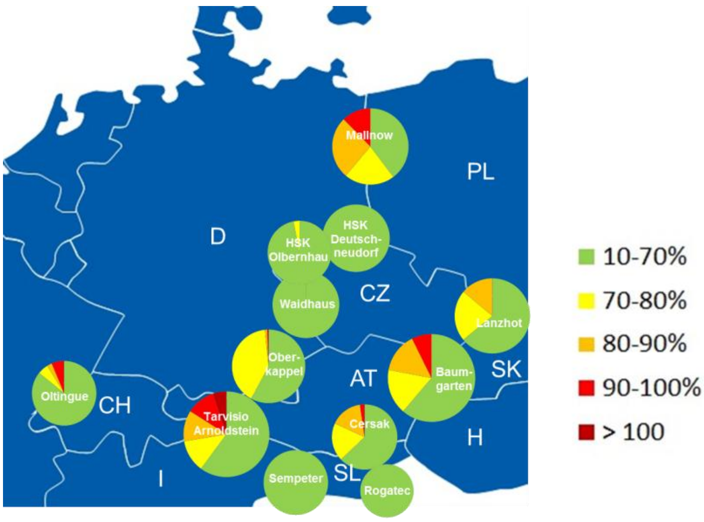
Figure 9 gives an overview on the aggregated capacity situation in the region whereas, figure 8 shows the capacity utilization for each individual IP. The aggregation was done separately for the H- and L-gas networks.

As regards the data of the IPs Winterswijk, Zevenaar, Bocholz (NL/DE) and Eynatten (BE/DE), technical capacities between OGE and the adjacent TSOs differ significantly and the determined capacity utilization rates based on a comparison of physical flows to technical capacities in many cases yielded results of up to 200%. However, no interruptions occurred at those interconnection points and, on inquiry, all TSOs confirmed that none of the interconnection points was physically congested. When comparing the data of offered, nominated, allocated and actually interrupted capacities between TSOs, OGE offers lower amounts of firm capacities, but sells unlimited amounts of interruptible capacities. The ratio of nominated and allocated interruptible and firm capacities is much higher compared to other TSOs. Therefore, the physical capacity at the respective IPs was approximated by including booked interruptible capacities.

The results suggest that there is excess capacity in this region. In 2011, the capacity utilization did not exceed 70% in more than 90% of all hours. According to the published data on interrupted volumes, there were no physical congestions in this region. Since this region is very important for transits of Norwegian, British and Dutch gas, the transported gas volumes are substantial. The results suggest that further market integration is likely to be highly beneficial in this region.

2.2 4 Central-East Europe

The analyzed data sample for the Central-East European region includes the major interconnection points between Germany, Poland, the Czech and the Slovak Republic, Italy, Austria, Slovenia and Hungary and covers 97% of the technical capacities in of the countries.



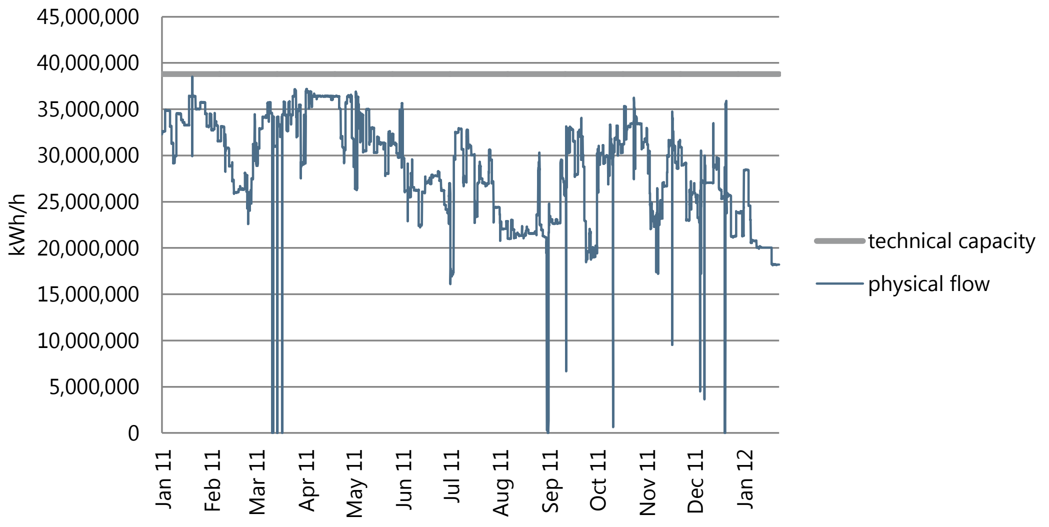
Source: Gascade, OGE, Net4Gas, Eustream, TAG, Geoplin Plinovodi, BOG

Figure 10: Central-East Europe: capacity utilization Jan 2011 to Jan 2012

Hourly data was available for the interconnection points at Mallnow (PL/DE) and Waidhaus, Olbernhau (CZ/DE) and Oberkappel (DE/AT), whereas all other results are based on daily data. Following the same approach as described in the previous section, the technical capacities of OGE at the interconnection point Waidhaus were adjusted, since the determined capacity utilization compared to the indicated technical capacities reached up to 200% in many hours, while there were no interruptions. The obtained results were consistent with the ones that an analysis of the data of Net4Gas yielded. As regards the interconnection point at Oberkappel, a different approach was chosen, since data of interrupted volumes was available. In the event of interruptions, the maximum physical capacity may be approximated by the allocations for the respective hour. An average of the observed allocations was determined on a monthly basis.

The results suggest that the capacity utilization at the interconnection points at the Austrian-Italian border, the German-Polish border and the Austrian-German border are highly loaded.

Mallnow



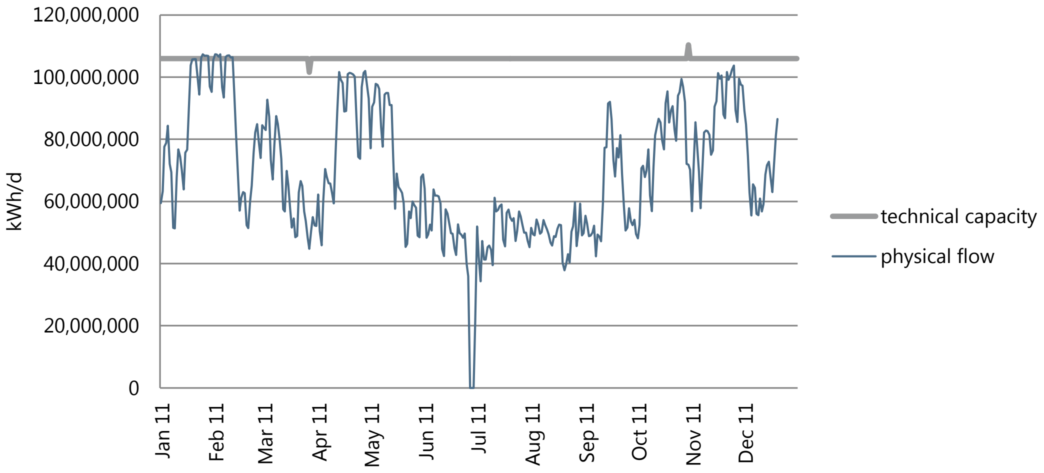
Source: Gascade

Figure 11: Mallnow: hourly physical capacity utilization Jan 2011 – Jan 2012

Figure 11 shows that the capacity utilization at the interconnection point Mallnow exceeded in about 40% of the hours 80% of the technical capacity, while in about 12% it was higher than 90% of the technical capacity. The high capacity utilization occurred throughout the year and did not show strong seasonality. Gascade offers interruptible capacities at Mallnow, the booked volumes of which amount to about 12% of firm capacities.

According to Gascade, no interruptions occurred during the considered period.

Arnoldstein/Tarvisio



Source: TAG

Figure 12: Arnoldstein/Tarvisio: Daily physical capacity utilization Jan 2011 – Dec 2011

The capacity utilization at the interconnection point in Arnoldstein/Tarvisio exceeded on 15% of all days 90% of the technical capacity and on 5% of all days 100% of the technical capacity. The maximum capacity utilization was at 101% of the technical capacity. Since only daily data was available, hourly capacity utilization rates might have been higher. Offered interruptible capacities represented about 4% of the technical capacity, which compared to the flows suggested that physical congestions might have occurred. Data on actual interrupted volumes was not available. Therefore a telephone interview was conducted. According to TAG, no interruptions occurred during the considered time period despite the high capacity utilization.

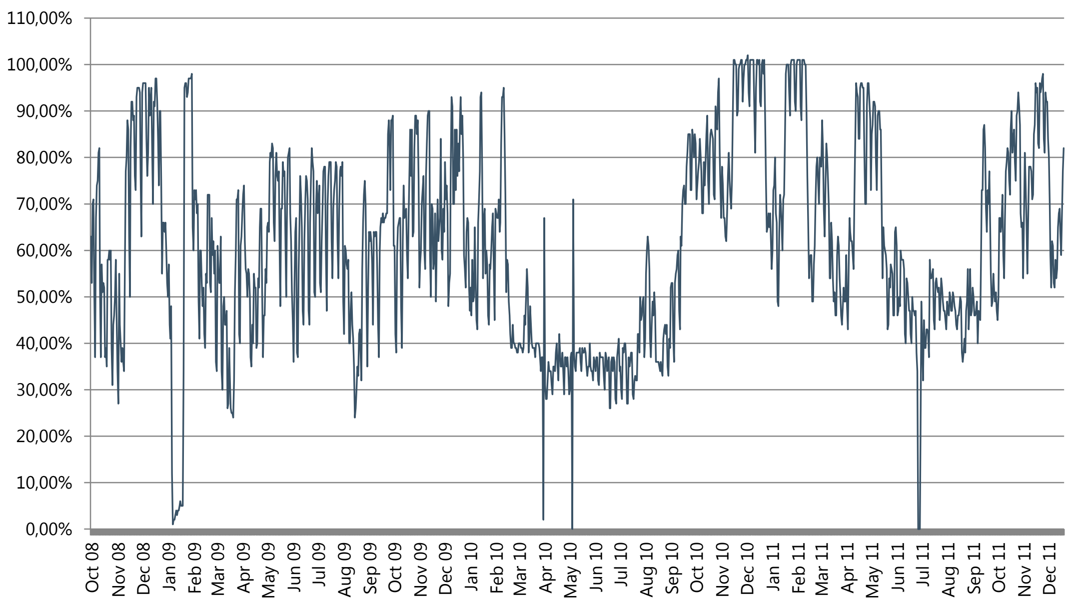


Figure 13: Arnoldstein/Tarvisio: physical capacity utilization Oct 2008 – Dec 2011

TAG publishes data as of 2008. An analysis of development of the capacity utilization at Arnoldstein/Tarvisio from 2008 to 2012 showed that in past years the capacity utilization was subject to seasonality, while there is no clear trend over time, but the capacity utilization in 2011 seems to be higher than in the previous years.

Oberkappel

The capacity utilization at the interconnection point in Oberkappel was the highest compared to all other IPs. As discussed above, for the determination of the capacity rate an approximated physical capacity was used, which was based on the indicated technical capacities by OGE.

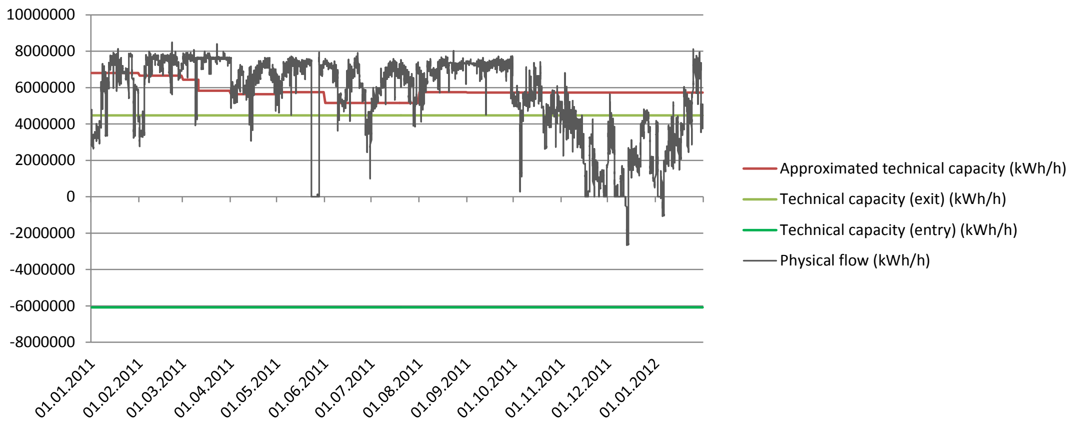


Figure 14: Oberkappel: hourly physical capacity utilization Jan 2011 – Jan 2012

The capacity utilization rate exceeded 100% of the approximated physical capacity in about 32% of all hours. The maximum utilization rate was at 170%. Interruptions occurred in 17% of all hours, but the actual interrupted volumes only represented a small share of 2% of booked interruptible capacities. Interruptions occurred throughout the year without showing any seasonality.

2.3 Summary of main findings

Part one of this reports analyzes the capacity utilization of the interconnectors in Europe. The analysis was based on data of the actual flows across the interconnectors and the maximum technical capacities provided by the TSOs. All data was publicly available. In several cases, the information was supplemented by telephone interviews with experts from the TSOs to either clarify data inconsistencies or to confirm assumptions made. We indicate in the text, when this additional information led to deviations from published data or when it allowed us to draw additional conclusions.

The interconnectors have been analyzed individually and also bundled together to draw conclusions about the aggregated interconnection capacities between markets. For aggregation purpose, the maximum technical capacities have been simply added. It is understood that this is a conservative approach and a combined calculation of interconnection capacities between markets may lead to higher numbers. However, it should also be noted that there are still significant uncertainties with respect to the coordinated capacity calculation method and that the technical capacities made available to the market may even need to be reduced in case flows change significantly and uncertainties increase.

The analysis of the 2011 data led to the following conclusions:

The capacity utilization is different across Europe. Three European regions may be distinguished: the North-West European region, which has significant excess capacities compared to today's utilization, the South-West European region, where cross-border capacities between France and Spain were highly used in 2011 and the Central-East European region around Austria, which is relatively high loaded, but still significant capacities are available at many interconnection points.

The North-West European region seems to be connected with sufficient transmission capacities. The utilization of the interconnection capacities is always below 70% of the nominated maximum technical capacity. Several large producers have access to this region, which supports up-stream competition. Further analysis would be useful to make an assessment to what extend the available interconnection capacity could be used to further reduce price differences between the major hubs and increase social welfare in the entire region.

The South-West European region experienced significantly higher loadings of their interconnectors. The interconnector between Spain and Portugal was loaded for more than 70% for some 25% of time. The France – Spain interconnection was even loaded for more than 70% for more than half of the time and fully loaded for 25% of time. A reduction of physical constraints would have most likely a higher priority in this region than the further development of the market design.

The Central-East European region is relatively highly loaded, but with substantial reserve margins. Particularly loaded was the interconnector at Oberkappel between Austria and Germany, where physical capacity seems to be insufficient. The capacity utilization at the Polish-German and the Austrian-Italian border was very high, but no physical congestions occurred. At the other interconnectors, substantial capacities were available for most of the time.

In the remaining part of the report, two regions around Austria will be selected and the impact of an integration of the markets will be analyzed. It will be analyzed, if further market integration would have an impact on the loading of the interconnectors and if the available interconnection capacities are sufficient to promote further convergence of the prices in the region.

3. Macro-economic analysis of CEE (regional) market integration

3.1 Work Approach

The main objective of the second part of the study is to estimate potential welfare effects from enhanced market integration in two selected regions. The first region includes Austria, the Czech and Slovak Republic, whereas the second one contains Austria and Italy. Those regions were chosen in the framework of the work programme of the Gas Regional Initiative for the South-South East European region, which aims at evaluating options for enhanced market integration in this region (see Figure 13). Based on a project-orientated approach, ten pilot projects are carried out, amongst which one focuses on the future market architecture in the region by evaluating cost and benefits of implementing different market integration models. To this aim, two studies were commissioned by E-Control: the present study that analyzes the welfare benefits of market integration in two SSE regions and a second subsequent one on the institutional market design and implementation steps for the SSE region.

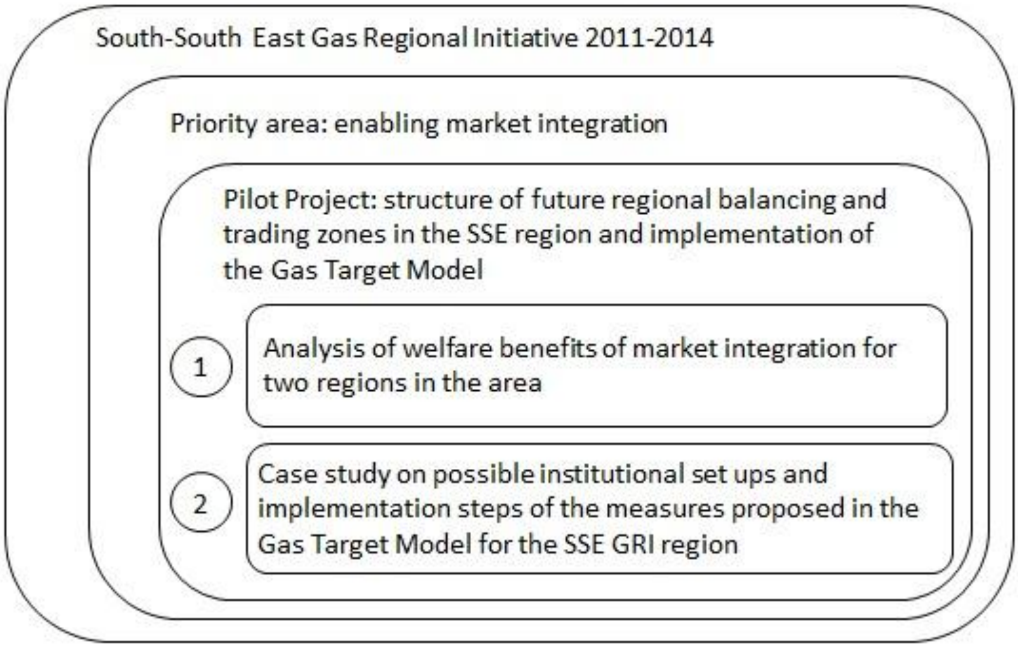


Figure 15: South-South East Gas Regional Initiative Work Programme 2011-2014

In the light of the above, the study focuses on the estimation of expected welfare that would be obtained if cross-border capacities were used efficiently. In practice, such an optimal allocation may be achieved through a number of policy measures that have been discussed in the framework of the elaboration of the European Gas Target Model, e.g. capacity release programmes, explicit or implicit auctioning of cross-border capacities, the creation of trade regions and the merging of existing market areas. However, the efficiency and effectiveness of those market integration measures depend largely on the market design and its implementation, which are in turn subject to the prevailing market conditions and adopted market rules of the considered countries. The evaluation of the market measures will be part of the second study as illustrated above.

The present study takes their common objective and the ultimate goal of the European internal gas market, i.e. the efficient use of cross-border capacities, as a starting point and working hypothesis of the welfare analysis and addresses the following four questions:

- What would be the additional welfare in the two selected regions, if cross-border capacities were allocated implicitly?
- How are those welfare gains distributed between markets and market participants?
- Are the existing cross-border capacities sufficient as to realize the expected trade effects given the current gas flow patterns?
- Could full price convergence at the wholesale level be achieved?

By taking the optimal allocation as given, the study sheds light on the maximum welfare gains to be achieved via market integration irrespective of the exact design of policy measures.

3.2 Criteria for evaluating the economic benefits

3.2 1 Price Convergence

Market integration leads to an optimal utilization of the interconnection capacities by applying implicit auctions. The market with the lower prices will export gas to the market with higher prices. The export leads to increasing prices in the exporting market and the import leads to lower prices in the importing markets. The difference between the prices of the markets will decrease. If there are no congestions on the interconnector, the price difference will diminish completely and prices will perfectly converge.

A single price across the entire integrated region enhances the relevance of the spot price for the entire market – organized markets of gas exchanges as well as OTC markets – and is the basis for additional economic benefits (see below). The degree of price convergence is an important criterion for estimating the economic benefit of market integration.

3.2 2 Social Welfare

The welfare analysis in this study is based on the classic static welfare concept. According to economic theory, the total social welfare associated with enhanced market integration is the sum of additional consumer, producer rent and congestion returns in the event of physical congestions, which are illustrated in Figure 16.

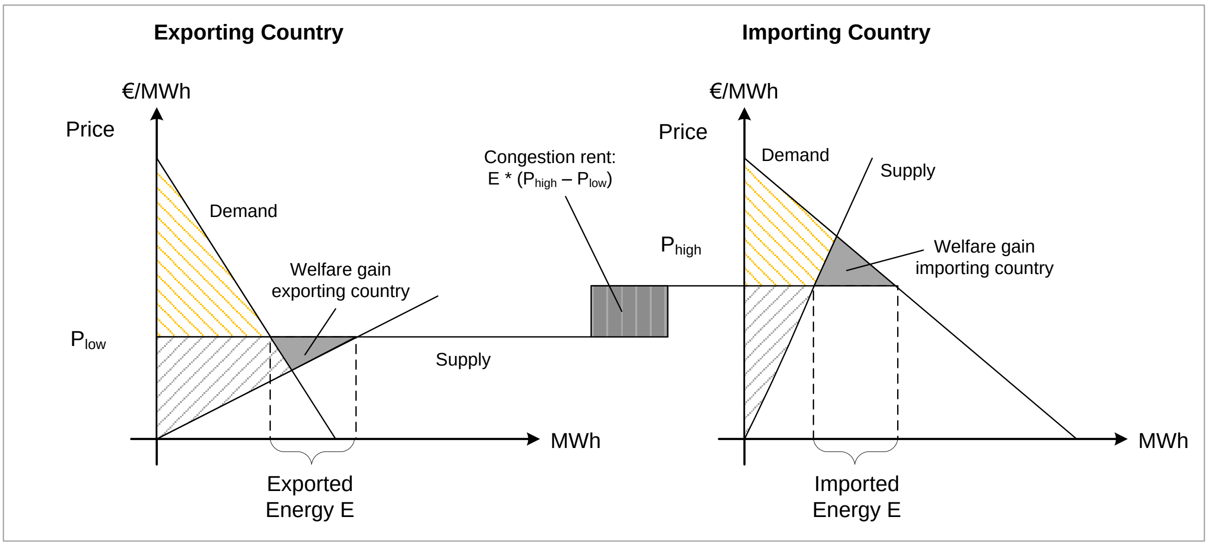


Figure 16: Illustration of static welfare effects from better allocation of resources

Additional trade between two adjacent market areas occurs, when the price differences are relevant and price arbitrage is possible. Price arbitrage enables a shipper to transport gas from the low-price country (the exporting country) into the high-price country (the importing country).

In the illustrated situation, export of gas (energy E) from the low-price country to the high-price country occurs and creates welfare effects via the following mechanism:

- Energy is offered by a shipper in the importing market at the price of the low-price market. The imported energy reduces the price in the high-price market.
- Due to this price reduction, the consumers in the high-price country gain additional welfare, which equals the additional consumer rent under the demand curve between the old and the new market price. In the importing country, part of this additional consumer surplus will be redistributed since in the low-price exporting country the price will increase. This “loss” is equal to the consumer rent under the demand curve between these two prices. The consumers’ net gain equals the welfare gain of consumers in the importing country net of the respective welfare loss of consumers in the exporting country. That net gain is marked in grey in Figure 16.
- As concerns the producers, the situation is inversed. The producers in the low-price country will realize additional producers' rent, whereas the producers in the high-price country will lose some of their surplus due to the decreased price. Again, this entails the redistribution of rents. The net gain for the producers is also marked in grey in Figure 16.
- The above described price arbitrage will continue until the prices on the adjacent markets are equalized if there is no physical congestion between the two markets, i.e. if the existing available capacities are sufficient to cover all required arbitrage trades. This is the result of the law of one price. If physical capacities are insufficient, some price difference remains between the two markets. Multiplying this price difference with the volumes offered and traded between the two countries yields the so-called congestion rent (the gray rectangle in Figure 16). If cross-border capacities are auctioned, that rent can be attributed to the TSOs and shall be used for physical investments or reductions of network tariffs. In this case, the congestion rent is part of the benefits of additional trade, just as the additional consumer and producer rents are.

- In case of full market integration, no congestion income but will be generated when physical congestions occur. On the contrary, welfare will be reduced since more balancing energy is required as to ensure system integrity thereby counter-balancing the welfare gains of consumers and producers.
- The total economic value of additional trade (net benefits) is equal to the sum of additional rents (consumer rents plus producer rents plus/minus congestion rents).

3.2 3 Other qualitative benefits

In addition to the above discussed welfare effects, a number of other benefits is associated with enhanced market integration.

- First and foremost, even though price convergence is not an end in itself, it does not only lead to static welfare gains as described in the previous section, but it also improves market signals by better aligning prices with market fundamentals, thereby providing better reference prices. More reliable spot prices might have an impact on gas supply contracts that are usually oil indexed. By loosening the link between the two commodity markets, also long term prices will better react to changes in the underlying supply and demand conditions. Ultimately, competitive prices provide better investment signals and ensure that required investments are made and are cost-efficient. Therefore, competitive wholesale markets are also key to improving security of supply in the long run.
- Increased market liquidity is likely to attract more traders since it facilitates transactions. Since new entrants often supply smaller market segments, access to liquid wholesale markets is vital to their business model. It allows them to easily procure small quantities at competitive prices. Furthermore, wholesale traders can optimize their portfolio in a more cost efficient way.
- The strengthening of competition and reduction of market concentration will impede strategic anti-competitive behavior by market participants since each single trader has less influence on the market price. Furthermore, the increased market transparency facilitates the market monitoring of regulatory and competition authorities since harmful actions may be detected more easily.
- At an individual level, enhanced market integration, for example by means of setting up a common virtual trading point, reduces transaction and information costs for each trader.
- Furthermore, improved access to cross-border capacities or alternatively the elimination of capacity booking requirement at IPs in a common trading/market area improves third party access between adjacent networks limiting or eliminating the scope of contractual congestions.
- Depending on the degree of market integration, the creation of cross-border balancing zones reduces further barriers to entry for new entrants since it allows for cross-border balancing accounts that are subject to the same balancing rules.

3.3 Method for estimating welfare effects

3.3 1 Derivation of supply and demand curves

Modelling of the supply and demand curve plays an essential role in our analysis of social welfare gains and price convergence resulting from enhanced market integration.

Supply and demand curves reflect the offered and demanded quantities for any given market price, which are illustrated in a stylized form in Figure 17. Both curves can be constructed via willingness-to-pay or offer curves. However as information about the market curves is usually proprietary information of the energy exchanges and hence confidential, they were simulated in a specific model. The model is based on publicly available data and information.

For modelling purposes, the demand and supply curves are split into different elements according to their short-term price elasticity. The exact shape of the demand and supply curves depends on the price sensitivity of customer and supplier groups in the respective markets.

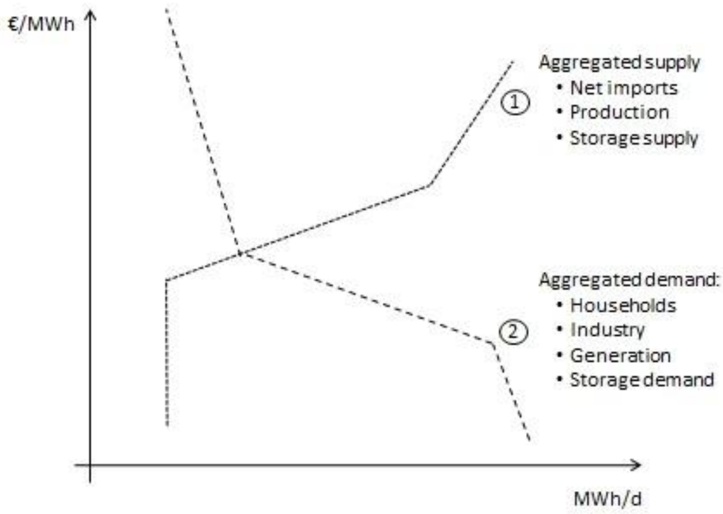


Figure 17: Supply and demand elements

The supply curve can be split into two elements: a "base supply" and "supply provided by storage facilities".

1. The volumes of net import and production determine the "base supply". This base supply is mainly characterized by long-term "take or pay" contracts. It is price-inelastic, i.e. does not react to changes in prices in the short-term.

2. Storage facilities may be flexibly used to withdraw gas and offer it on the market. The storage supply therefore reacts to changes in market prices provided that storage capacity is available.

The demand curve can be split into three elements: demand by households, industry/generation and storage demand.

3. The first element represents the gas consumption of households that mainly use gas for residential heating purposes. Their heating decisions solely depend on the outside temperature. Since they use gas irrespective of market prices, their demand is assumed to be totally price-inelastic in the short-term.

4. The second element is the gas demand of industry/generation used for production processes, either as a direct input, e.g. in the chemical industry, or for heating purposes in the course of the manufacturing process. This demand is price-elastic.

5. The third element of the demand curve represents the demand of storage facilities. Due to the short-term flexibility of storage facilities, the storage demand reacts to changes in the market price provided that storage capacities are available.

As to determine the aggregated demand and supply functions, the demanded and supplied quantities of the above described consumer and supplier groups are added up for any given price.

A detailed description of the methodology used for deriving the supply and demand curves is given in the next chapters.

3.3 2 Model of supply curve

The supply curve consists of two elements:

- Net import/production
- Storage facilities.

3.3 2 1 Net-imports and production

The net imports and production curves are assumed to be nearly completely inelastic, since they are assumed to consist mainly of "take or pay" contracts.

The "take or pay" clause requires the importing party to purchase a minimum volume of gas whether the delivery is taken or not. The gas price is determined according to a formula that factors the development of competing fuels in and is adjusted every few months. Short term volume flexibility might be provided by swing options included in the contracts that are usually limited in number, but allow the supplier to react to a certain degree to changing market conditions. Since the exact specification of those contractual arrangements is confidential information and since "take or pay" contracts are usually used to cover the expected base load and provide only very limited volume flexibility, the net imports and production are assumed to be price-inelastic.

The information on net imports and production is based on publicly available data. Monthly figures are provided by national statistical offices and are also published by Eurostat. For modelling purposes, it is assumed that the monthly net imports and production do not significantly vary on a day-to-day basis. Therefore, monthly figures are allocated equally to the days of each month.

3.3 2 2 Storage supply

Storage supply is the main short-term flexibility instrument. Gas storage facilities are mainly used for price arbitrage during summer and winter seasons, but can also be used to cover daily variations in demand. The price sensitivity of storage users is mainly determined by storage costs and the expected future prices.

Storage operators usually apply multi-part tariffs. The price consists of two main components: a fixed component for the storage capacity and a variable component for the injected and withdrawn energy volumes. The capacity price is based on a certain working gas volume to which, given the technical characteristics of the storage facilities, a maximum hourly injection and withdrawal rate are linked. This capacity price will vary according to the contract duration and the flexibility requirements of the user. In general, storage operators offer long term (more than one year) and short-term capacity products (less than one year), which are sold bundled or unbundled and on an interruptible and firm basis. Given the reserved capacity, gas volumes may be injected and withdrawn to which a commodity charge is applied.

In a perfectly competitive market and disregarding strategic behaviour, storage users would base their day-to-day withdrawal/injection decisions only on the applied commodity charge. Given the high market concentration in storage markets and the high share of capacity costs in total storage cost it, is assumed that storage users will also in the short-run factor in a fixed-cost mark up in their withdrawal/injection decision. This capacity cost mark-up varies according to the actual capacity usage. If the reserved capacity is not used, opportunity costs occur and will increase the mark-up. The final usage of the capacity will be mainly influenced by demand and supply fluctuations.

Against this backdrop, a rational storage user would try to minimize its storage costs by optimizing its capacity products given the expected demand/supply variations (as to optimally choose the required capacity volume) and their expected frequency (as to optimally choose the duration of the contract). The storage supply curve is therefore determined as follows:

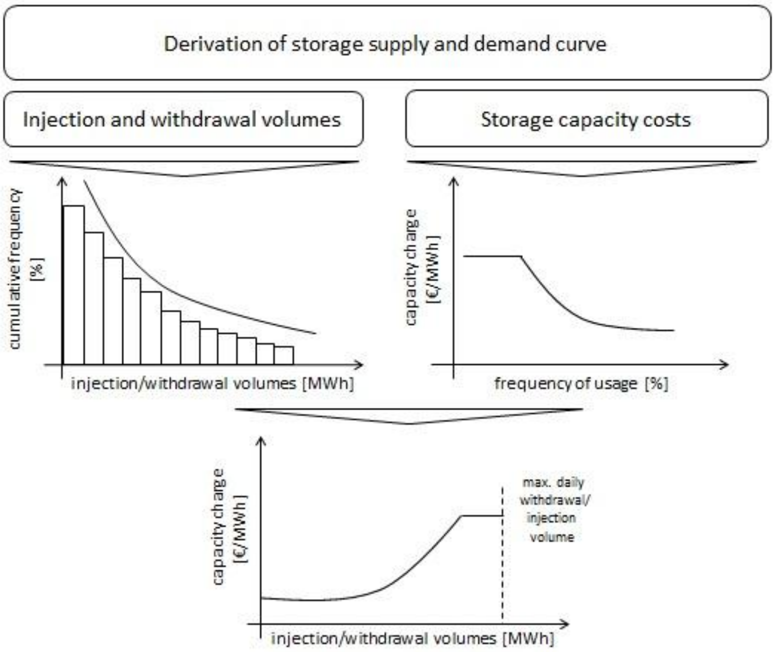


Figure 18: Overview modelling of storage demand and supply

- In a first step, a capacity cost curve is determined depending on the frequency of the actual capacity usage. To this aim, the prices for offered long-term and short-term capacity products that are published by the respective storage operators are taken and adjusted for the opportunity costs based on the frequency of usage. Then an optimal cost curve is determined by allocating the lowest price to each frequency level.
- In a second step, a cumulative frequency curve of observed injection and withdrawal volumes in 2011 is determined. To this aim, the actually observed daily injection and withdrawal volumes in 2011 are taken and allocated to 100 000 KWh volume segments. For each volume segment, the number of days that the actually observed volumes in 2011 exceeded the upper bound of the respective segment is determined. The obtained frequencies are accumulated as to obtain the cumulative frequency curve.
- In a last step, the two curves are combined as to obtain the storage supply curve depending on the storage costs.

The derivation of the storage supply curve is based on publicly available data. Data on daily storage injection volumes, storage levels as well as injection costs and service charges is published by almost all the storage facility operators according to the Guidelines of Good Practice for Storage System Operators (GGPSSO).

Since the specifications of the capacity storage products are numerous and vary between storage operators, the capacity costs for standard bundled products for different durations were used.

The daily storage supply in the model is determined based on a comparison of daily net imports and production volumes with the daily total demand. If the demand is higher, then the difference in volume is supplied by storage facilities.

3.3 3 Model of demand curve

The demand curve consists of three consumption groups:

- Households
- Industry/generation
- Storage demand.

Gas consumption data is only published on an aggregated level, i.e. without differentiations according to consumer groups, and it is provided on a monthly basis. The allocation of the monthly consumption data with respect to the consumer groups is based on IEA country information on the relative share of each consumer group in the overall gas consumption.

3.3 3 1 Households

The gas demand of households is only temperature-elastic and completely price-inelastic since their gas consumption is mainly used for heating purposes.

The used heating equipment by households and commercial clients has no fuel-switching capacities, high investment costs and a long economic lifetime. Therefore, once the gas-fired equipment is installed, customers are locked-in due to high switching cost which makes their demand highly price-inelastic in the short-term.

As regards the volumes, it is assumed that the total household consumption does not react to changes in prices, whereas commercial heating gas demand is below 5% of the industrial consumption.

Based on the monthly data, the daily demanded quantities are determined by means of temperature data and standard load profiles. The average daily temperature of each national market is approximated by the data of a representative climate station, which is used as the input parameter. Based on this temperature data, daily volumes are determined based on standard load profiles. Those profiles describe the typical household consumption depending on the daily temperature. The daily consumption is modelled by multiplying the yearly average amount by the daily temperature factor. In a last step, temperature sensitivity is limited via variance analysis in which variance of the data to be explained by our estimates is minimized throughout the total monthly consumption of each Member State.

For our modelling we used the SLP DE-HEF03, which is published by the TU Munich. This profile assumes that consumers' gas demand on weekdays and weekends is the same, if the temperature is equal on these days.

3.3 3 2 Industry/generation

The process gas demand by the industry and power generators is assumed to be price elastic in the short term since part of those customers use equipment with fuel-switching capacities.

This customer group mainly uses gas either as a raw material in the production process or for steam raising for power generation. Depending on the production process and technology used, customers might substitute gas for other fuels or may store some volumes, which makes them price sensitive in the short run. If customers have fuel-switching equipment, their responsiveness depends on the price of the competing fuel and the switching cost.

The demand for process gas by the industry and power generators is represented by the residual value, after having determined the daily consumption of all the other demand elements. The assumed elasticity values are based on public studies for OECD countries.

3.3 3 3 Storage

The storage demand curve is developed similarly to that used for the storage supply curve. Since bundled products were considered, the shape of the curve is a mirror image of the supply curve, whereas the cost level is different since the maximum injection volumes are lower than the maximum withdrawal volumes.

3.4 Estimated economic benefits

3.4 1 1 Description of the regions

A conceptual design of the two selected regions is provided in Figure 19.

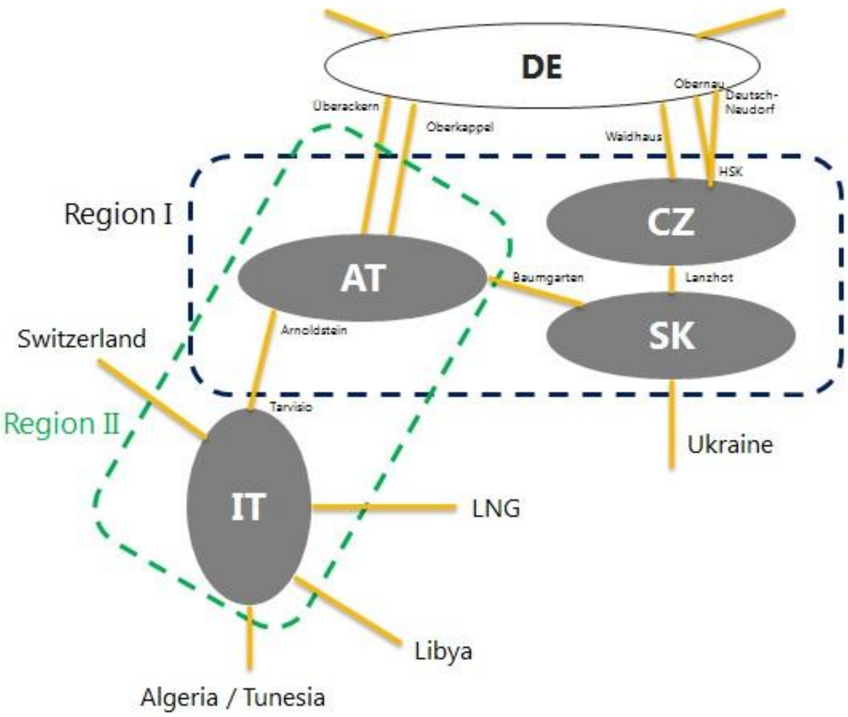


Figure 19: Overview of the two selected regions

The first region covers Austria, the Slovak and Czech Republic. It is characterized by strong imports from Russia via Ukraine and exports to Italy, whereas gas flows to Germany are bi-directional. The three countries are only connected through the Slovak Republic. There are no direct connections between Austria and the Czech Republic.

The second region covers Austria and Italy. This region has a much wider diversification of imports. Strong imports come from Russia via the Ukraine and the Slovak Republic, from Switzerland, Libya and Algeria/Tunisia. There are no significant exports.

An organized daily market exists in Italy and Austria. In the Czech Republic, only the intra-day market enjoys a relevant trading activity. A workable wholesale market place does hardly exist in the Slovak Republic. Further market integration across region 1 would therefore not only support the efficient allocation of the intra-regional interconnection capacities, but would also improve the availability of organized trading platforms in all three markets.

The major flows, loads, storage and transmission capacities are provided in Figure 20. The indicated numbers are based on IEA data as to ensure their comparability between countries.

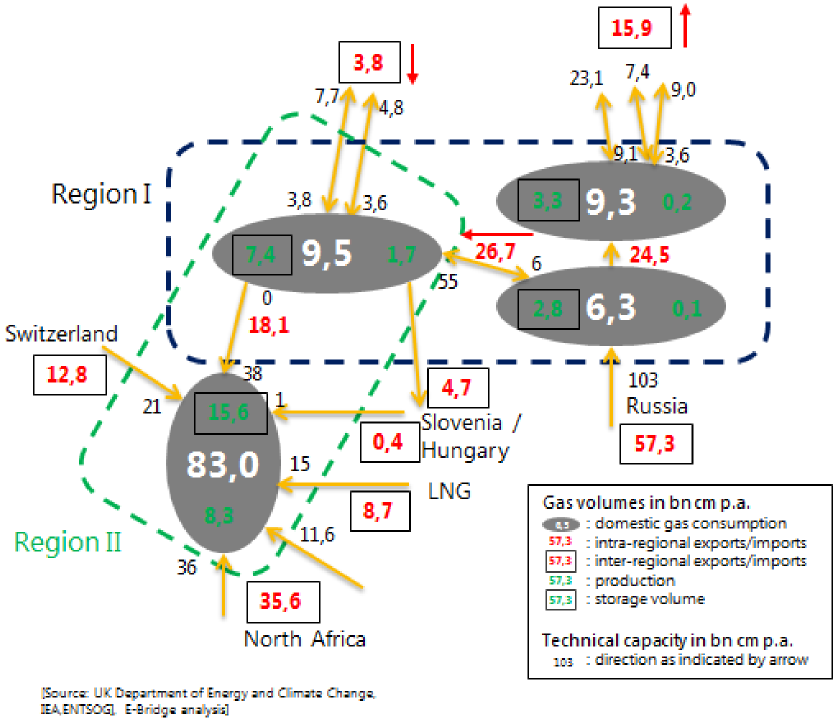


Figure 20: Technical data and flows across the two investigated regions in 2010/2011

The market integration of Region I would lead to a market with a common demand of some 25 billion m^3 (compared to some 9,5 billion m^3 of Austria only). This market would have significant transits, i.e. some 50% higher than the total aggregated demand in the region. However, imports would be mainly from Russia, own exploration would cover less than 10% of the demand and only 3% of the imports.

The storage capacity in the Region would be significant. More than half of the annual demand could be covered by the storages, some 30% of which are located in Austria. The Slovak Republic contributes some 11% of the entire storage capacity.

An integration of the markets in region I would primarily lead to a better utilization of the interconnection capacities and would enhance competition on the supply and demand side. Furthermore, the region is characterized by significant transit flows. Whereas those transit flows might also increase the market liquidity, they are not analyzed in detail in the study.

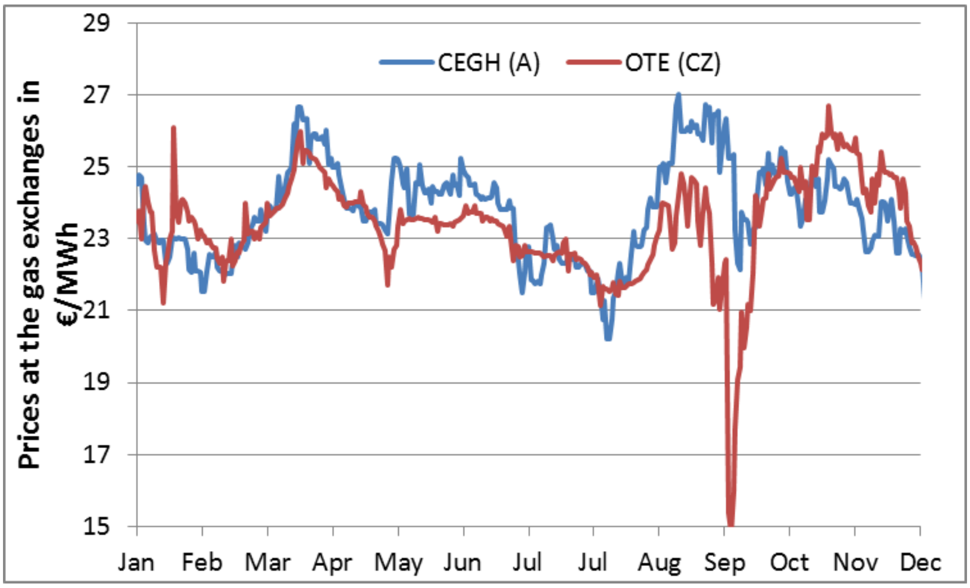
The characteristics of Region II would be very different. The size of the region in terms of annual demand would be significantly higher, namely some 92 billion m^3. About 90% of this demand is located in Italy. Own exploration would be similar, i.e. some 10% of the entire demand. However, this region would face very little transits. Also, the storage capacity would be smaller and cover only 25% of the entire demand. Although Austria has a significantly higher storage/demand ratio, double the storage capacity would be located in Italy in Region II.

Market integration on Region II may primarily enhance competition among gas producers, i.e. between LNG and pipeline gas and between gas sources.

3.4 2 Observed price convergence

3.4 2 1 Region I: Austria, Slovak and Czech Republic

The prices at the gas exchanges in Austria (CEGH) and the Czech Republic (OTE) are provided in Figure 21. Please note that there were only data from the intra-day market available at OTE since day-ahead trade did not occur. Also, there were only 190 days when trades where matched at the OTE. The missing data was approximated by determining averages.



Source: CEGH, OTE

Figure 21: Spot prices in Austria and the Czech Republic in 2011

It can be seen that during the summer periods, the prices in Austria are above the prices in the Czech Republic. During winter periods the price situation reverts and the prices in the Czech Republic are above the Austrian prices. Please note the displaced clearance of the y-axis.

In an integrated market, the price difference between the two markets should disappear, if there is enough transmission capacity available between the markets. There is ususally a strong import of gas towards Austria on the interconnection at Baumgarten. Baumgarten connects the Slovakian market with the Austrian one. In case of higher prices in Austria compared to the prices in the Czech market, gas should flow from the Czech Republic via the Slovak Republic towards Austria. In this case the interconnecter at Baumgarten would be loaded in the same direction as the “usual” imports. A price difference can be justified, if this inteconnection would be congested. In case of higher prices in the Czech Republic, the interconnection at Lanzhot between the Slovak and the Czech Republic will be loaded in the same direction as the “usual” flow and may become congested. Baumgarten would be deloaded in this case.

Although the price differences have been substantial on several days in both directions, the average price level is very similar in both markets. In 2011, the average price in Austria amounted to 23.78 €/MWh and 23.38 €/MWh in the Czech Republic. In total, the market prices in Austria were slightly above the Czech market price.

In Figure 22 we show the actual utilization of the interconnections and put it in relation to the price difference between the two markets.

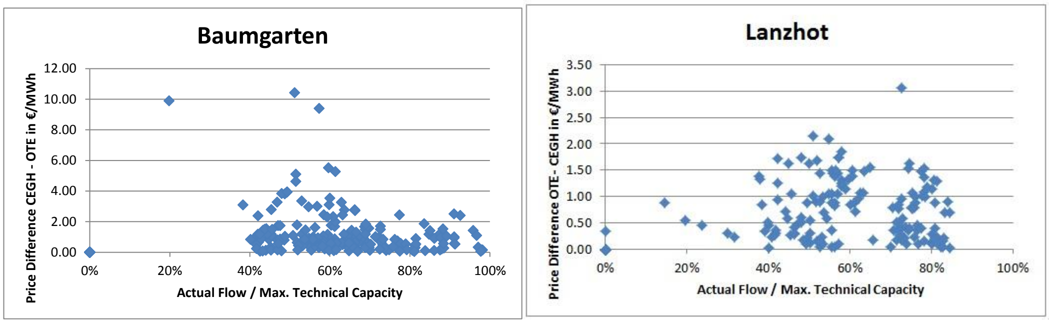


Figure 22: Comparison of the price differences between the Austrian and the Czech market in comparison with the loading of the critical interconnections (2011)

The figure on the left shows the loading of the interconnection at Baumgarten in periods of higher prices in Austria. The figure on the right shows the loading of Lanzhot during periods of higher Czech prices. If markets would work perfectly, the price difference would be expected to be close to the horizontal axis, if excess capacity is available. Both diagrams show clearly that price differences exist between the Austrian and Czech markets, which cannot be justified by insufficient interconnection capacities. Rather, enhanced market integration in this region is supposed to reduce any market imperfection and would support an efficient use of the two interconnections. This would ultimately lead to a convergence of the spot prices across the region.

In order to simulate the price convergence, the demand and supply curves have been modelled for each market as described above. Since storage facilities provide the highest short-term flexibility, the existing storage capacities in Austria and the Czech Republic have an important impact on the results. The marginal costs of the storage facilities have been calculated by distributing the fixed costs of operating the storage among the days of operating the storages. We assumed an optimal planning of the storage users, i.e. that they can structure the storage products perfectly to meet the demand. In practice, there are always some uncertainties with respect to the storage usage and the actual operation of the storage will be managed by applying approaches based on option theory. However, for the purpose of an assessment of the fundamental economic benefits of the storage usage, the application of the "optimal portfolio structure" seems reasonable.

The observed price discrepancies between the Austrian and Czech markets are shown in Figure 23.

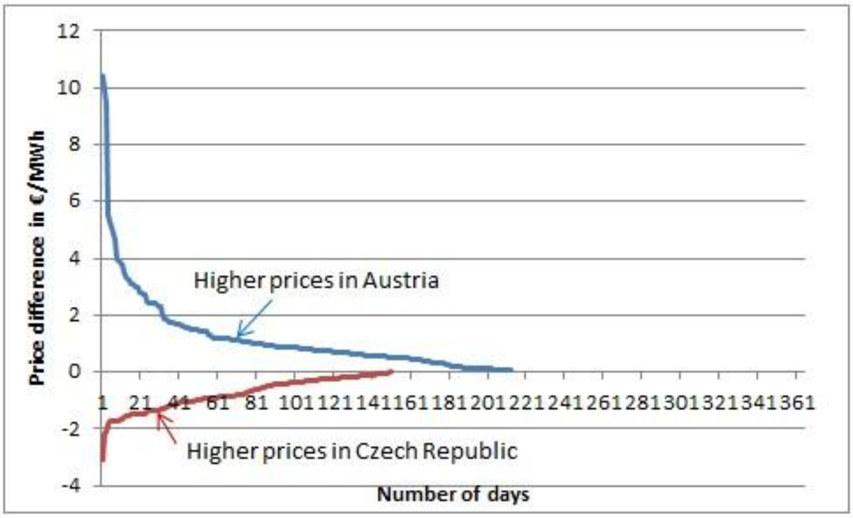


Figure 23: Observed price differences between the Austrian and Czech market in 2011

It can be seen that the prices in Austria were higher or lower than the Czech prices for almost the same amount of time. However, the price differences are clearly higher when the prices in Austria are above the Czech prices. The price difference exceeds 2 €/MWh on about 10% of all days, when the Austrian prices are higher, but do hardly exceed 2 €/MWh, when the Czech prices are above the Austrian one. This leads to an average price difference between the countries of 0,38 €/MWh (higher prices in Austria). However, the average price difference during times of higher prices in Austria is 1.21 €/MWh and 0.76 €/MWh during times of higher prices in the Czech market.

The introduction of market integration across the region would level the prices between the markets during almost all days, i.e. a single spot price can be achieved across the region for most of the time. The required additional flows between the markets do hardly generate physical congestions. Additional flows of less than 50 million kWh are usually sufficient to achieve complete price convergence. Compared to the maximum technical capacity of 1.600 million kWh (Baumgarten) or 1.200 million kWh (Lanzhot), the additional volumes are relatively low.

Figure 24 shows the impact of the market integration on the prices in each market.

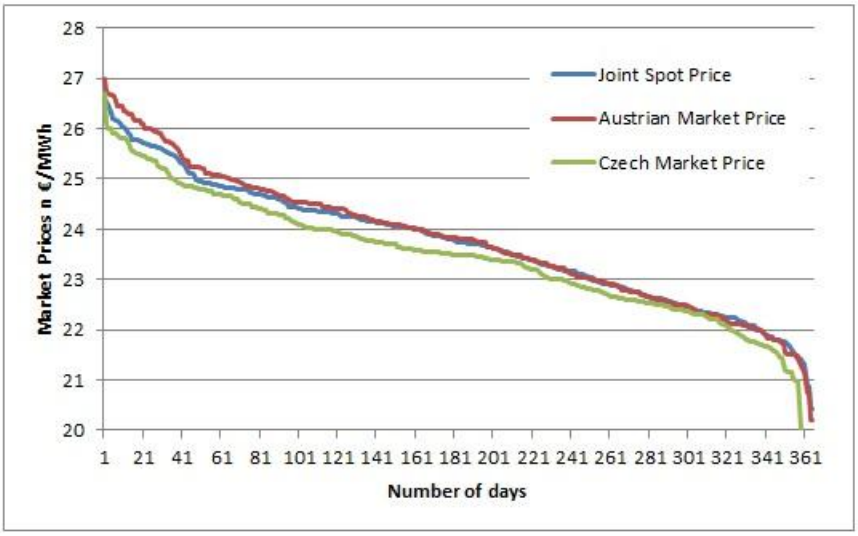


Figure 24: Cumulated frequency curves of the observed market prices in 2011 compared to the simulated joint market price after market integration

It can be seen that the market prices in Austria will decrease as a consequence of market integration. The most significant effect is the reduction of the high prices in Austria. The number of days with average or low prices will not change significantly. The cumulated frequency curve for the Czech market shows increasing prices. The Czech prices will decrease for about half of the time compared to the prices in the single market. However, the price increase during the other periods is stronger, which leads to the prices curve as shown in Figure 25.

It is important to note that the model used for calculating the price convergence is based on several assumptions. In the absence of better information about the demand and supply curves, the curves are approximated using simplified models and publicly available data. The validity of the underlying assumptions needs to be carefully reviewed.

- The marginal cost curve of the storage facilities in Austria and the Czech Republic has a significant impact on the results. The cost curves are based on published capacity costs of storage operators and the observed usage of the storage facilities in 2011.
- The usage pattern of the storage will be changed by the integration of the markets. A changing usage pattern has an impact on the marginal cost curve of the storage facilities. In order to verify the results, we therefore considered the changing utilization of the storage facilities and calculated adjusted marginal cost curves accordingly. The revised marginal cost curves change the demand and supply curves in the countries and have an impact on the calculated prices and the loading of the interconnector. The conclusion that price convergence is possible for most of the time is still valid.
- Also, the resulting prices in the integrated region depend on the net export curves of the involved markets. According to the 2011 data, the net export curve in the Czech market was steeper than in Austria. This leads to stronger price effects in the Czech Republic compared to the Austrian prices. It may be assumed that the fixed costs of the storage usage will come closer in the future and that net export curves will become more similar. In this case, prices in Austria would stronger decrease and prices in the Czech Republic would less strongly increase.
- The calculated net export curves, which determine the rate in which prices change as a consequence of changing imports or exports, are only indicative, considering the data available and the simplicity of the model used. As an important pre-requisite of our calculations, we assumed short-term effects on the

demand and supply curve only with fixed long-term import and export contracts. The consideration of some flexibility in the long-term contracts would result in higher price elasticity. This in turn would result in higher flows between the markets. However, as indicated above, we can observe that the free transmission capacity on the interconnectors is significant compared to the required additional flows between the market. We therefore expect that even, if higher price elasticity would lead to higher flows across the borders, prices between the markets in the region would significantly converge.

3.4 2 2 Region II: Austria and Italy

Figure 25 depicts the development of the price difference between the Austrian day-ahead gas price at the CEGH and the Italian day-ahead price at the GME in 2011.

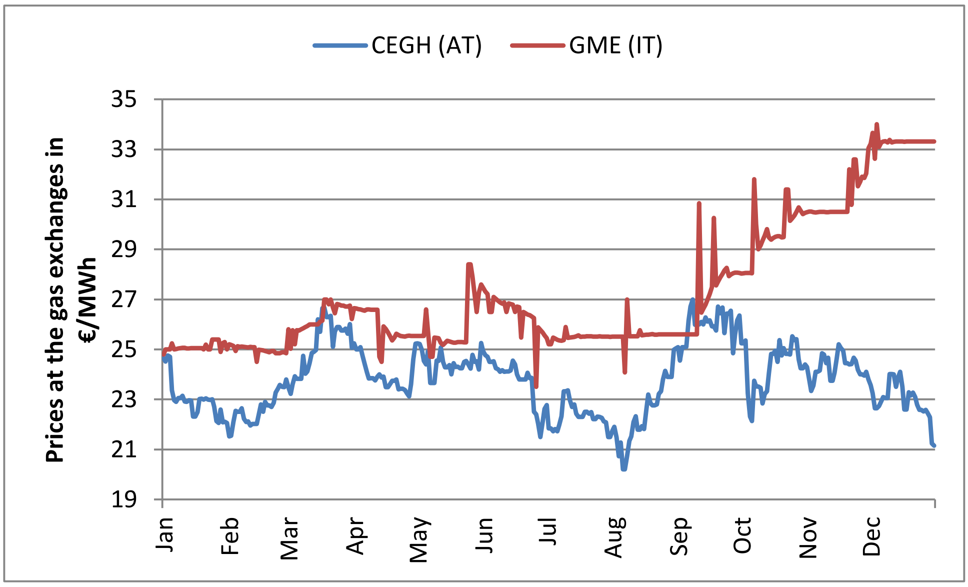


Figure 25: Spot prices in Austria and Italy in 2011

The Italian price is almost always significantly higher than the Austrian price. The positive price gap widened at the end of the year, when prices in Austria decreased whereas they increased in Italy. This might be due to the exceptionally low temperatures in Italy during this time of the year. In any case, the observed price differences between the two markets are more significant than between Austria and the Czech Republic. Also, the prices in Austria are structurally below the prices in Italy. The average price in 2011 in Austria was 23.77 €/MWh compared to 27.24 €/MWh in Italy.

Price differences between the markets should be an indication of limited connection capacity between the adjacent networks. Figure 26 shows the observed price differences between the Austrian and Italian market and compares it to the actual utilization of the interconnection.

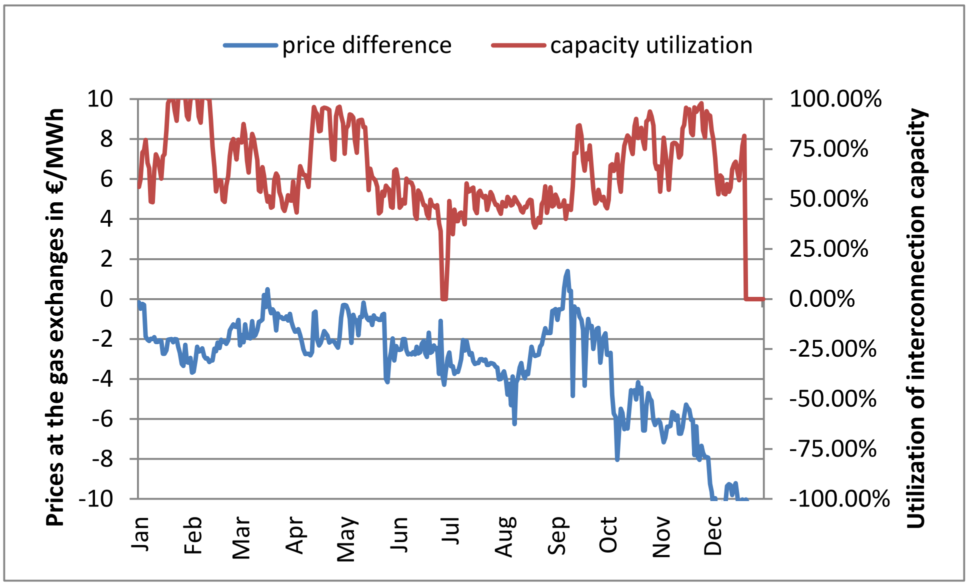


Figure 26: Comparison of the observed price differences between the Italian and Austrian markets and the utilization of the cross-border interconnection capacity.

It can be seen that the price differences are not directly linked to the physical utilization of the interconnection. Early in 2011, the utilization was above 100% of the technical capacity. During this time, we do observe price differences between the markets, but they are not larger than during later periods, when there is abundant capacity left on the interconnection. Enhanced market integration of these two markets is supposed to converge prices provided that sufficient capacity is available.

The observed price discrepancies between the Austrian and Italian markets are shown in Figure 27.

Figure 27: Observed price differences between the Austrian and Italian markets in 2011

It can be seen that the prices in Austria were lower than the Italian prices for almost all of the time. The average price difference is only little less than 4 €/MWh.

Enhanced market integration across the region would lead to significant flows towards Italy during times of sufficient physical capacity (see also Figure 27). This would lead to increasing prices in Austria while in Italy, prices would decrease.

Although the interconnection between Italy and Austria is one of the few interconnections in Europe that shows a very high utilization of physical capacity for a relevant number of days during the year, there is significant capacity available during the rest of the year, which would lead to converging prices in an integrated market.

However, given the high utilization in the past, we do not expect that the capacity is able to lead to a single price during most of the time. Based on the data we gathered, we estimated the net export curves in Austria and Italy, which resulted in additional exports from Austria of some 160 million kWh per 1 €/MWh price increase. In order to compensate for 4 €/MWh price difference, an additional flow of 300 – 350 million kWh would be required, i.e. 25% to 30% of the entire inteconnection capacity. Market integration may have led to a single price across Austria and Italy during the summer period in 2011. For the rest of the time, prices would have converged, but a remaining price difference would have remained due to physical congestions.

As discussed above, the results may only serve as an indication of the potential price convergence as the assumed price elasticity may differ from the observed numbers in 2011. Particularly, the model assumed only short-term price elasticities, mainly resulting from the utilization of the storage facilities. In case of Region II, we would be faced with an overall annual export from Austria towards Italy.

The price elasticity of long-term contracts would therefore have a more relevant impact in the long-run.

3.4 3 Social Welfare Gain

3.4 3 1 Region I: Austria, Slovak and Czech Republic

The social welfare gain results from two components: the social welfare in each market as well as the social welfare gain in form of congestion rents across the interconnections. As the change in congestions rents cannot be estimated as the actual exchange between the markets in 2011 is not known, the impact of the congestion rents on the social welfare gain will not be considered. This is a reasonable assumption, as congestion rents may increase or decrease depending on the change in flow and the price difference between the markets. Also, in case of Region I, we do not expect that significant congestion rents remain after the market integration, as prices will converge completely.

The calculated social welfare gain in Austria is estimated below 5 million € p.a. and between 10 and 15 million € p.a. in the Czech Republic. The social welfare gain is moderate, but would justify implementing an integrated market across the region. Due to the lack of data on wholesale prices, welfare gains for the Slovak Republic could not be quantified in the study.

Please note that there will be a number of additional, not quantifiable benefits resulting from market integration, which will be discussed below.

3.4 3 2 Region II: Austria and Italy

Due to the limitations of the model we refrained from the calculation of the social welfare gain in Region II. However, it can be reasonably estimated that:

- The welfare gain will be substantially above the welfare gain estimated for Region I. The higher price differences will force higher flows across the border and thus will lead to higher welfare gains.

- As it can be assumed that congestions at the border will further increase, significant congestion revues will be generated.
- Market prices in Austria will significantly increase, while they will decrease in Italy.

3.4 4 Other qualitative benefits

In the Czech Republic, the number of market participants was limited in 2011 and gas was actually traded on 190 days of the year only. In Italy, traders were only active on the GME day-ahead market on 70 days in 2011. This suggests that prices might not reflect the true costs and willingness to pay of the two market sides. Therefore, enhanced competition from other market parties is likely to yield high benefits since it would further increase the pressure on the prices. The final market price in an integrated market might therefore be lower than the ones determined in the model. This will lead to additional welfare effects.

Also, as mentioned earlier, in the model it is assumed that Slovak market players will not participate in the gas trade given the current national market design. Depending on the price level in the Slovak Republic, further welfare gains might be achieved, if those market players also participate in the market.

Furthermore, due to limited information short-term flexibility of long-term contracts was not considered in the model. Depending on the exact contractual specifications as regards swing options, additional welfare effects will be realized.

Ultimately, the analysis focused on the estimation of expected welfare effects in the short-term. In the long-term, since the estimated price elasticities of all market participants are significantly higher, the welfare gains are likely to increase further.

Ultimately, the increase in liquidity stemming from the above mentioned increase in competition will provide for better optimization opportunities of suppliers and traders and reduces their risk of being matched. Market participants will therefore require a lower risk premium due to the better predictability of prices.

3.5 Summary of main findings

In the second part of this report we estimated the economic benefits resulting from the introduction of market integration across the regions. The economic benefits are caused by the most efficient utilization of the cross-border capacities. This can be achieved by introducing implicit auction systems. The assessment assumes optimal utilization of the interconnection capacities and does not consider any practical hurdles that result from the actual conceptual design of the market integration. This is the objective of a companion project.

Two regions have been identified and selected together with E-Control: Region I comprises the markets of Austria, the Slovak Republic and Czech Republic, Region II covers Austria and Italy. The first region is characterized by markets of nearly the same size – only the Slovak markets is somewhat smaller compared to the two others -, strong transits (about 150% of the domestic demand) and significant storage capacities (about half of the annual consumption). Region II combines two markets, which are very different in size (the Austrian market is about 10% of the size of the Italian market), little transits and only moderate storage capacities (about 25% of the annual consumption).

In order to estimate the economic effects of market integration, the demand and supply curves were modelled for each market. In the absence of publically available data, these curves have been modelled using a tool developed by E-Bridge in a previous study on the “Macro-Economic Effects Regarding Congestion Management in Europe” and applied also in the process.

The model simulates the effects of short-term price elasticity in the demand and supply curves. Given those elasticities, market participants will profit from arbitrage trade which will lead to price convergence in the two markets. The impact of possible elasticity of long-term contracts has not been considered. This effect would lead to higher exports and imports between the markets and would increase the potential social welfare gain.

It is important to recognize that the provided simulation results can only serve as an indication and shall be cross-checked with actual data from the exchanges, if possible.

The main findings are summarized below:

1. The market integration of Region I would generate additional economic benefits

   The capacities of the existing interconnectors between Austria and the Slovak Republic as well as between the Slovak Republic and the Czech Republic have not been used efficiently in 2011: Price differences between the markets could be observed in spite of free physical capacity on the interconnectors. Better utilization of this capacity would have generated additional social welfare.

   The market integration would facilitate a better usage of the interconnector capacities. Crucial for this are a careful conceptual design of the market and the selection of a practical implementation path. The prices in Austria would decrease, which would result in social welfare gains for Austrian gas consumers.

   Next to the direct economic benefits, which result from the market integration and a more efficient utilization of the interconnection capacities, additional qualitative benefits could be gained as well. The number of competing parties would increase and would enhance the pressure on competitive prices. Stable prices would increase transparency and create a more robust and reliable basis for trade at the exchanges as well as for the OTC trade.

   However, it is important to note that the number of independent producers would hardly increase. A significant increase of pressure on the producers is not expected, as long as Region I will not become a strong hub itself. The most significant benefit would result from the fact, that the region may become a major hub due to its significant amount of transits. When developing the conceptual design for the joint market, special emphasis shall be put on the requirements to make Region I a solid hub for the supply of gas in the South-East European region.

2. The expected social welfare gain in the region justifies the establishment of an integrated market in Region I

   The expected social welfare gain in the region is estimated to amount to more than € 15 million. Welfare gains in the Slovak Republic and from additional price elasticity of long-term contracts are not considered and would further increase the benefits. Although the social welfare gain is only moderate, a single market appears to be promising.

   The market integration would further increase transparency, would support the development of stable and reliable prices and would increase competition among market participants. These secondary effects are likely to create substantial additional economic benefits, but cannot be quantified in this study.

   Furthermore, important prerequisites for a well-functioning common market are given. Past price differences have been moderate while cross-border capacities are sufficient. Furthermore, all three markets have a large share of transit gas, which depending on the market design might considerably increase the liquidity in the region. Furthermore, all three markets are of a similar size, which reduces the risk of spill overs of market imperfections through trade liberalisation.

3. The interconnection capacities seem sufficient to allow for price convergence during most of the time

The demand and supply curves in Austria and the Czech Republic are not known and had to be simulated based on publicly available data. A particularly important impact on the supply and demand curves have the marginal cost curves of the storage facilities. They have been modelled based on the published utilization costs of the storages.

The modelled price elasticity of demand and supply leads to additional exports or imports between the markets. These additional flows increase the loading of the interconnectors by a few percentages only and do hardly generate additional congestions. Increasing price elasticity would increase the social welfare and would increase the flows between the countries. Prices would significantly converge as the available interconnection capacities are substantial.

4. Region I could be expanded by Region II after promising experience has been gained

The interconnection between Italy and Austria is physically congested at certain days. Price differences would always remain during these days.

The prices in Italy are significantly higher and market integration would lead to a structural export from Austria to Italy. This would lead to siginificantly higher prices in Austria and declining prices in Italy. Given the high quantities, the modelled short-term flexibility of storage facilities does not provide reliable results. Data on volume flexibility in long-term contracts would be required as to estimate the responsiveness of market parties.

Furthermore, there is a high degree of uncertainty whether Italian gas prices truly reflect the economic value of the commodity, since spot prices are significantly higher than in the rest of Europe.

However, the region would offer access to several competing producers, which may increase the competitiveness and lead to lower prices.

In the light of the above, a cautious approach to enhanced market integration seems recommendable.

Therefore, special emphasis might be given to the determination of cross-border capacities and their allocation. Against this backdrop, explicit/implicit capacity auctioning might be a first step as to determine the economic value of additional capacity and to assess whether physical investments might be economically viable.

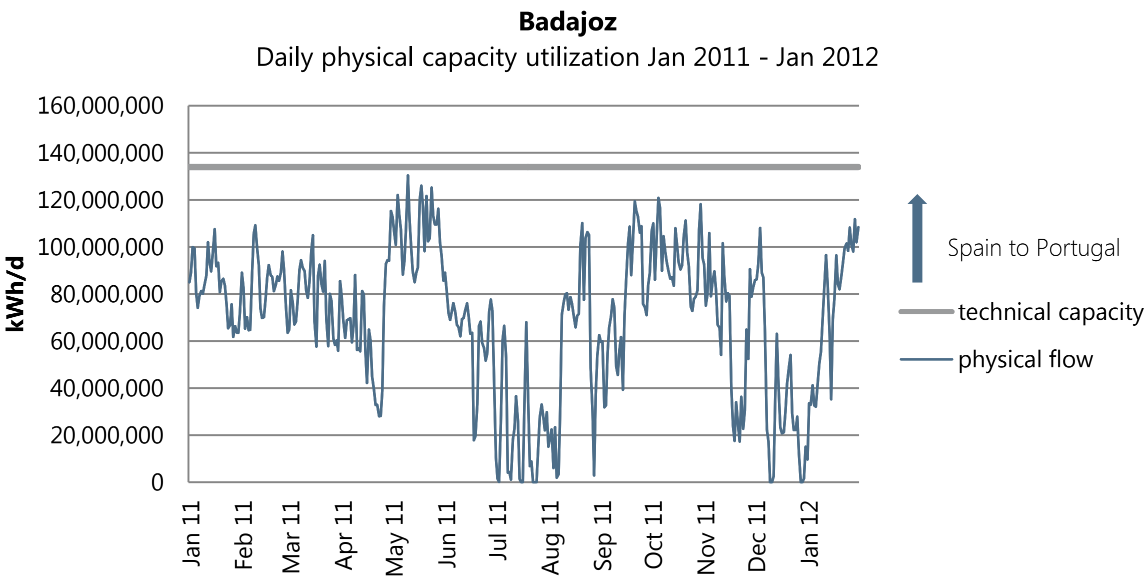
Furthermore, an in-depth analysis of the liquidity of the Italian wholesale market might be useful as to better assess potential competition effects associated with enhanced market integration.

APPENDICES

A. CAPACITY UTILIZATION AT INDIVIDUAL INTERCONNECTION POINTS

Badajoz/Campo Maior	
TSOs	▪ Enagas (ES) ▪ REN Gasodutos (PT)
Technical capacity	▪ ES to PT: 134,000,000 kWh/d ▪ PT to ES: 35,000,000 kWh/d (winter), 70,000,000 kWh (summer)
Flow direction	▪ Bi-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ ES/PT: 69,418,416.73 kWh/d

Table 1: Badajoz/Campo Maior : Basic information



Source: Gasodutos/REN

Figure 28: Badajoz: Daily physical capacity utilization Jan 2011 – Jan 2012

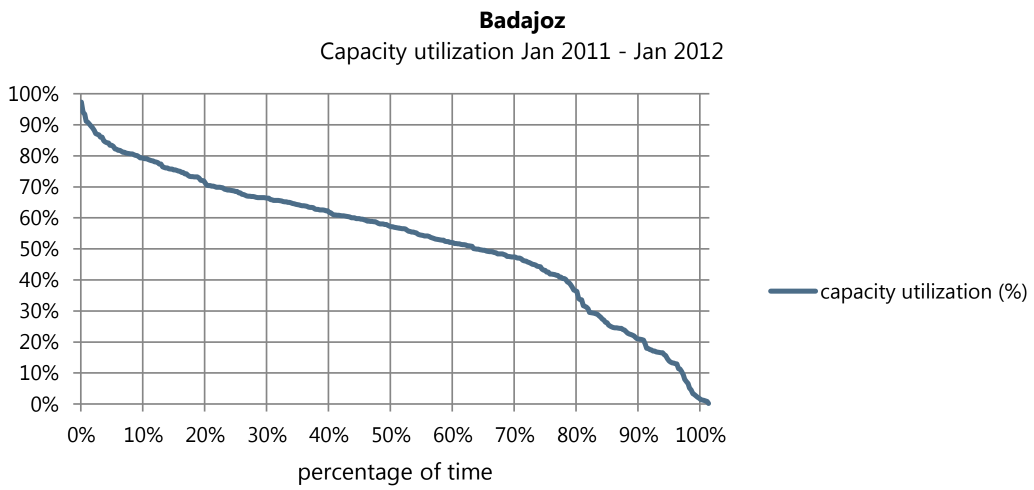


Figure 29: Badajoz: Capacity utilization Jan 2011 – Jan 2012

Larrau	
TSOs	▪ TIGF (FR) ▪ Enagas (ES)
Technical capacity	▪ FR to ES: 100,000,000 kWh/d ▪ ES to FR: 30,000,000 kWh/d (winter), 50,000,000 kWh/d (summer)
Flow direction	▪ Bi-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ FR/ES: 66,020,367.86 kWh/d

Table 2: Larrau: Basic information

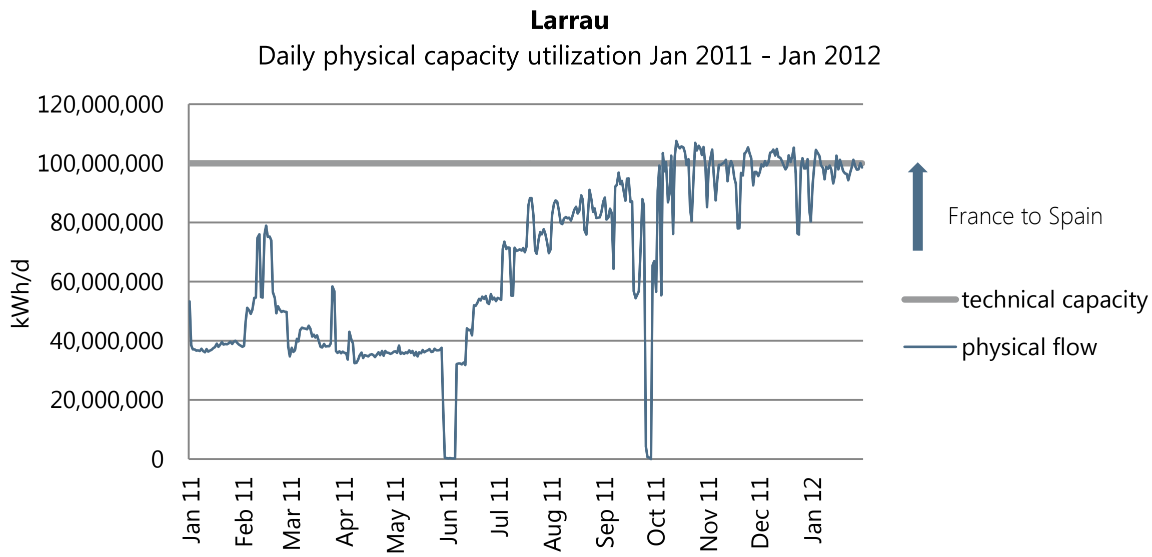


Figure 30: Larrau: Daily physical capacity utilization Jan 2011 – Jan 2012

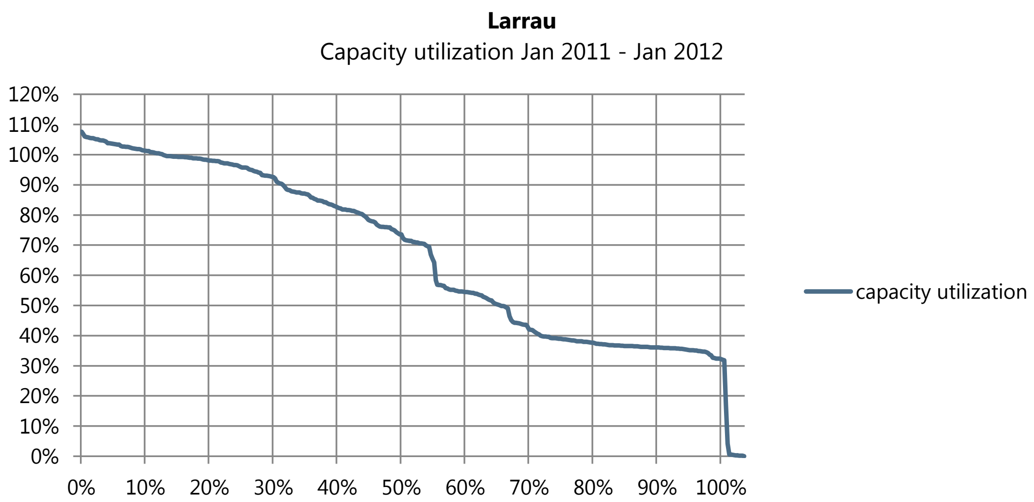


Figure 31: Larrau: Daily physical capacity utilization Jan 2011 – Jan 2012

Juliandorp/Balgzand	
TSOs	▪ Gastransportservices (NL) ▪ BBL Company (UK)
Technical capacity	▪ The Netherlands to UK: 448,870,000 kWh/d (Jan 2012)
Flow direction	▪ uni-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ NL/UK: 91,587,016.35 kWh/d

Table 3: Juliandorp/Balgzand: Basic information

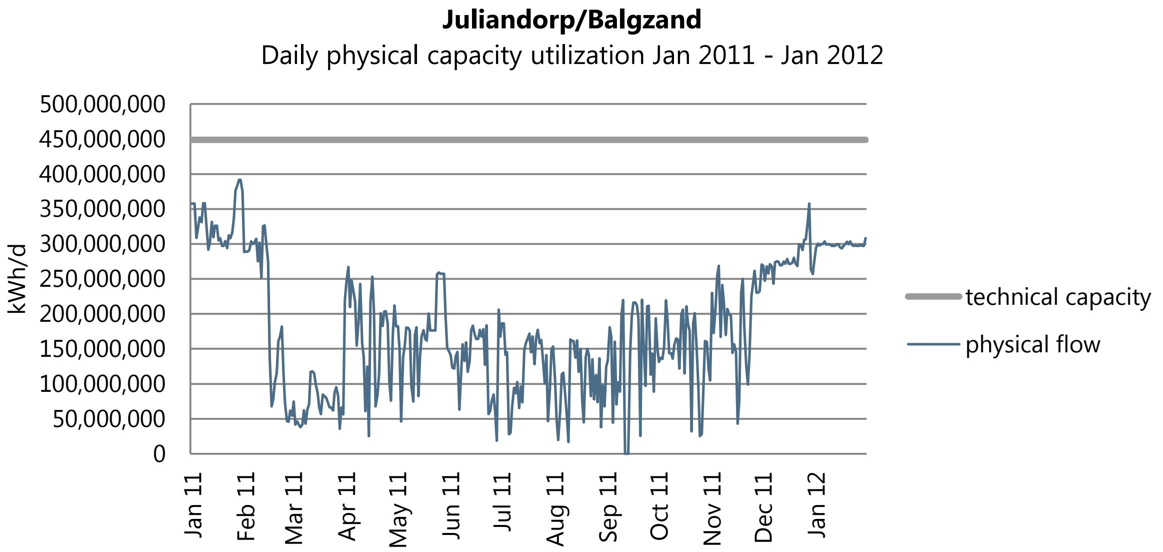
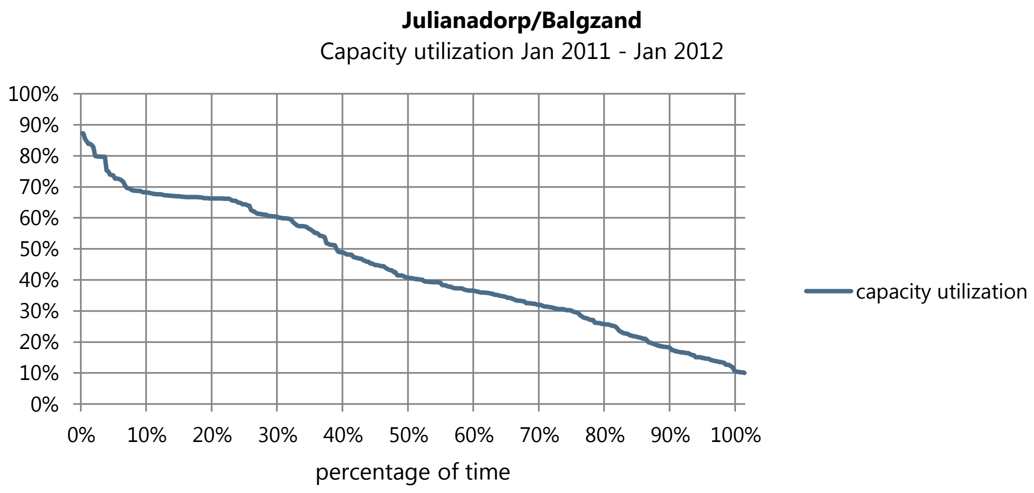


Figure 32: Juliandorp/Balgzand: Daily physical capacity utilization Jan 2011 – Jan 2012



Source: BBL Company

Figure 33: Juliandorp/Balgzand: Capacity utilization Jan 2011 – Jan 2012

Interconnector Bacton (UK) – Zeebrugge (B)	
TSOs	▪ Interconnector (UK) ▪ Fluxys (BE)
Technical capacity	▪ UK export/Belgium import: 807,500,000 kWh/d ▪ Belgium export/UK import: 630,100,000 kWh/d
Flow direction	▪ bi-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ UK/Belgium: 317,625,560.1 kWh/d ▪ Belgium/UK: -82,969,172.12 kWh/d

Table 4: Bacton/Zeebrugge: Basic information

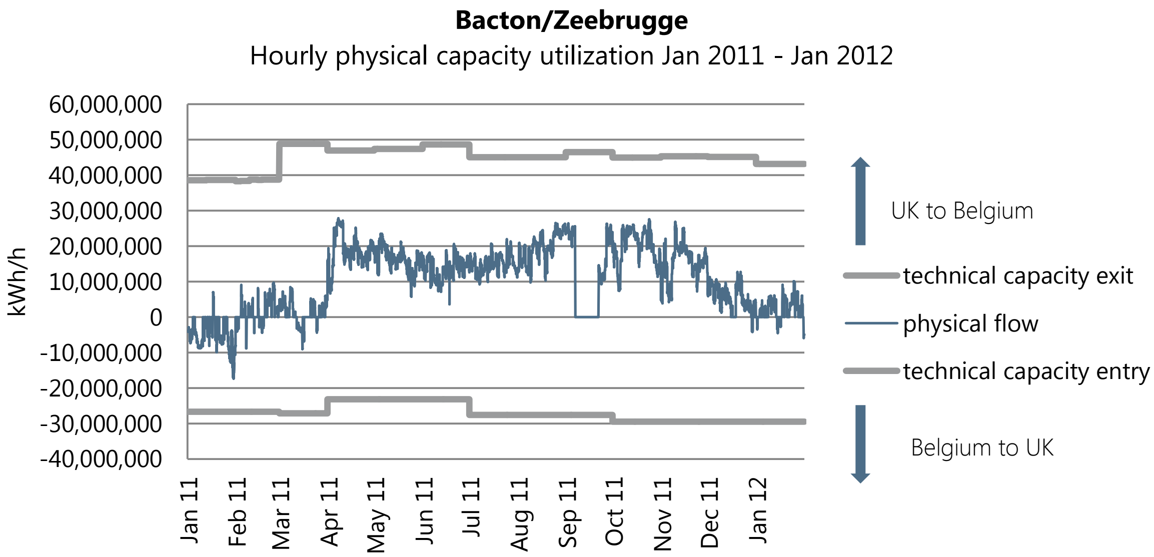
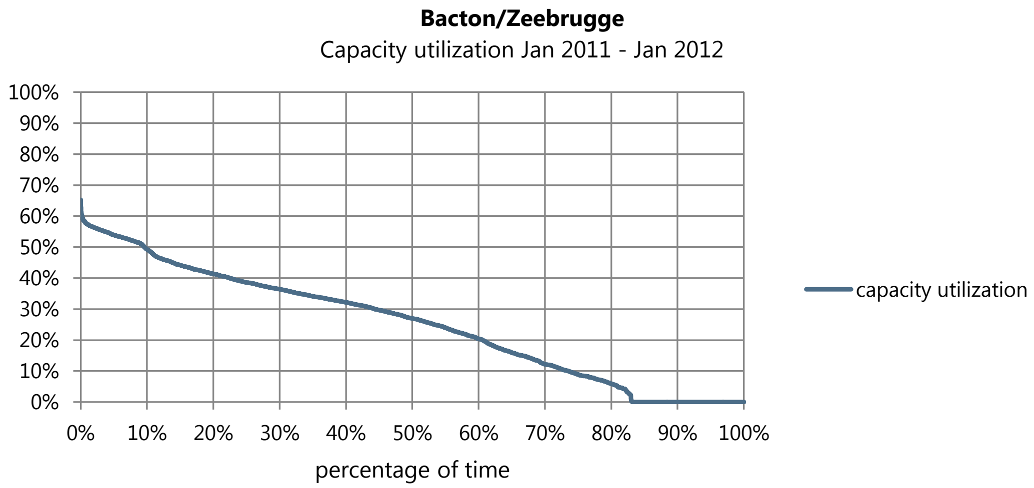


Figure 34: Bacton/Zeebrugge: Hourly physical capacity utilization Jan 2011 – Jan 2012



Source: Fluxys

Figure 35: Bacton/Zeebrugge: Capacity utilization Jan 2011 – Jan 2012

Zelzate 1	
TSOs	▪ Fluxys (BE) ▪ Gastransportservices (NL)
Technical capacity	▪ Belgium to the Netherlands: 209,300,000 kWh/d (Jan 2012) ▪ The Netherlands to Belgium: 295,000,000 kWh/d (Jan 2012)
Flow direction	▪ The flow direction is bi-directional. ▪ Mainly used for gas exports to the Netherlands.
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ Belgium/Netherlands: 61,444,910 kWh/d ▪ Netherlands/Belgium: 26,527,812 kWh/d ▪ Total: 2,149,155 kWh/h ▪ Total: 51,579,717 kwh/d
Zelzate 2	
TSOs	▪ Fluxys (BE) ▪ Zebra Pijpleiding (NL)
Technical capacity	▪ Belgium to the Netherlands: 139,600,000 kWh/d (Jan 2012)
Flow direction	▪ uni-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ Belgium/NL: 52,387,622 kWh/d

Table 5: Zelzate: Basic information

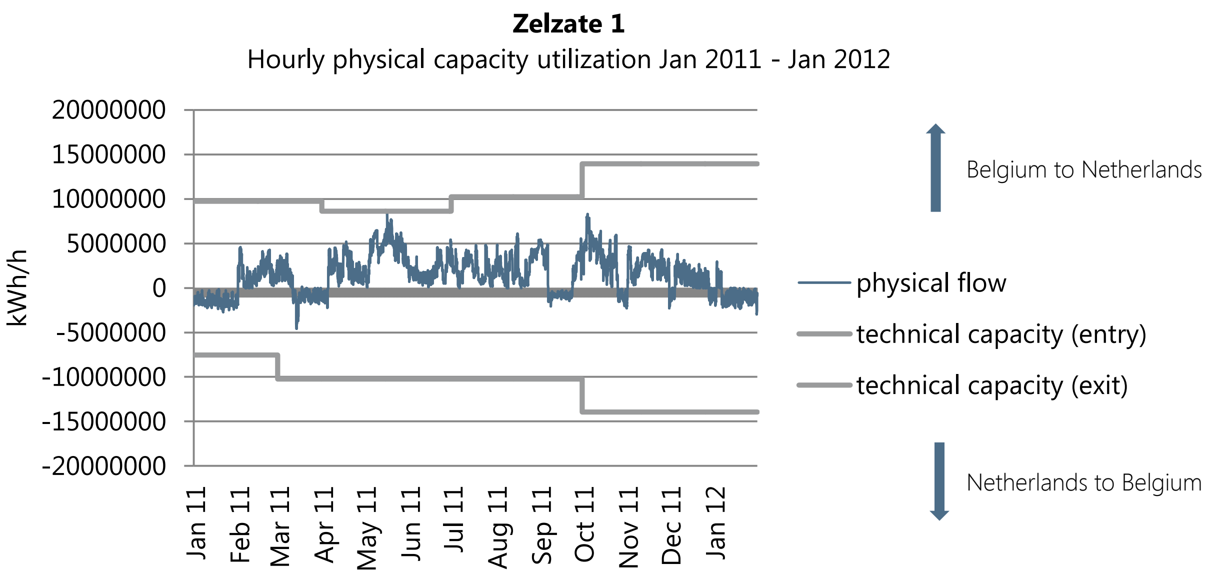
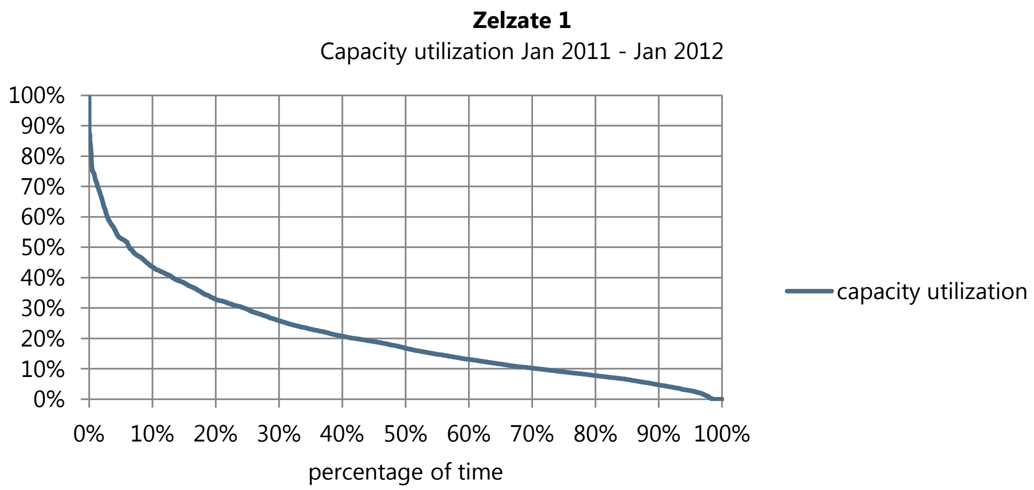


Figure 36: Zelzate 1: Hourly physical capacity utilization Jan 2011 – Jan 2012



Source: Fluxys

Figure 37: Zelzate 1: Capacity utilization Jan 2011 – Jan 2012

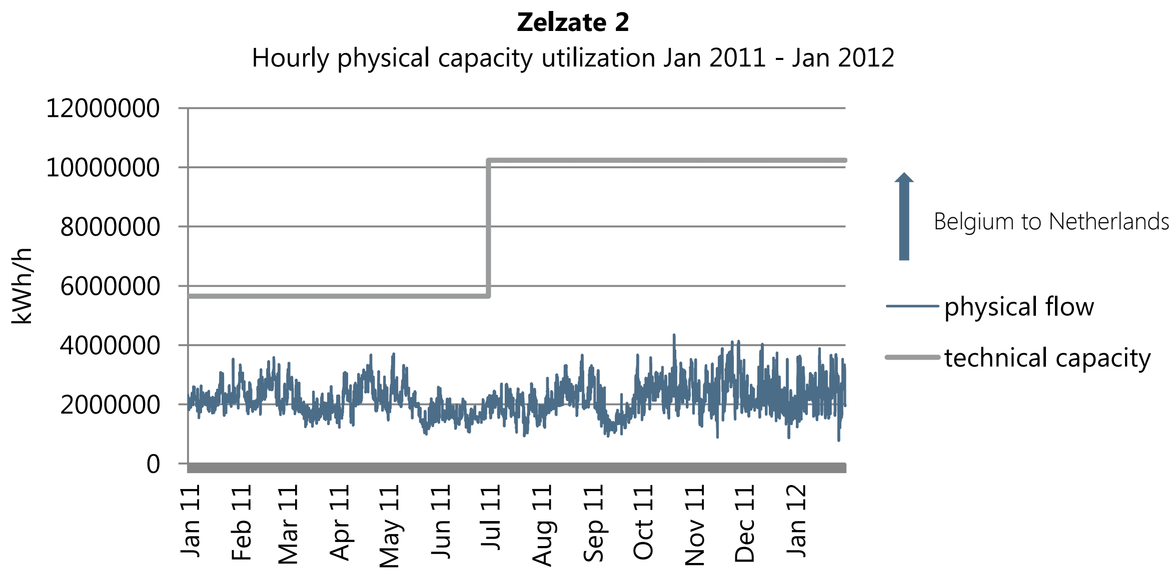
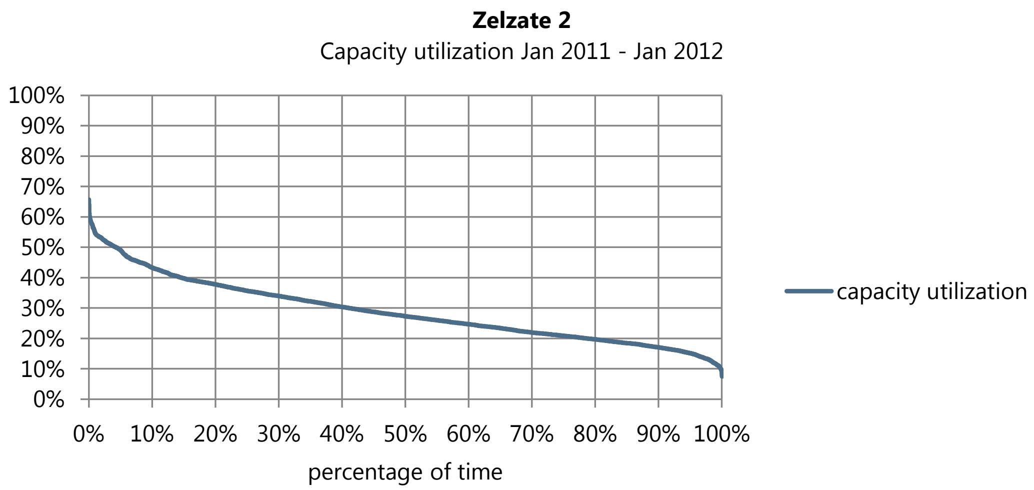


Figure 38: Zelzate 2: Hourly physical capacity utilization Jan 2011 – Jan 2012



Source: Fluxys

Figure 39: Zelzate 2: Hourly physical capacity utilization Jan 2011 – Jan 2012

S'Gravenvoeren-Dilsen	
TSOs	▪ Fluxys (BE) ▪ Gastransportservices (NL)
Technical capacity	▪ The Netherlands to Belgium: 362,800,000 kWh/d (Jan 2011)
Flow direction	▪ Uni-directional, from the Netherlands to Belgium
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ Netherlands/Belgium: 93,439,070.5 kWh/d

Table 6: s'Gravenvoeren: Basic information

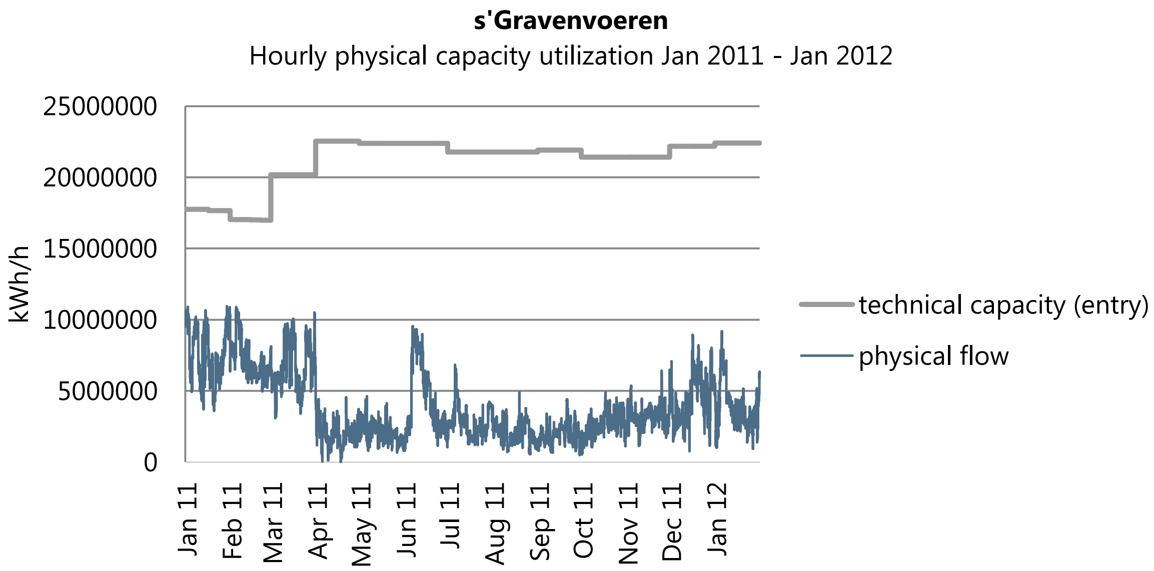
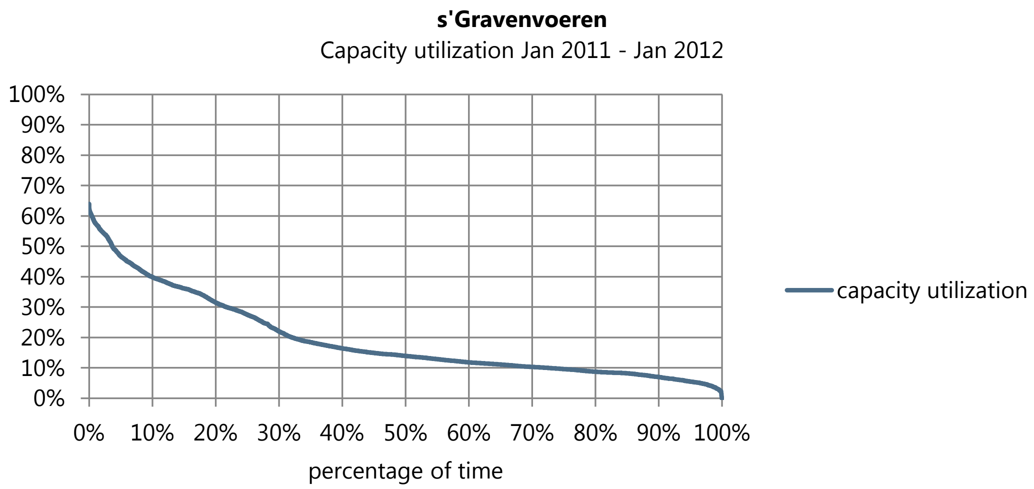


Figure 40: s'Gravenvoeren: Hourly physical capacity utilization Jan 2011 – Jan 2012



Source: Fluxys

Figure 41: s'Gravenvoeren: Capacity utilization Jan 2011 – Jan 2012

Hilvarenbeek/Poppel	
TSOs	▪ Fluxys (BE) ▪ Gastransportservices (NL)
Technical capacity	▪ The Netherlands to Belgium: 640,100,000 kWh/d (Jan 2011)
Flow direction	▪ The flow direction is unidirectional, from the Netherlands to Belgium
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ Netherlands/Belgium: 280,034,590.7 kWh/d

Table 7: Poppel: Basic information

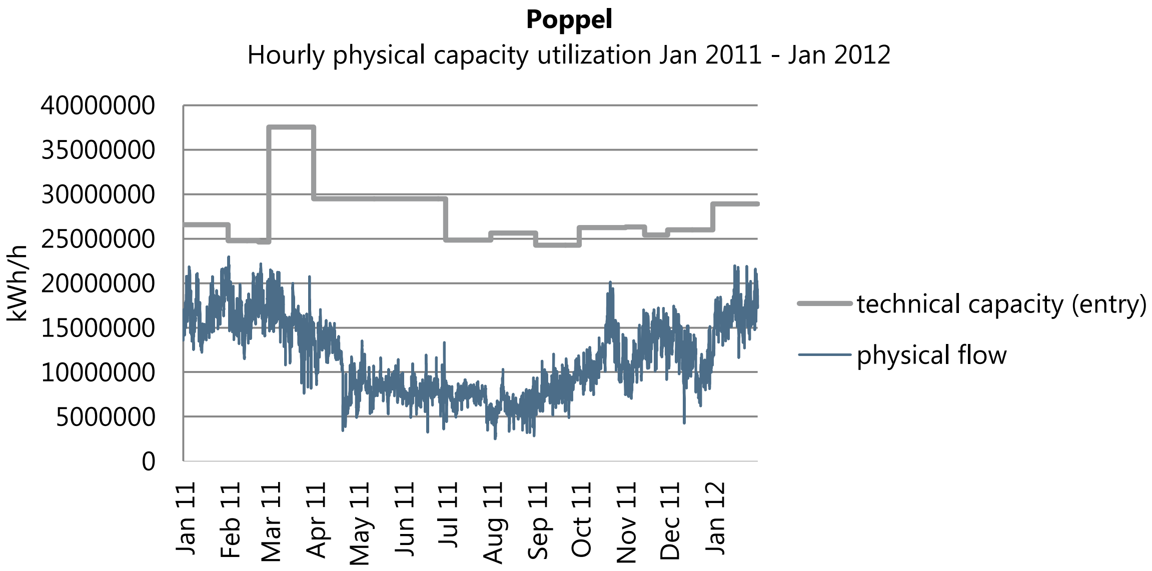
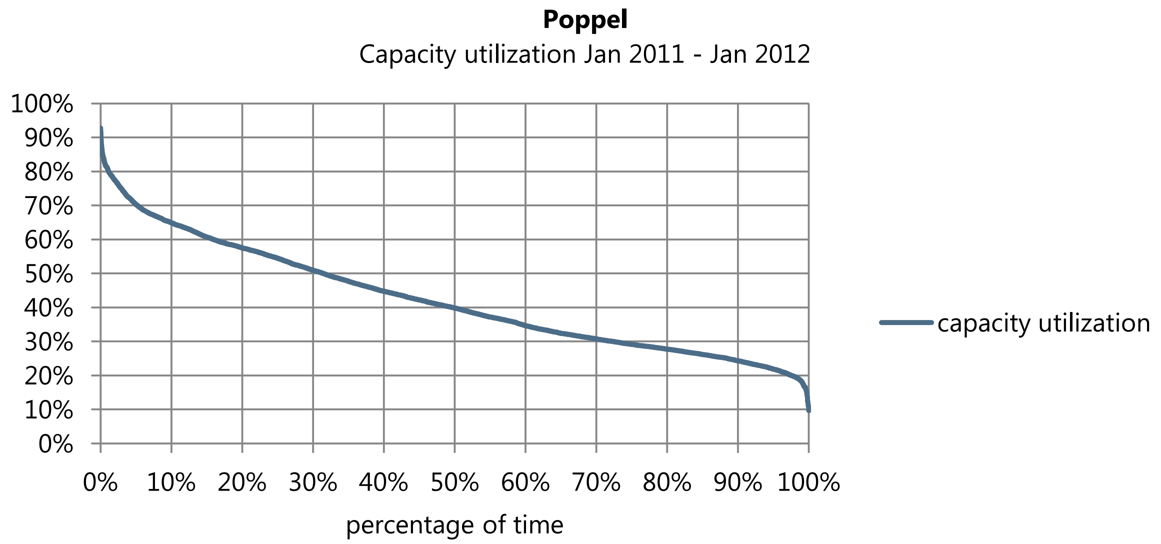


Figure 42: Poppel: Hourly physical capacity utilization Jan 2011 – Jan 2012



Source: Fluxys

Figure 43: Poppel: Capacity utilization Jan 2011 – Jan 2012

Blaregnies Segeo (BE) / Taisnières (FR)	
TSOs	▪ Fluxys (BE) ▪ GRTgaz (FR)
Technical capacity	▪ BE to FR (H): 590,000,000 kWh/d ▪ BE to FR (L): 230,000,000 kWh/d
Flow direction	▪ uni-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ BE/FR (L): 5,717,202.83 kWh/h (hourly) ▪ (L): 137,212,868.01 kWh/d (daily) ▪ (H): 13,524,400.13 kWh/h (hourly) ▪ (H): 324,585,603.14 kWh/d (daily)

Table 8: Blaregnies: Basic information

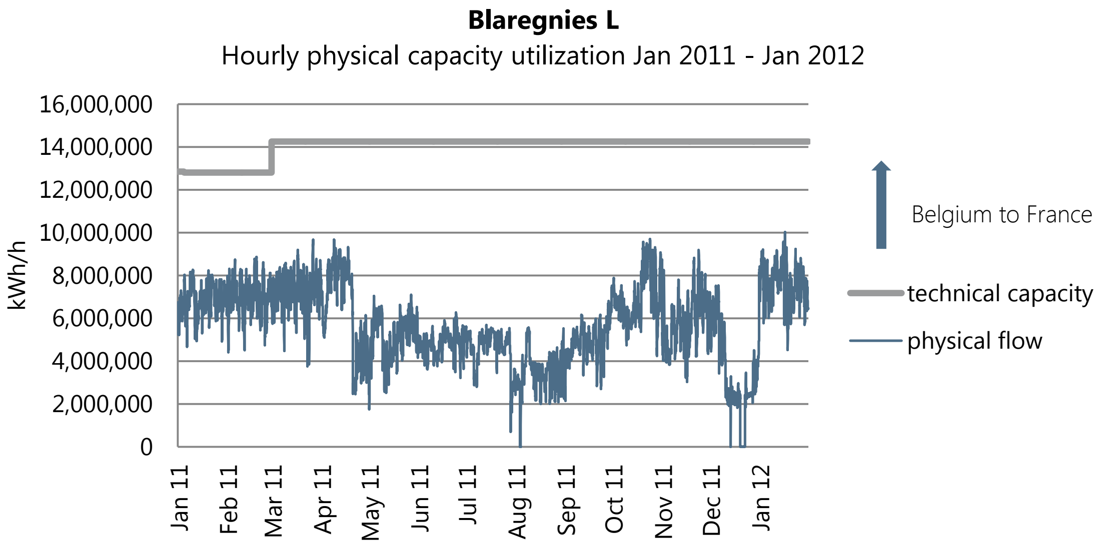


Figure 44: Blaregnies L: Hourly physical capacity utilization Jan 2011 – Jan 2012

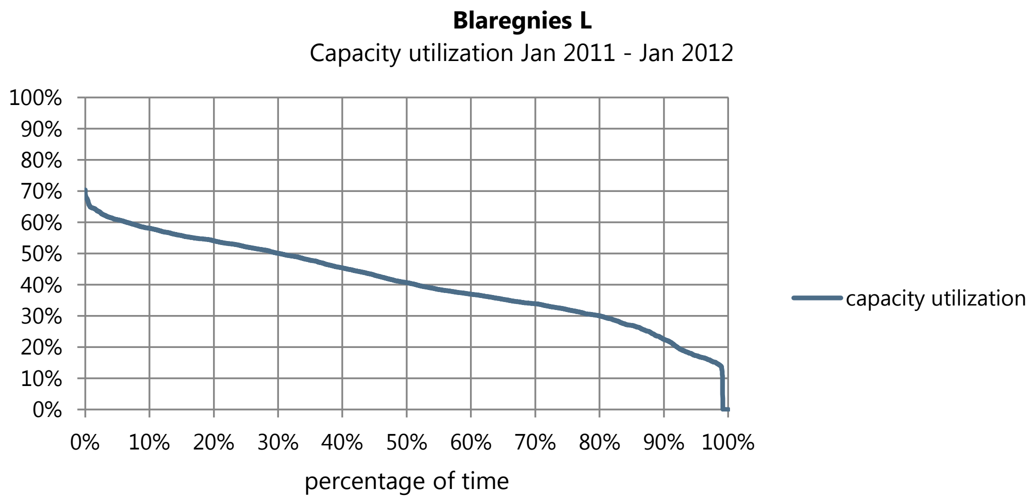


Figure 45: Blaregnies L: Capacity utilization Jan 2011 – Jan 2012

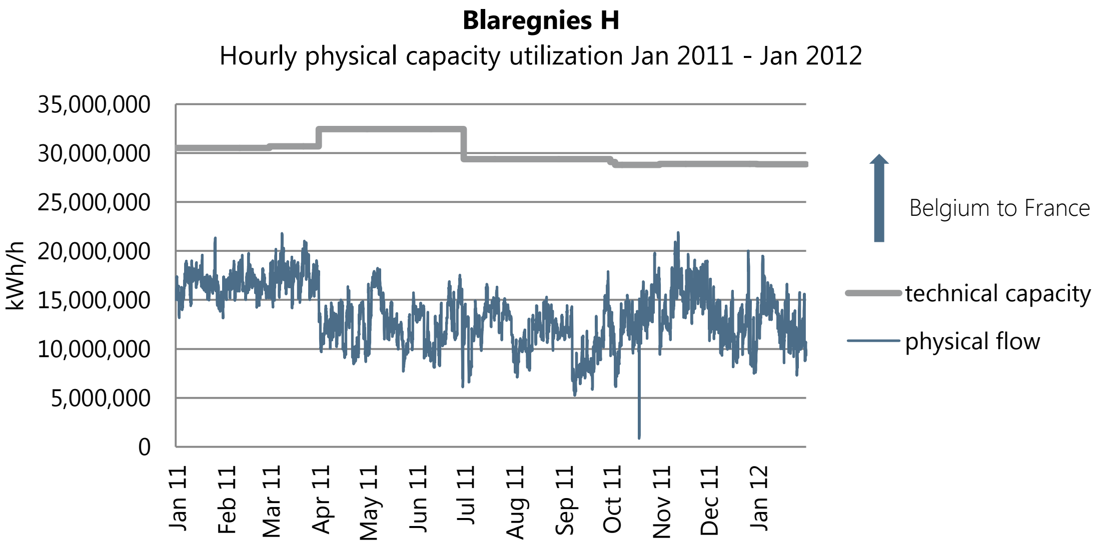
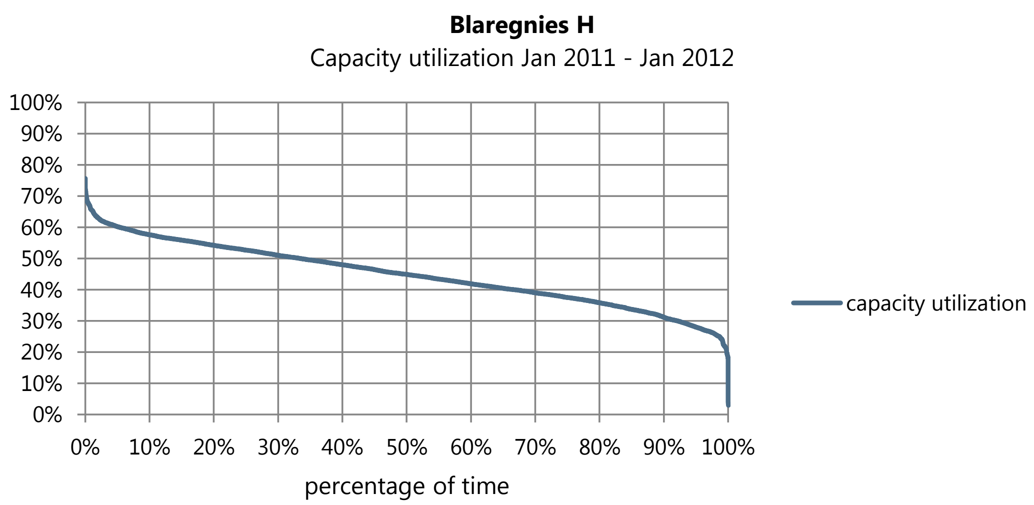


Figure 46: Blaregnies H: Hourly physical capacity utilization Jan 2011 – Jan 2012



Source: Fluxys

Figure 47: Blaregnies H: Capacity utilization Jan 2011 – Jan 2012

Pétange/Bras – GD Lux	
TSOs	▪ Fluxys (BE) ▪ CREOS (Lux)
Technical capacity	▪ Belgium to Luxembourg: 50,200,000 kWh/d (Jan 2012)
Flow direction	▪ uni-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ Belgium/Luxembourg: 16,424,793.6 kWh/d

Table 9: Pétange/Bras: Basic information

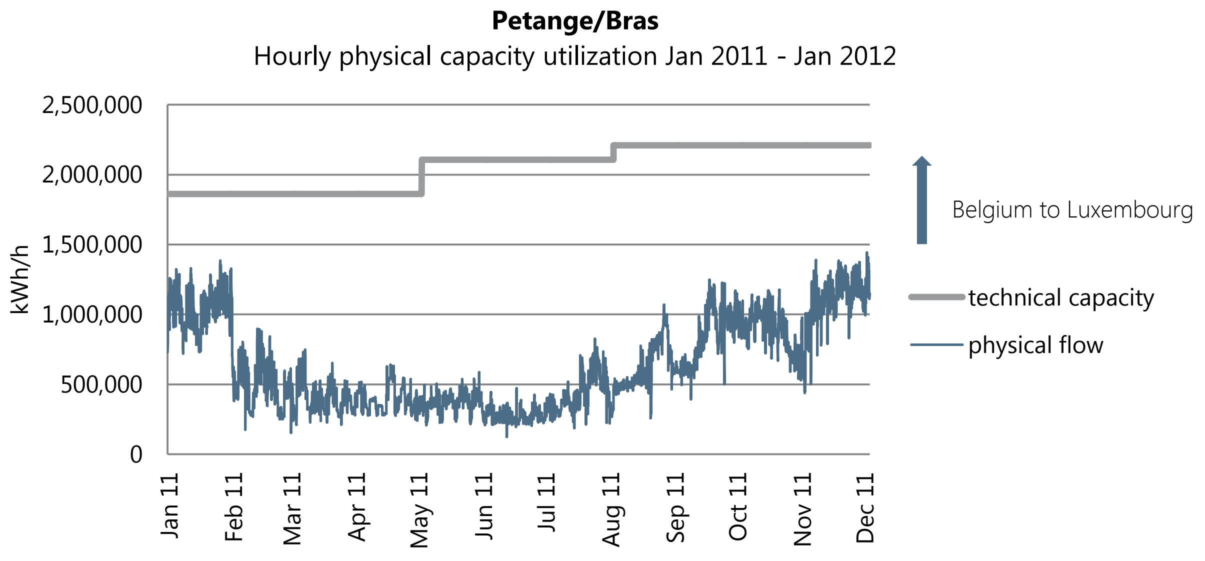
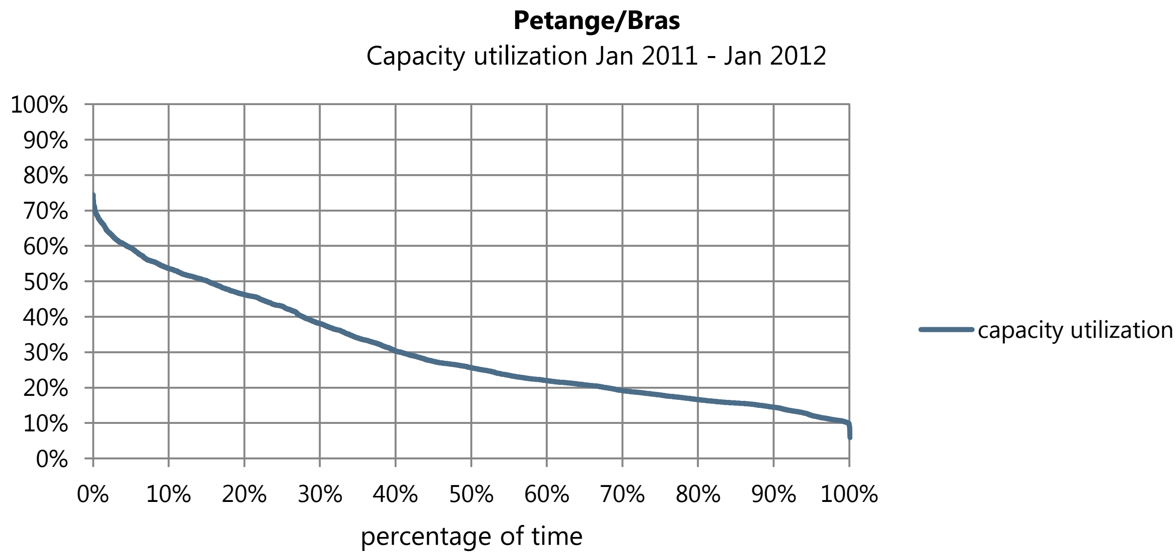


Figure 48: Pétange/Bras: Hourly physical capacity utilization Jan 2011 – Jan 2012



Source: Fluxys

Figure 49: Petange/Bras: Capacity utilization Jan 2011 – Jan 2012

Bocholtz	
TSOs	▪ Gastransportservices (NL) ▪ Open Grid Europe (DE) ▪ Eni Gas Transport Deutschland (DE)
Technical capacity	▪ Netherland to Germany: 67,800,000 kWh/d (Jan 2012)
Flow direction	▪ uni-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ Netherland/Germany: 12,080,077.1 kWh/d

Table 10: Bocholtz: Basic information

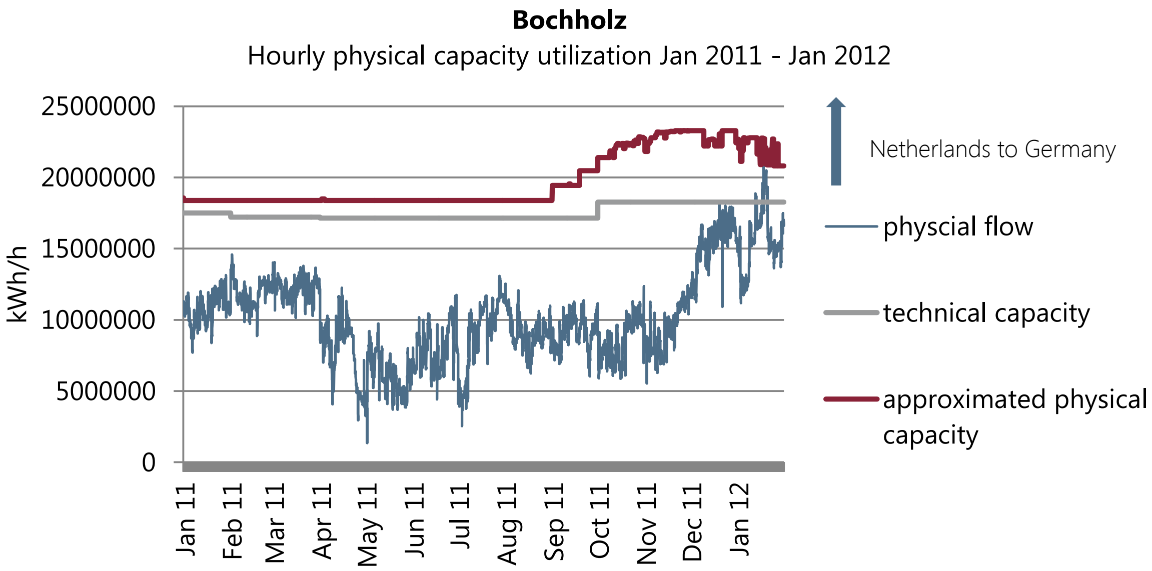
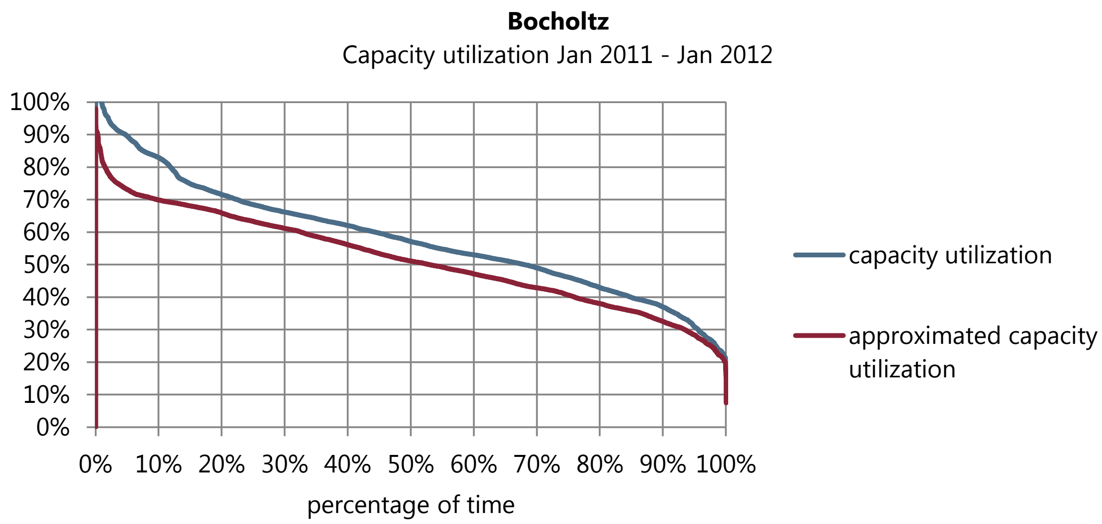


Figure 50: Bocholtz: Hourly physical capacity utilization Jan 2011 – Jan 2012



Source: OGE

Figure 51: Bocholtz: Capacity utilization Jan 2011 – Jan 2012

Zevenaar/Elten	
TSOs	▪ Gastransportservices (NL) ▪ Open Grid Europe (DE) ▪ Thyssengas (DE)
Technical capacity	▪ Netherland to Germany: **24,700,000** kWh/d (Jan 2012)
Flow direction	▪ The flow direction is bi-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ Netherlands/Germany: 8,081,386.08 kWh/d

Table 11: Zevenaar/Elten: Basic information

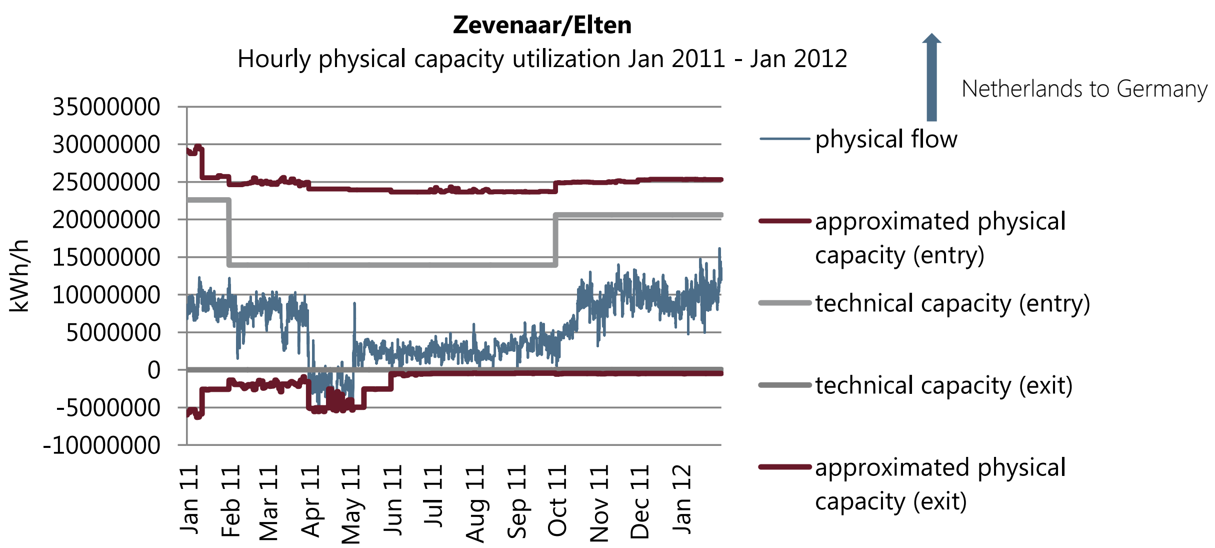
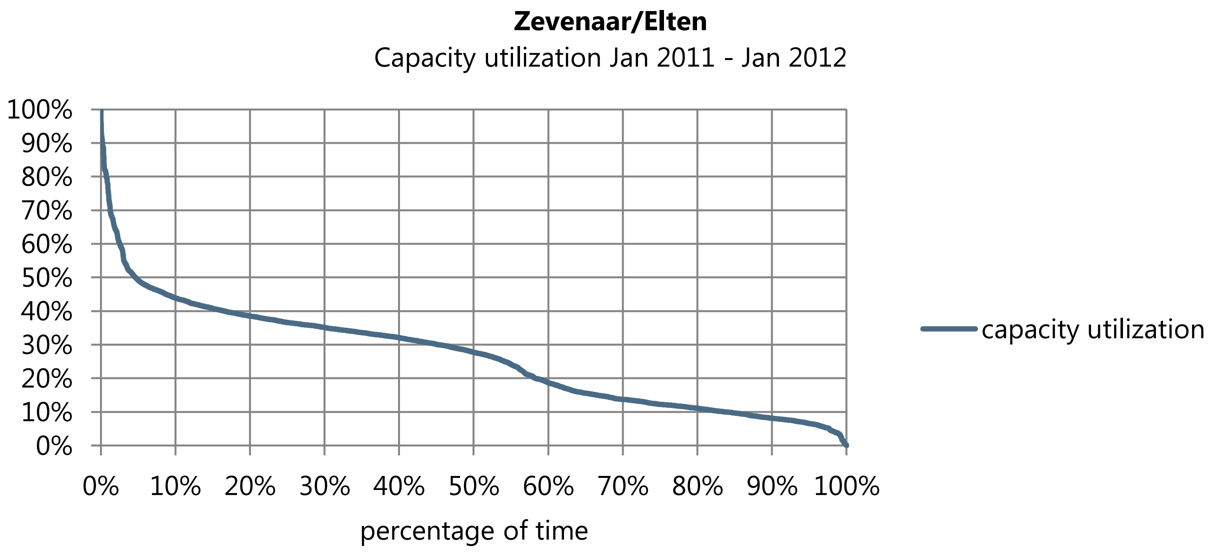


Figure 52: Zevenaar/Elten: Hourly physical capacity utilization Jan 2011 – Jan 2012



Source: OGE

Figure 53: Zevenaar/Elten: Capacity utilization Jan 2011 – Jan 2012

Winterswijk	
TSOs	▪ Gastransportservices (NL) ▪ Open Grid Europe (DE)
Technical capacity	▪ Netherland to Germany: 251,000,000 kWh/d (Jan 2012)
Flow direction	▪ uni-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ Netherlands/Germany: 11,030,094.3 kWh/d

Table 12: Winterswijk: Basic information

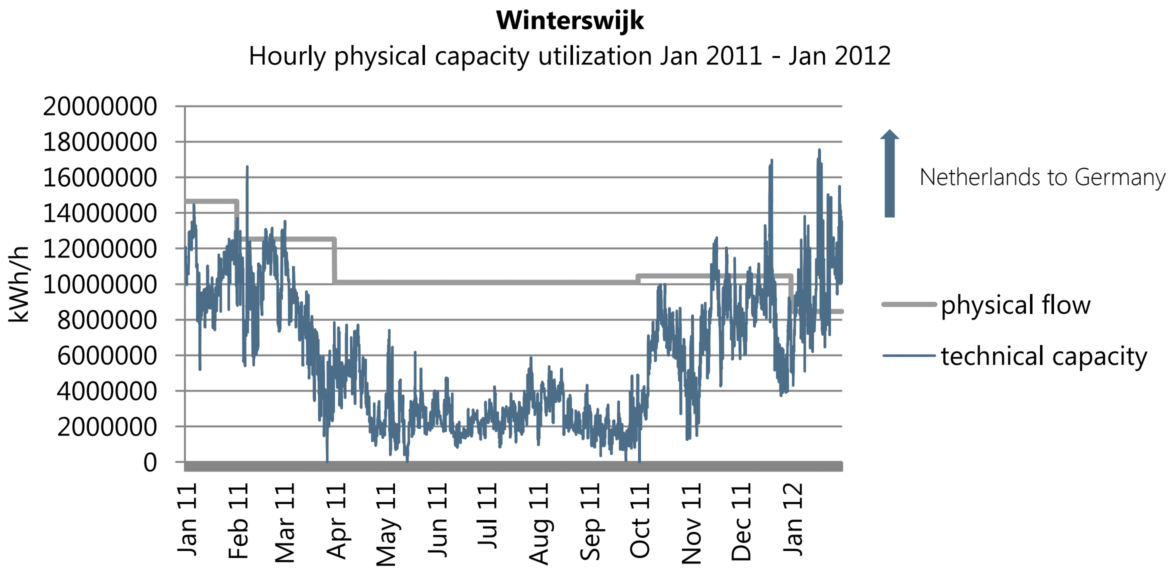
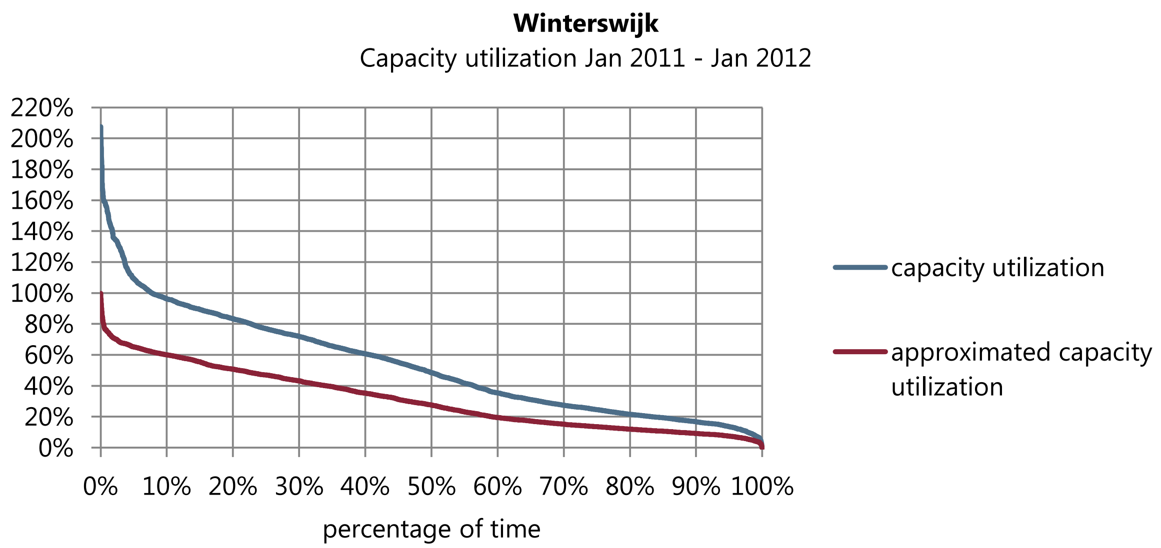


Figure 54: Winterswijk: Hourly physical capacity utilization Jan 2011 – Jan 2012



Source: OGE

Figure 55: Winterswijk: Capacity utilization Jan 2011 – Jan 2012

Eynatten 1	
TSOs	▪ Fluxys (BE) ▪ Wingas (DE)
Technical capacity	▪ Belgium to Germany: 136,500,000 kWh/d (Jan 2012) ▪ Germany to Belgium: 87,700,000 kWh/d (Jan 2012)
Flow direction	▪ bi-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ Belgium/Germany: 89,014,149.32 kWh/d ▪ Germany/Belgium: 33,323,447.41 kWh/d
Eynatten 2	
TSOs	▪ Fluxys (BE) ▪ OGE (DE), ▪ Eni Gastransport Deutschland (DE)
Technical capacity	▪ Belgium to Germany: 119,600,000 kWh/d (Jan 2012) ▪ Germany to Belgium: 363,100,000 kWh/d (Jan 2012)
Flow direction	▪ bi-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ Belgium/Germany: 82,461,784.35 kWh/d ▪ Germany/Belgium: 114,195,005.6 kWh/d

Table 13: Eynatten: Basic information

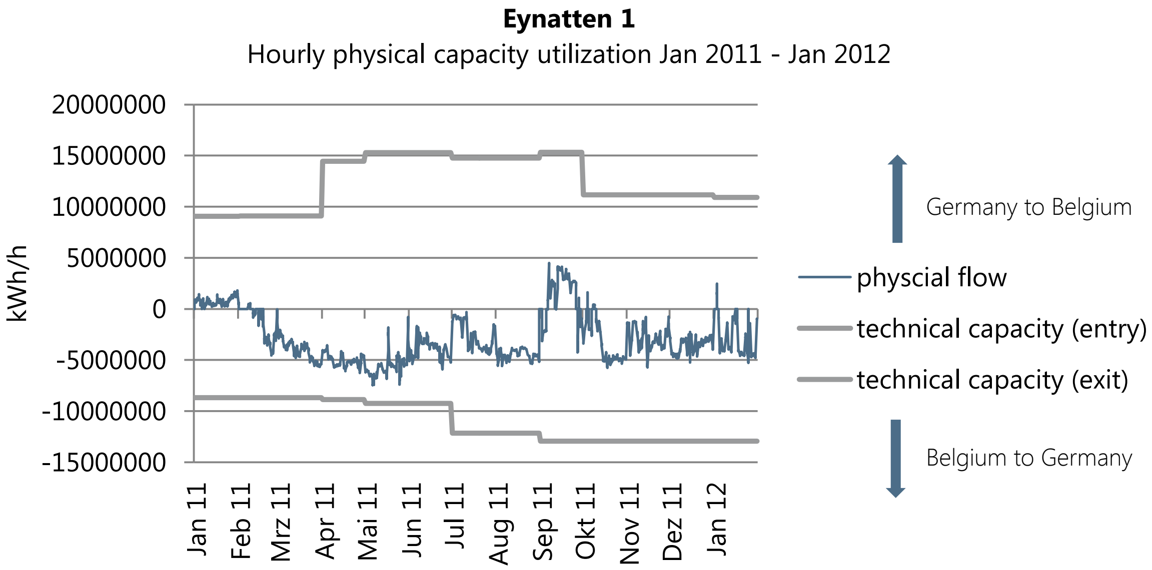


Figure 56: Eynatten 1: Hourly physical capacity utilization Jan 2011 – Jan 2012

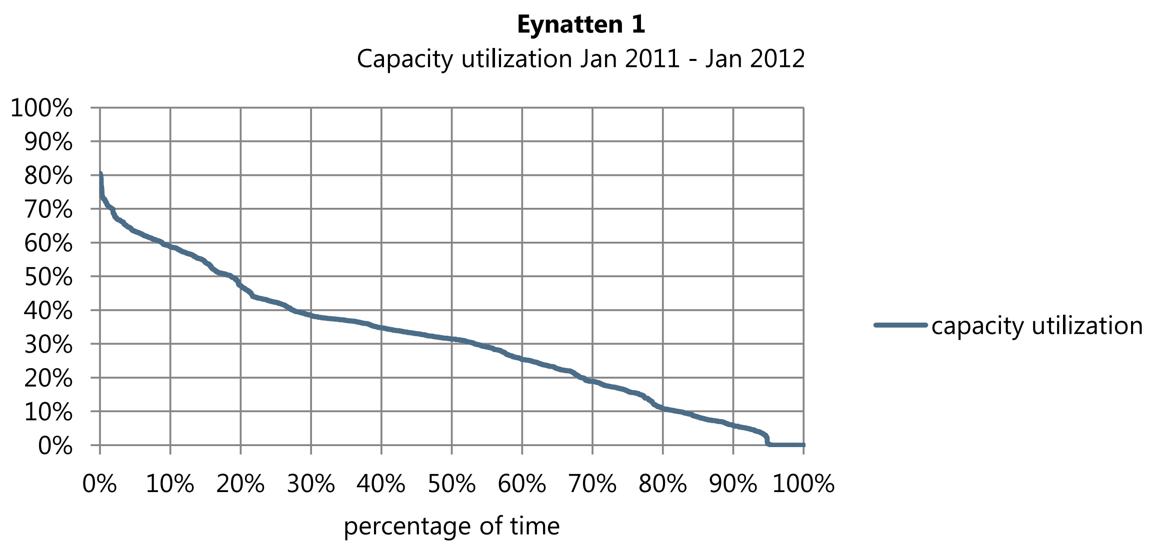


Figure 57: Eynatten 1: Capacity utilization Jan 2011 – Jan 2012

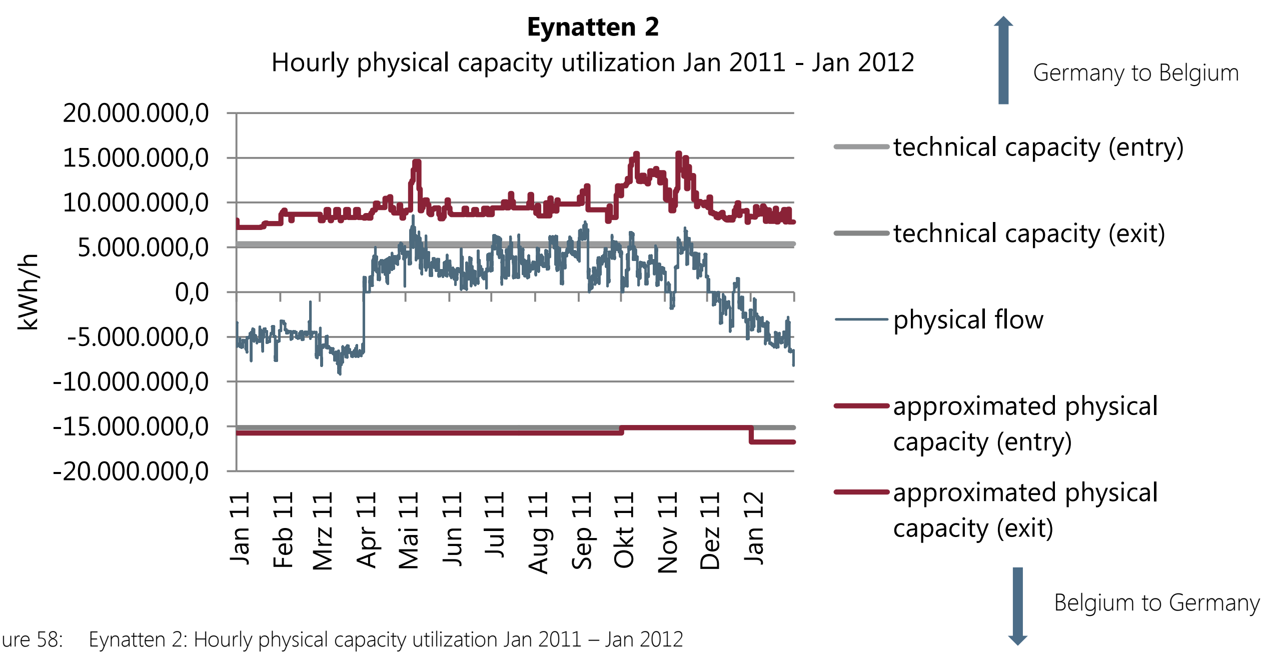
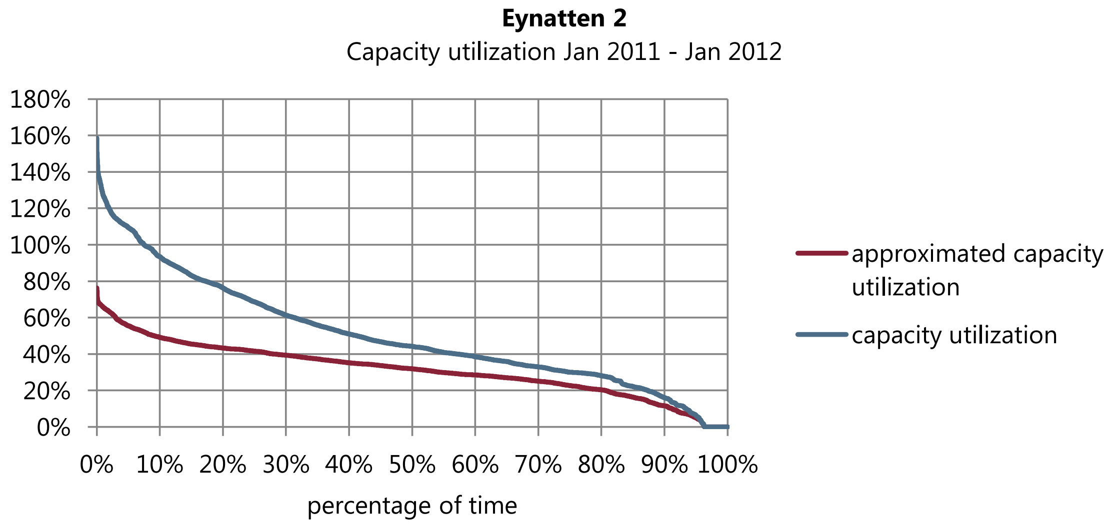


Figure 58: Eynatten 2: Hourly physical capacity utilization Jan 2011 – Jan 2012



Source: OGE

Figure 59: Eynatten 2: Capacity utilization Jan 2011 – Jan 2012

Medelsheim (DE) / Obergailbach (FR)	
TSOs	▪ Open Grid Europe (DE) ▪ GRTgaz (FR) ▪ GRTgaz Deutschland (DE)
Technical capacity	▪ DE to FR: 620,000,000 kWh/d
Flow direction	▪ uni-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ FR/CH: 221,855,267.25 kWh/d

Table 14: Obergailbach: Basic information

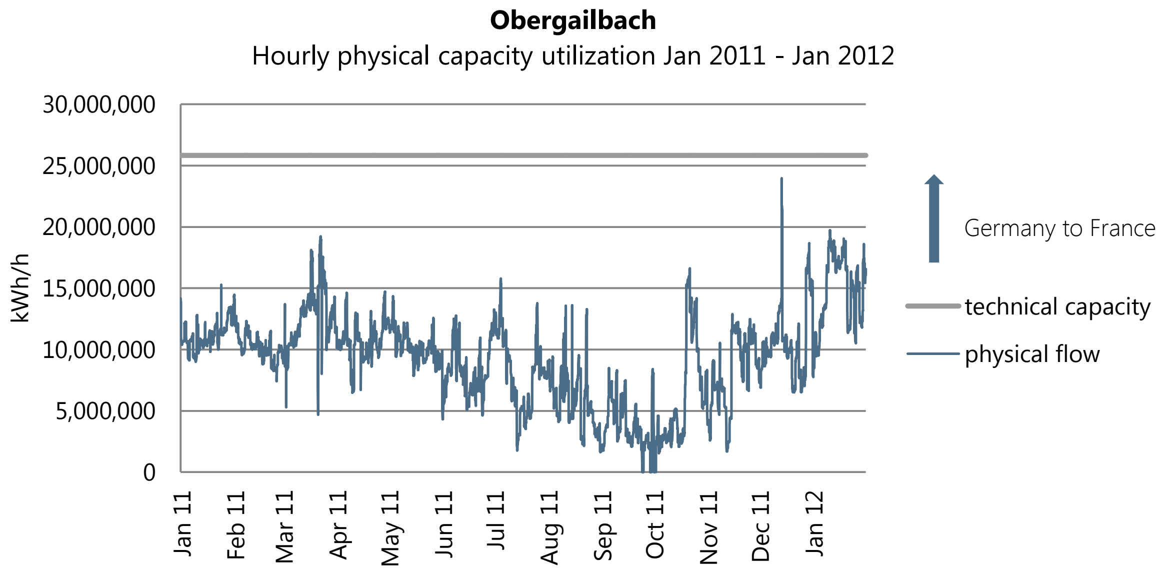
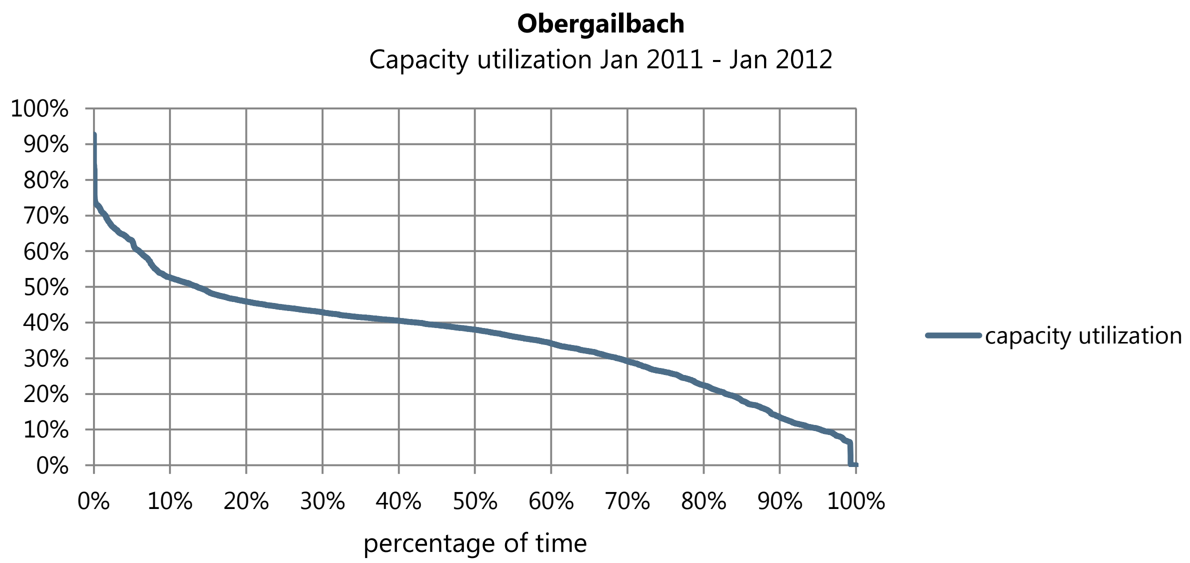


Figure 60: Obergailbach: Hourly physical capacity utilization Jan 2011 – Jan 2012



Source: OGE

Figure 61 Obergailbach: Capacity utilization Jan 2011 – Jan 2012

Mallnow	
TSOs	▪ Gaz-System (PL) ▪ Wingas Transport (DE)
Technical capacity	▪ 931,500,000 kWh/d
Flow direction	▪ Uni-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ PL/DE: 796,270,926.85 kWh/d (daily) ▪ 33,177,957 kWh/h (hourly)

Table 15: Mallnow: Basic information

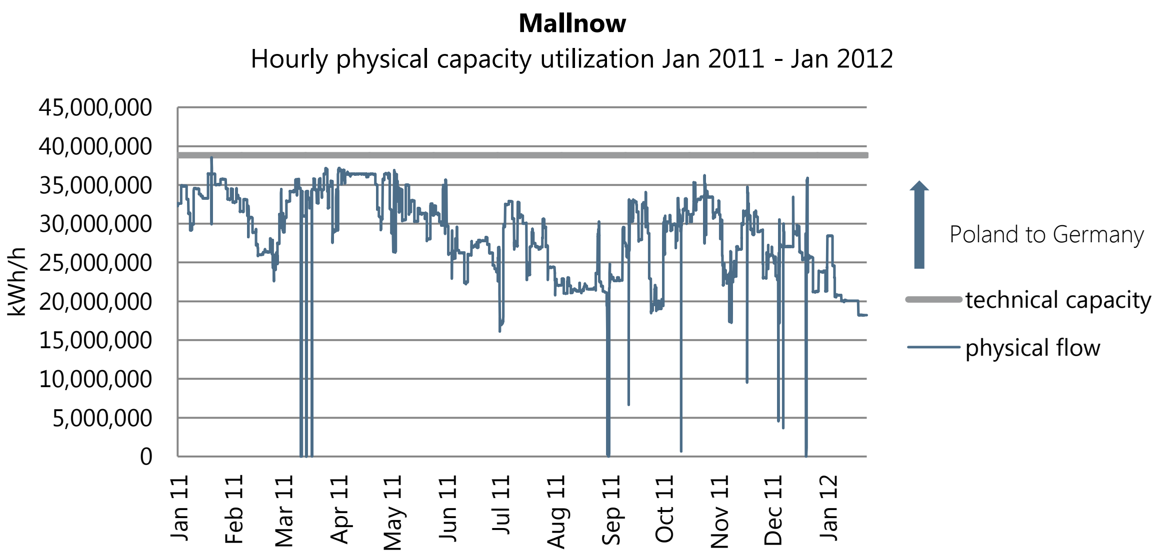
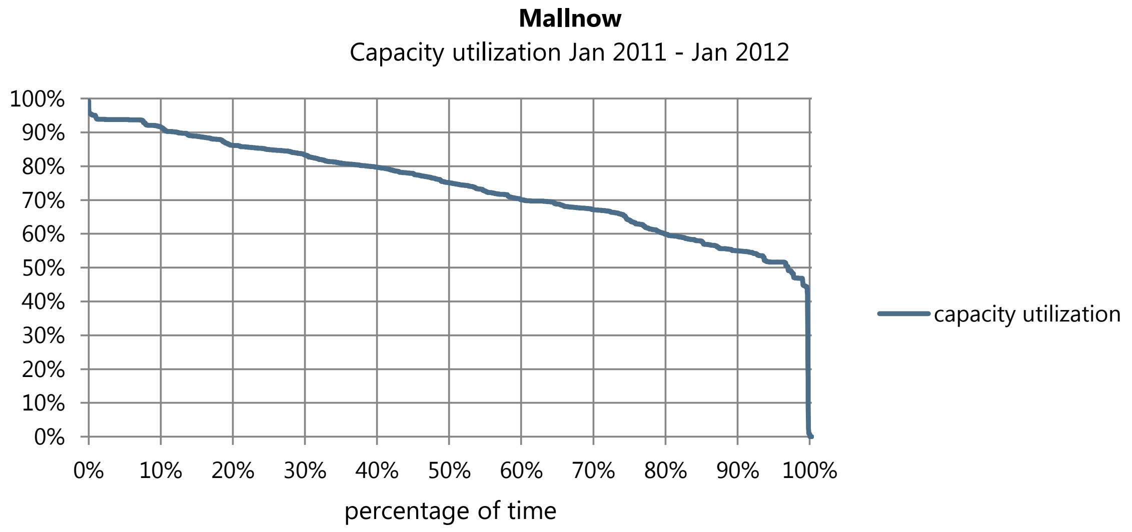


Figure 62: Mallnow: Hourly physical capacity utilization Jan 2011 – Jan 2012



Source: Gascade

Figure 63: Mallnow: Capacity utilization Jan 2011 – Jan 2012

Hora Svate Kateriny	
TSOs	▪ Ontras (DE) ▪ Net4gas (CZ) ▪ Wingas Transport (DE)
Technical capacity	▪ Czech to Germany: 492.000,000 kWh/d (Jan 2012)
Flow direction	▪ bi-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ Czech/Germany: 100,260,843 kWh/d

Table 16: Hora Svate Kateriny: Basic information

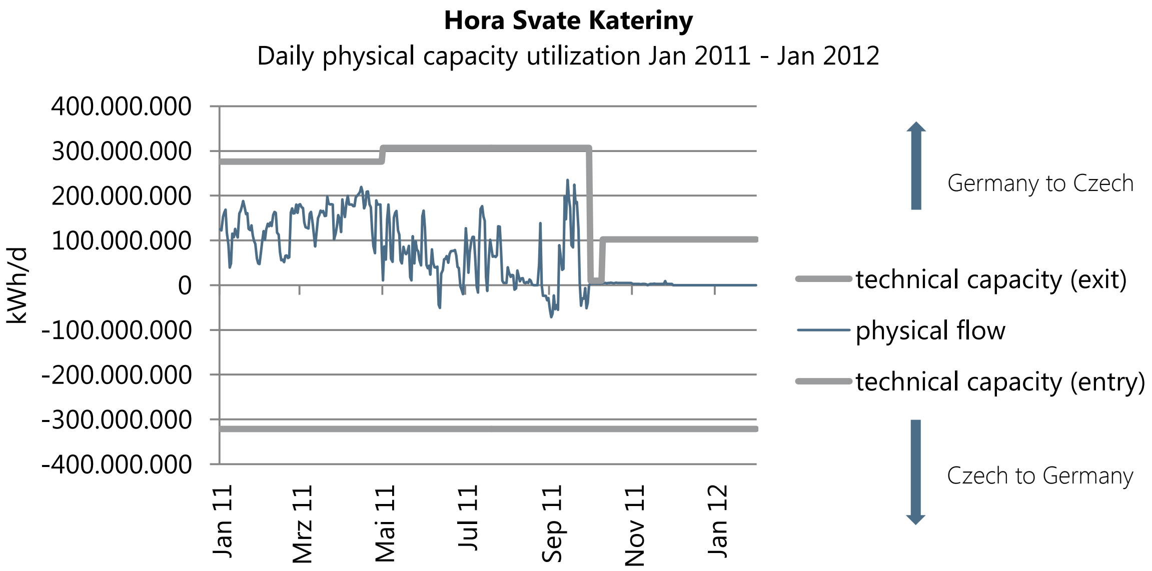


Figure 64: Hora Svate Kateriny: Hourly physical capacity utilization Jan 2011 – Jan 2012

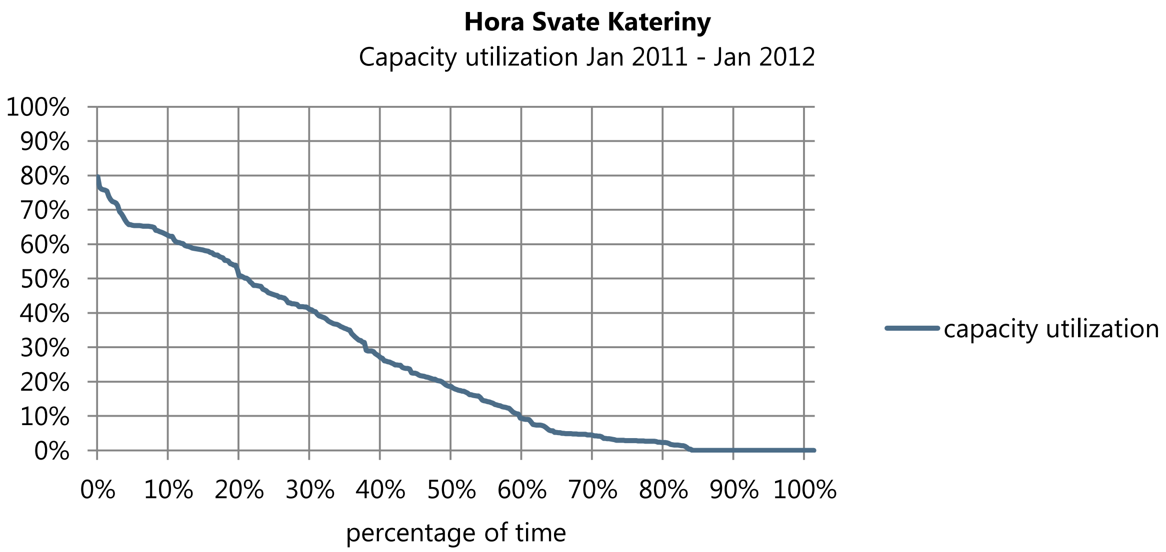


Figure 65: Hora Svate Kateriny: Capacity utilization Jan 2011 – Jan 2012

Waidhaus	
TSOs	▪ Net4gas (CZ) ▪ Open Grid Europe (DE) ▪ GRTgaz Deutschland (DE)
Technical capacity	▪ Czech to Germany: 695,100,000 kWh/d (Jan 2012)
Flow direction	▪ bi-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ Netherlands/Germany: 22,407,024 kWh/d

Table 17: Waidhaus: Basic information

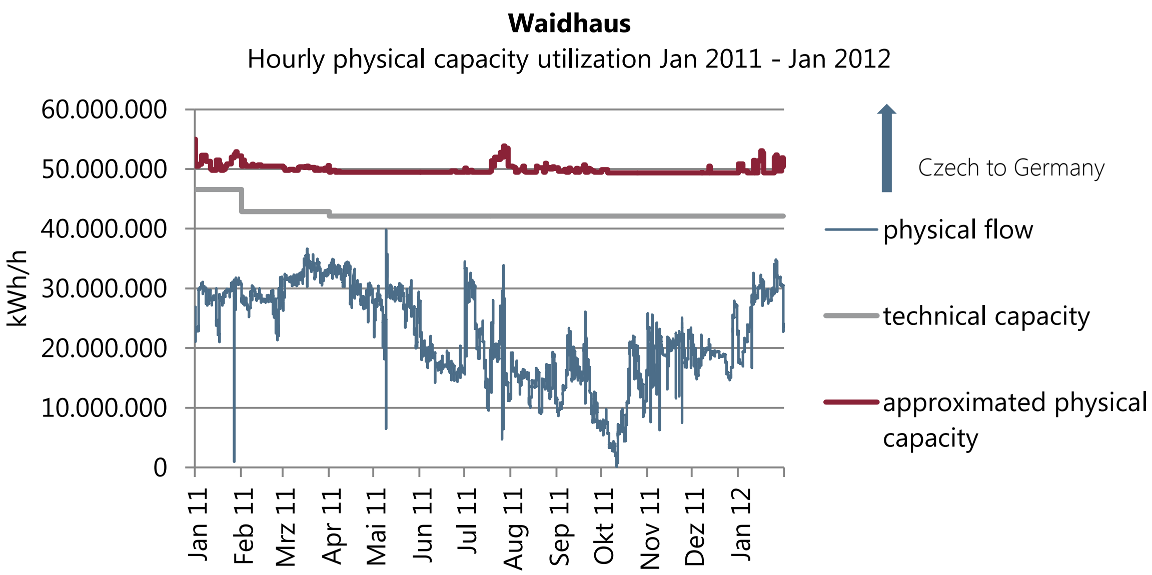
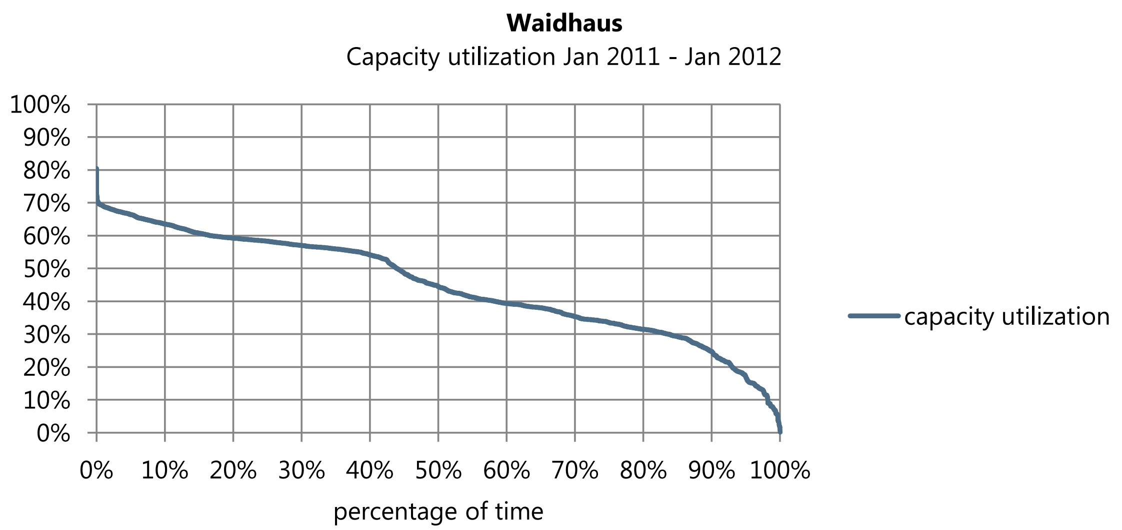


Figure 66: Waidhaus: Hourly physical capacity utilization Jan 2011 – Jan 2012



Source: OGE

Figure 67: Waidhaus: Capacity utilization Jan 2011 – Jan 2012

Oberkappel	
TSOs	▪ Open Grid Europe (DE) ▪ BOG (AT) ▪ GRTgaz Deutschland (DE)
Technical capacity	▪ Austria to Germany: 146,000,000 kWh/d (Jan 2012)
Flow direction	▪ bi-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ Netherlands/Germany: 22,407,024 kWh/d

Table 18: Oberkappel: Basic information

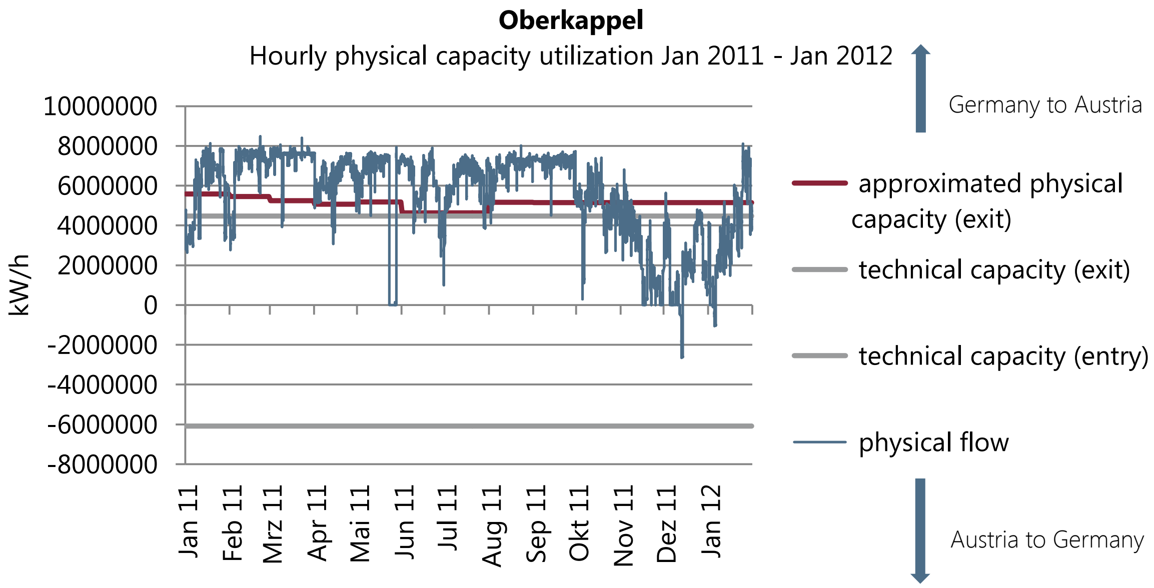
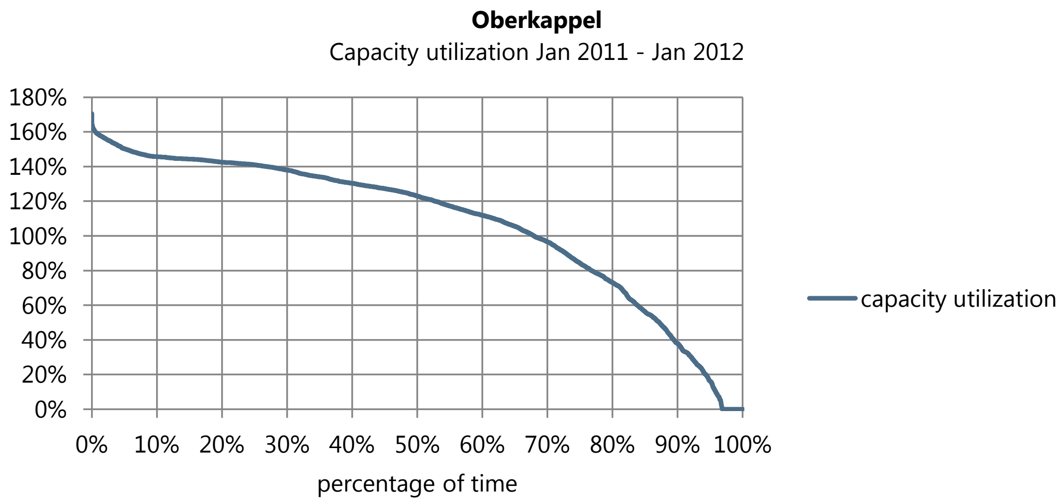


Figure 68: Oberkappel: Hourly physical capacity utilization Jan 2011 – Jan 2012



Source: OGE

Figure 69: Oberkappel: Capacity utilization Jan 2011 – Jan 2012

Tarvisio (IT) / Arnoldstein (AT)	
TSOs	▪ TAG (AT) ▪ Snam Rete Gas (IT)
Technical capacity	▪ AT to IT: 1,135,500,000 kWh/d
Flow direction	▪
Average flow	▪ 01.01.2011 – 20.12.2011: ▪ AT/IT: 69,062,116.61 kWh/d

Table 19: Arnoldstein: Basic information

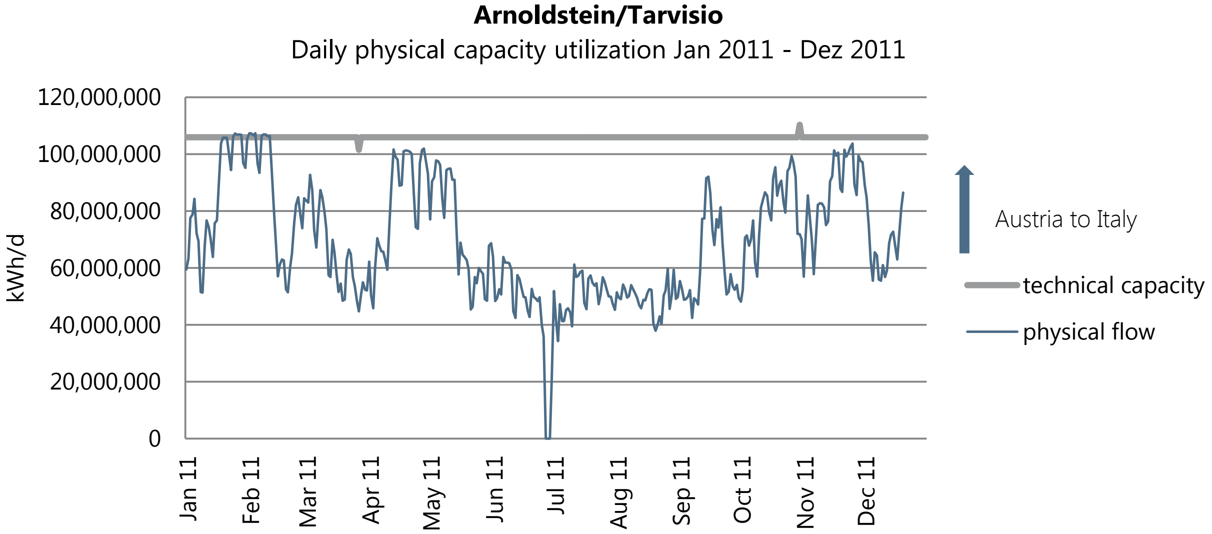
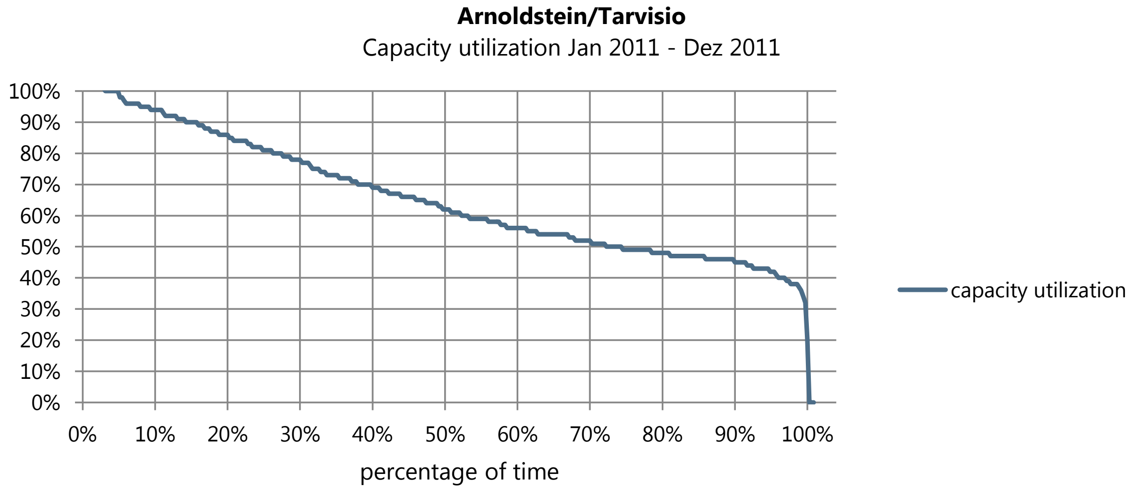


Figure 70: Arnoldstein: Hourly physical capacity utilization Jan 2011 – Jan 2012



Source: TAG

Figure 71: Arnoldstein: Capacity utilization Jan 2011 – Jan 2012

Oltingue (FR) / Rodersdorf (CH)	
TSOs	▪ GRTgaz (FR) ▪ Eni Gas Transport International (CH)
Technical capacity	▪ FR to CH: 223,000,000 kWh/d
Flow direction	▪ Uni-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ FR/CH: 121,914,825.04 kWh/d

Table 20: Oltingue: Basic information

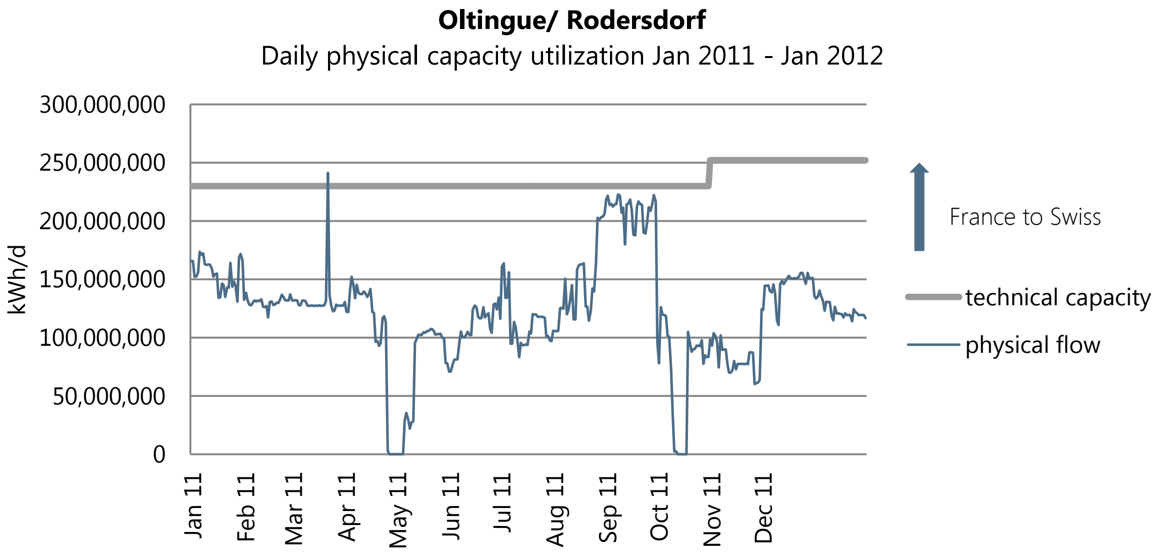
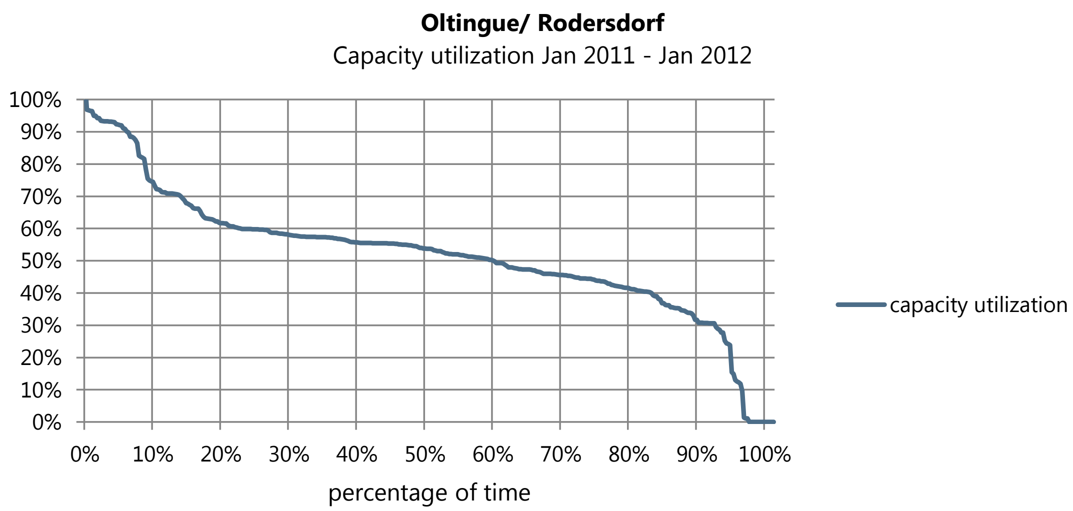


Figure 72: Oltingue: Daily physical capacity utilization Jan 2011 – Jan 2012



Source: GRTgaz France

Figure 73: Oltingue: Capacity utilization Jan 2011 – Jan 2012

Baumgarten	
TSOs	▪ Eustream (SK) ▪ BOG (AT) ▪ OMV Gas (AT) ▪ TAG (AT)
Technical capacity	▪ Eustream to BOG: 482,000,000 kWh/d ▪ BOG to Eustream: 186,600,000 kWh/d ▪ Eustream to OMV Gas: 115,300,000 kWh/d ▪ Eustream to TAG: 1,079,800,000 kWh/d
Flow direction	▪ Uni-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ SK/AT: 1,072,550,834.76 kWh/d

Table 21: Baumgarten: Basic information

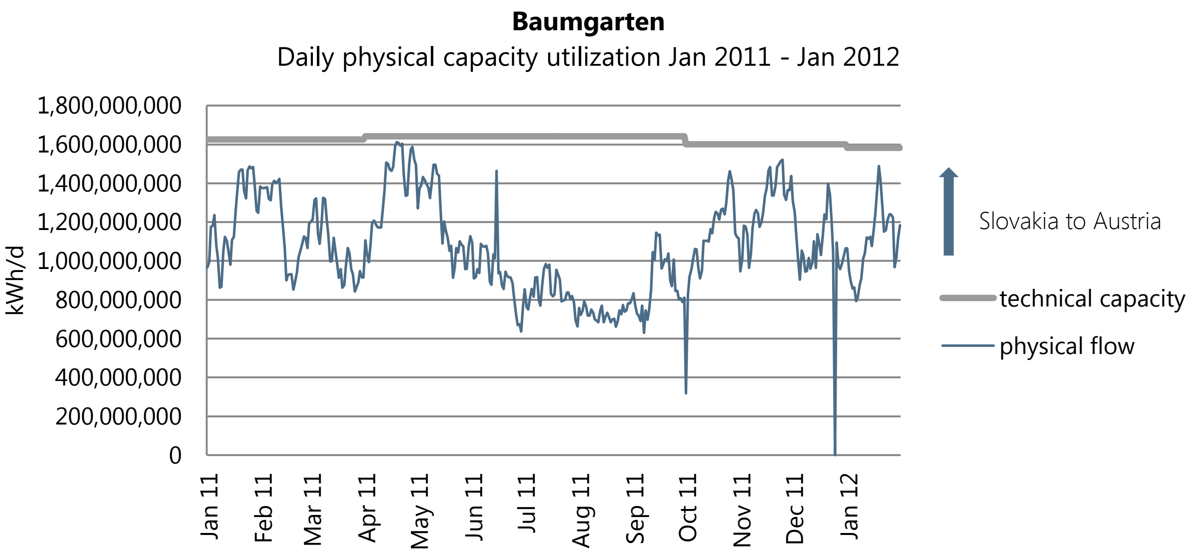
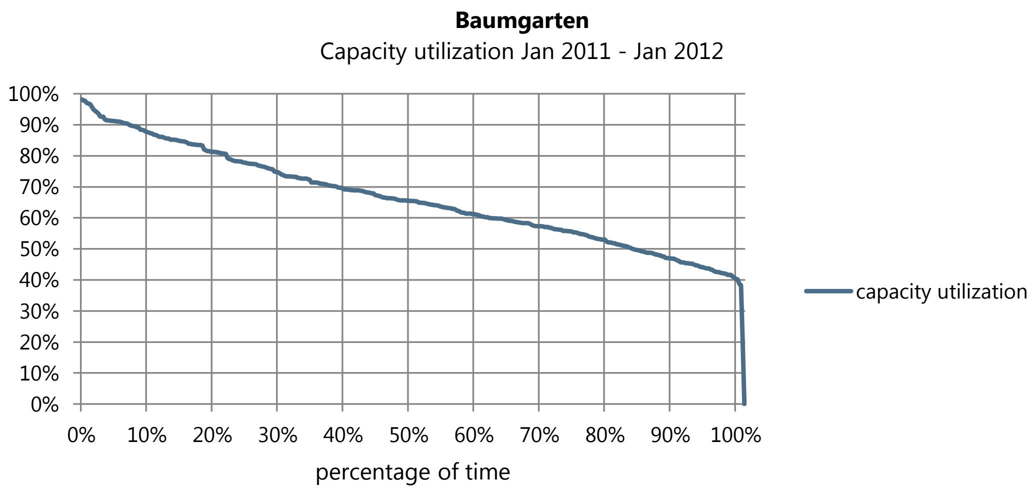


Figure 74: Baumgarten: Daily physical capacity utilization Jan 2011 – Jan 2012



Source: Eustream

Figure 75: Baumgarten: Capacity utilization Jan 2011 – Jan 2012

Murfeld (AT) / Ceršak (SL)	
TSOs	▪ OMV Gas (AT) ▪ Geoplin Plinovodi (SL)
Technical capacity	▪ AT to SI: 74,900,000 kWh/d
Flow direction	▪ Uni-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ FR/CH: 61,541.33 kWh/d

Table 22: Cersak: Basic information

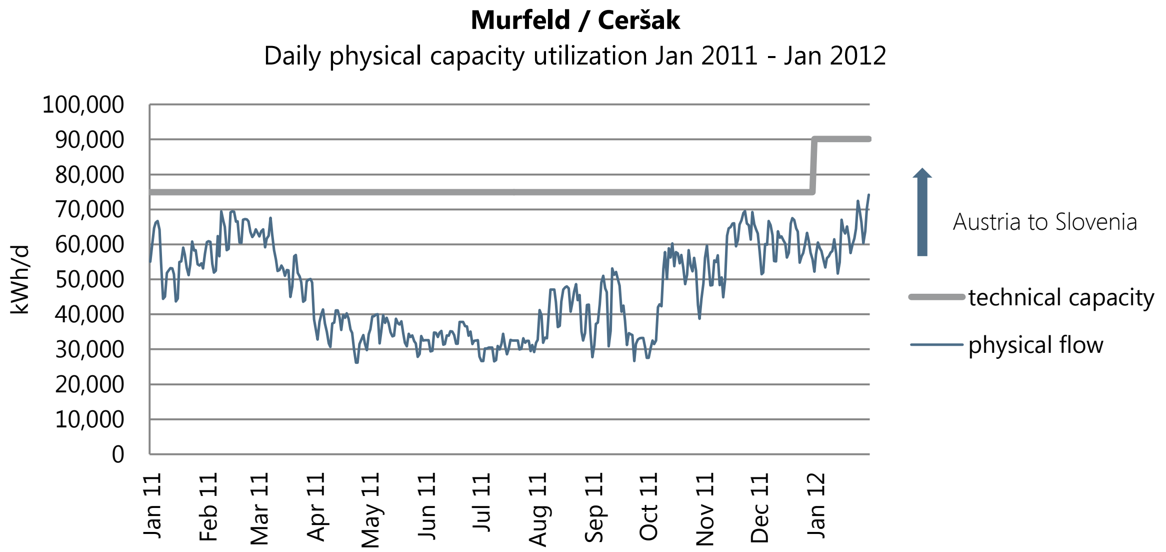
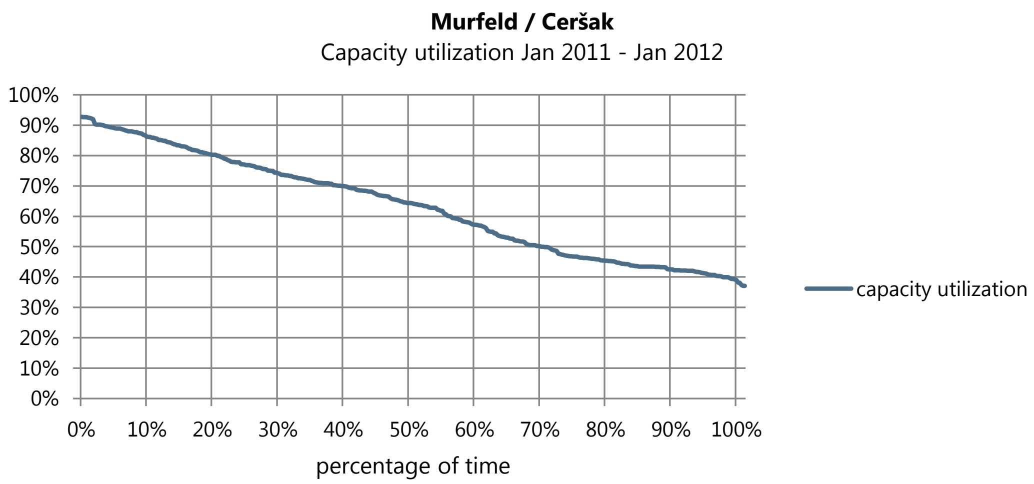


Figure 76: Cersak: Daily physical capacity utilization Jan 2011 – Jan 2012



Source: Geoplin Plinovodi

Figure 77: Cersak: Capacity utilization Jan 2011 – Jan 2012

Gorizia (IT) /Šempeter (SL)	
TSOs	▪ Snam Rete Gas (IT) ▪ Geoplin Plinovodi (SL)
Technical capacity	▪ IT to SL: 27,900,000 kWh/d
Flow direction	▪ Uni-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ IT/SL: 3,753 kWh/d

Table 23: Sempeter: Basic information

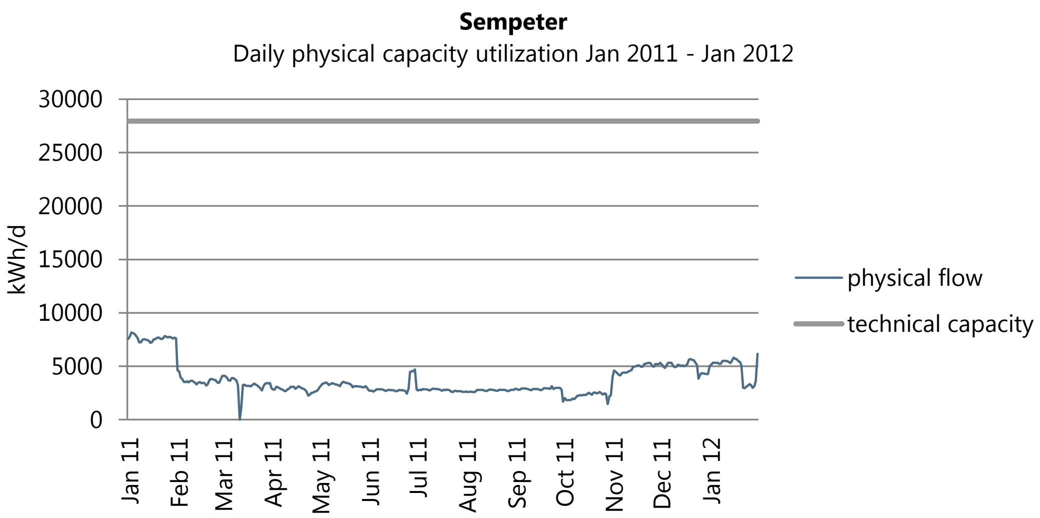
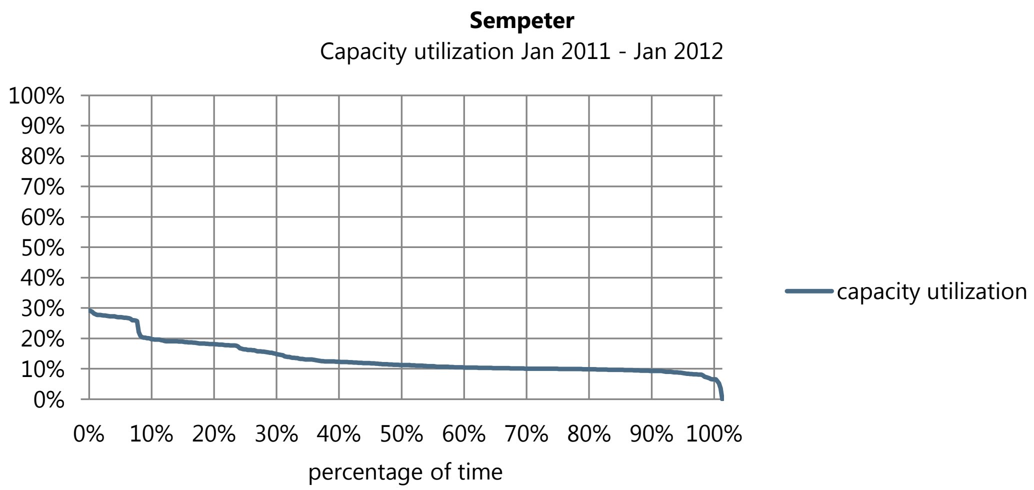


Figure 78: Sempeter: Daily physical capacity utilization Jan 2011 – Jan 2012



Source: Geoplin Plinovodi

Figure 79: Sempeter: Capacity utilization Jan 2011 – Jan 2012

Rogatec	
TSOs	▪ Geoplin Plinovodi (SL) ▪ Plinacro (HR)
Technical capacity	▪ SL to HR: 53,300,000 kWh/d
Flow direction	▪ Uni-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ SL/HR: 23,863 kWh/d

Table 24: Rogatec: Basic Information

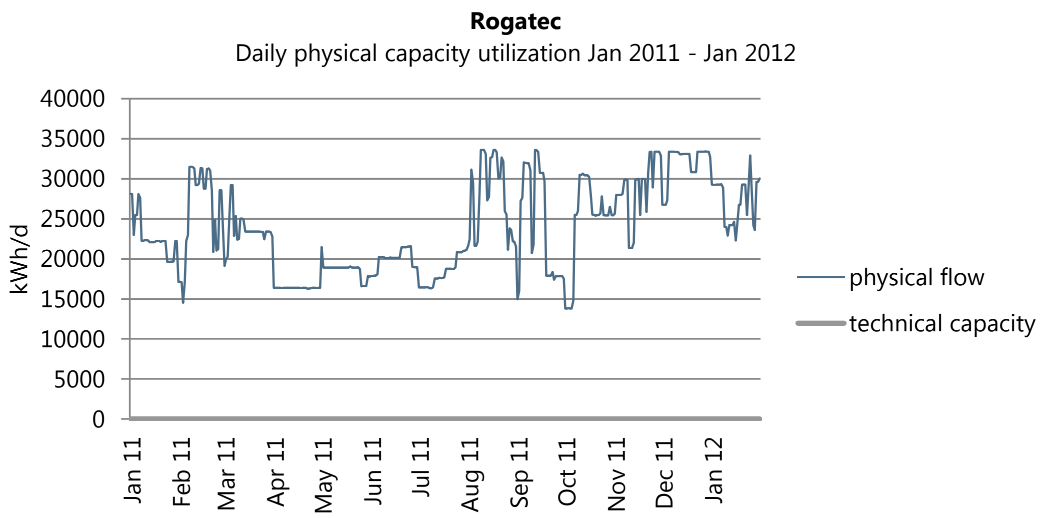
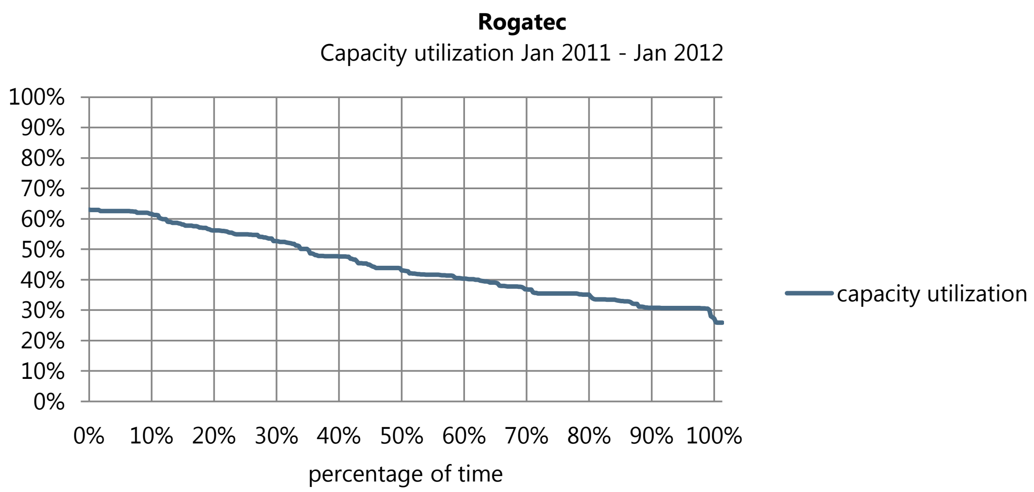


Figure 80: Rogatec: Daily physical capacity utilization Jan 2011 – Jan 2012



Source: Geoplin Plinovodi

Figure 81: Rogatec: Capacity utilization Jan 2011 – Jan 2012

Lanžhot	
TSOs	▪ Eustream (SK) ▪ Net4gas (CZ)
Technical capacity	▪ SK to CZ: 1,267,950,000 kWh/d ▪ CZ to SK: 208,300,000 kWh/d
Flow direction	▪ Uni-directional
Average flow	▪ 01.01.2011 – 31.01.2012: ▪ SK/CZ: 708,939,764.93 kWh/d

Table 25: Lanzhot: Basic information

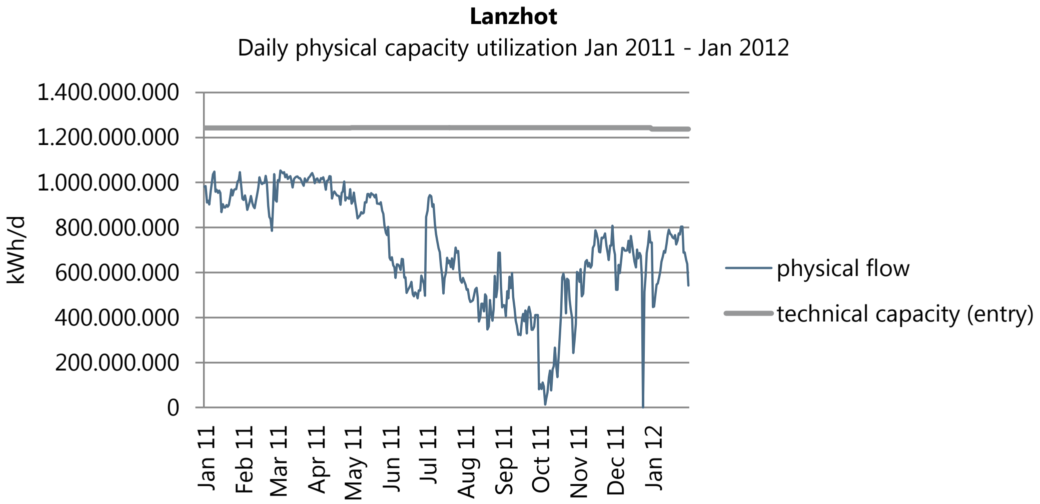
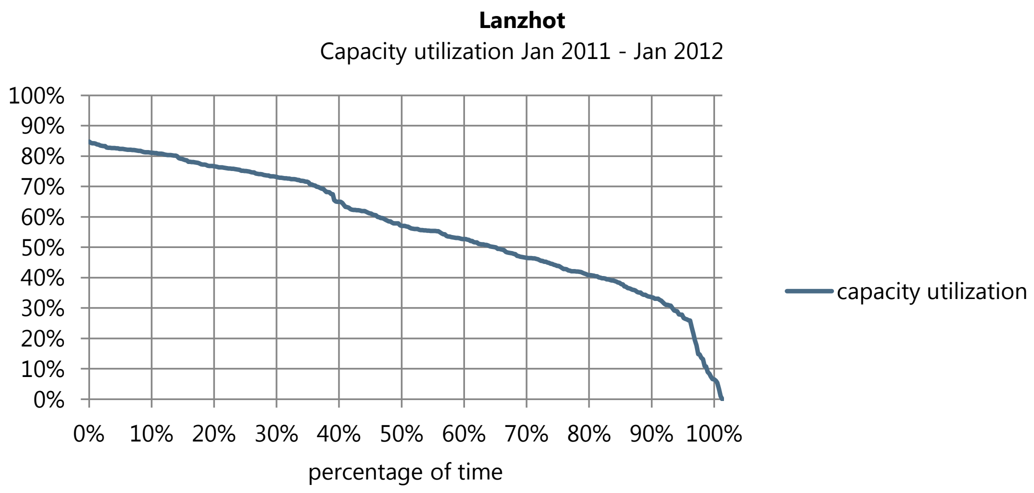


Figure 82: Lanzhot: Daily physical capacity utilization Jan 2011 – Jan 2012



Source: Eustream/Net4Gas

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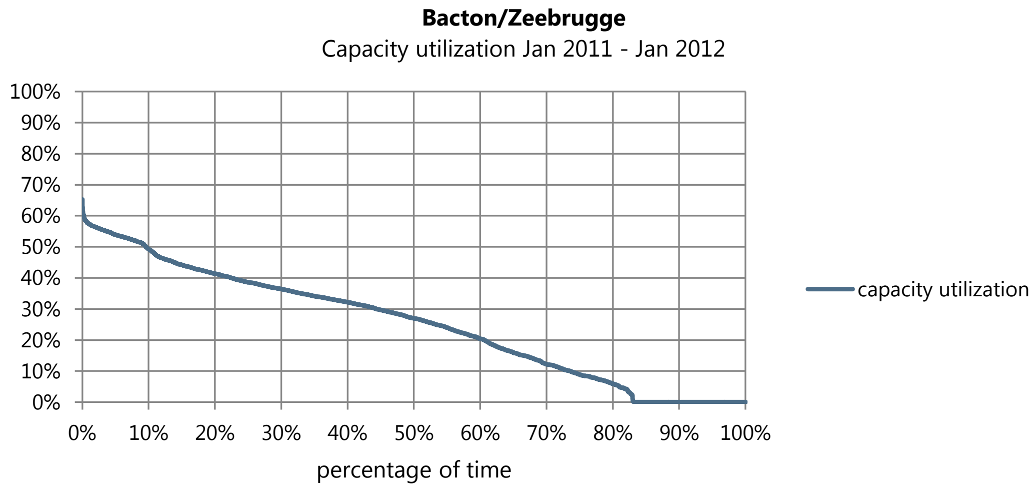

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