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Report on the influence of existing bidding zones on electricity markets

Undertaken in the context of the joint initiative of ACER and ENTSO-E for the early implementation of the Network Code on Capacity Allocation and Congestion Management (CACM) with respect to the review of bidding zones

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Trg republike 3 – 1000 Ljubljana – Slovenia – T: +386 (0)8 2053 413 – info@acer.europa.eu – www.acer.europa.eu

This document contains a report prepared by the Agency for Cooperation of Energy Regulators that aims to evaluate the influence of the current bidding zone configuration on electricity market efficiency. The report is issued in the scope of the early implementation of the Network Code on Capacity Allocation and Congestion Management ('CACM NC'.) with respect to the assessment and review of the bidding zone configuration in some parts of Europe.

Related documents

- Regulation (EC) No 713/2009 of the European Parliament and of the Council of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators.
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:211:0001:0014:EN:PDF
- Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross border exchanges in electricity and repealing Regulation (EC) No 1228/2003
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:211:0015:0035:EN:PDF
- Framework Guidelines on Capacity Allocation and Congestion Management for Electricity, 29 July 2011, FG-2011-E-002
  http://www.acer.europa.eu/portal/page/portal/ACER_HOME/Public_Docs/Acts%20of%20the%20Agency/Framework%20Guideline/Framework_Guidelines_on_Capacity_Allocation_and_Congestion_M/FG-2011-E-002%20(Final).pdf
- Network Code on Capacity Allocation and Congestion Management (CACM), ENTSO-E's final proposals, 27 November 2012
  https://www.entsoe.eu/major-projects/network-code-development/capacity-allocation-and-congestion-management
- Terms of Reference for the early implementation of the NC CACM concerning a Bidding Zone Review in CWE (Belgium, France, Germany, Luxembourg, the Netherlands), Denmark-West, CEE (Austria, Czech Republic, Germany, Hungary, Poland, Slovenia, Slovakia) Switzerland and Italy, October 2012
  http://ec.europa.eu/energy/gas_electricity/doc/forum_florence_electricity/20121123_023_meeting.zip
- The influence of existing bidding zones on electricity markets, Consultation document, 31 July 2013, PC-2013-E-04
  http://www.acer.europa.eu/Official_documents/Public_consultations/Pages/PC_2013_E_04.aspx

1 Introduction

This report is issued in the context of the joint initiative of the Agency for the Cooperation of Energy Regulators (the Agency) and ENTSO-E for the early implementation of the Network Code on Capacity Allocation and Congestion Management (CACM NC) with respect to the assessment and review of the bidding zone configuration in some parts of Europe.

On 30 August 2012, the Agency invited ENTSO-E to initiate a pilot project on the assessment and review of the efficiency of the bidding zone configuration in some parts of Europe based on the process described in the draft CACM NC. This initiative from the Agency originates from the difficulties in the completion of the Electricity Target Model (in particular the Flow-Based Market Coupling) in the regions of the Central-East (CEE) and Central-West Europe (CWE), where (in particular in CEE) progress has been and is still being hampered by the current bidding zone configuration in Central Europe. The Agency therefore proposed to test the efficiency and practical implementation of the Target Model against different bidding zone configurations.

In this early implementation pilot project, the assessment and review is performed for the regions of CWE (Belgium, France, Germany, Luxembourg, the Netherlands), Denmark-West, CEE (Austria, Czech Republic, Germany, Hungary, Poland, Slovakia, Slovenia), as well as Switzerland and Italy as they are part of the highly meshed network in Central Europe.

According to the Terms of Reference (ToR) presented by ENTSO-E at the Florence Forum in November 2012, taking into account the updated provisions of Article 39 of the draft CACM NC[1], the assessment and review process consists of the following four core activities:

- Activity 1: Technical Report prepared by ENTSO-E including the analysis of congestions and power flows.
- Activity 2: Market Report evaluating the influence of the current bidding zone configuration on market efficiency prepared by the Agency.
- Activity 3: Decision to launch the process for reviewing the bidding zone configuration in the event that inefficiencies in the current bidding zone configuration are identified in the technical or market report.
- Activity 4: Review of the bidding zone configuration. ENTSO-E shall carry out a full review process by comparing alternative bidding zone configurations with respect to network security, overall market efficiency and stability, and robustness of the configuration.

The assessment in this early implementation builds on the assumption that the decision to launch the review of the existing bidding zone configuration (Activity 3) has already been taken. This Market Report and the Technical Report prepared by ENTSO-E have been developed in parallel and to a large extent independently. The outcome of one could therefore not be considered within the other report.

Although not required by the draft CACM NC, the Agency has performed a Public Consultation on the influence of the existing bidding zone configuration on the electricity market. Stakeholders were asked to provide comment on the various aspects and process of this pilot project, with a total of 33 responses received. This report therefore also takes into particular consideration the feedback provided by stakeholders involved in the Public Consultation. In addition, based on stakeholders' responses, this report also provides some recommendations for Activity 4 and some criteria according to which the decision to launch the review process may be made in the future.

The assessment of the efficiency of the bidding zone configuration is widely perceived as a challenging task. First, because this is a new process experimented for the first time at a supra-national level with a large number of parties involved. Second, because a robust and rigorous

[1] Draft of November 22nd, 2013 as circulated by the European Commission for the Electricity Cross-Border Committee.

assessment of market efficiency has not previously been undertaken on such a scale in Europe. Third, because any bidding zone configuration or reconfiguration touches upon significantly diverging views and economic interests of different parties. This report is therefore mainly qualitative, future reports may however involve more quantitative elements as more experience is gained through the (re)configuration review process. Nevertheless, this assessment will allow for some recommendations for ENTSO-E to consider during the review (Activity 4).

This report is structured as follows. In Chapter 2, the impact of the current bidding zone configuration on the electricity markets is addressed. More specifically, the chapter considers the impact on the efficient use of infrastructure, liquidity and hedging, market power and investment incentives. Chapter 3 provides recommendations to ENTSO-E, whereas conclusions are presented in Chapter 4. Annex I reports on market power indicators and Annex II provides a summary of the stakeholders' responses to the Public Consultation.

2 Assessment criteria for the bidding zone configuration

2.1 Introduction

Due to the limited EU transmission infrastructure, the efficiency and functioning of wholesale electricity markets and the operational security of the network are impacted by the flows of electricity from source to sink. Congestion management methods and market design arrangements (e.g. the configuration of bidding zones) aim to handle these flows in the most efficient way respecting the necessary security criteria and providing for an appropriate framework for the optimal use and development of the EU network.

The EU Electricity Target Model envisages a zonal design which addresses network congestions between "properly defined bidding zones" by using preventive and curative congestion management methods.

- Preventive methods define *ex-ante* limitations to trade by calculating cross-zonal capacities and allocating them efficiently to market players[2]. TSOs use preventive methods more often than curative ones, because applying *ex-ante* limitations is usually considered cheaper, safer and simpler than intervening closer to real time.
- Curative methods, or remedial actions, aim at modifying the network topology or the initial dispatch when operational security is endangered, despite any preventive measures taken.

At present, the meaning of "properly defined bidding zones" is not straightforward and needs deeper consideration.

The clustering of some nodes of the European transmission network into a bidding zone is based on the idea of simplifying the physical reality of the functioning of the electrical system for reasons linked to electricity trading. All trades related to nodes belonging to a bidding zone are cleared together, making the assumption that there is no limitation imposed on those trades by the physical grid.

This ground hypothesis assumes that operational security of electricity system can be maintained at any node, considering injections and withdrawals in the whole bidding zone as if it was a single entity. In other words, all the nodes belonging to the same bidding zone virtually collapse in a single one. From a market perspective, a bidding zone is assumed to be a "copper plate".

The literature suggests that in meshed networks the identification of clearly constrained lines to define bidding zone borders is difficult because they may change over time. Even in the case of less meshed networks, as with the network topology in the Nordic countries or in Italy, it is still difficult to define bidding zones in a manner that avoids structural (frequent) congestions[3] within a zone when the network infrastructure is insufficient to transfer the electricity from generation to load.

The existing configuration of bidding zones within the scope of this pilot project is as follows (the number in brackets reflects the number of the bidding zones): Belgium (1), France (1), Germany, Austria and Luxembourg[4] (1), the Netherlands (1), Denmark-West (1), Czech Republic (1), Hungary (1), Poland (1), Slovakia (1), Slovenia (1), Switzerland (1) and Italy (6).

[2] In some cases redispatching may be considered as preventive method.
[3] Annex I to Regulation (EC) 714/2009.
[4] To specify, the major part of the consumption of Luxembourg is covered by Germany while a minor part is covered by Belgium (connection at substation Aubange) and France (connection at substation Moulaine).

This configuration is the result of the historical approach of the national electricity markets rather than the outcome of appropriate assessments at regional or pan-European level. This contributes to the rationale for launching the review of bidding zones. While the identification of general criteria to evaluate the influence of the existing bidding zone configuration on electricity markets and to launch their review is still under discussion, this report evaluates the following possible relevant areas that are related to the influence on the market, and upon which the decision to launch a review is based:

- Efficient use of infrastructure (preventive and curative congestion management). The bidding zone configuration does not affect the physical ability of the network to transmit electricity from generators to loads. However, with limited or congested network, the bidding zone configuration impacts generators' decisions to generate electricity and, to a limited extent, also the way in which loads consume electricity. This relates to the efficient utilisation of the network, including the calculation and allocation of capacities, the use of remedial actions and the operational security of the electricity system.
- Liquidity and hedging. The bidding zone configuration might have a limited impact on the liquidity of the day-ahead market (depending on the available capacities). However, the impact on the forward or hedging market might be significant. Higher liquidity in the forward market provides in general better hedging opportunities. It is thus important that market design and bidding zone configuration support liquidity and by this the efficient hedging tools and create a level playing field for market participants in different bidding zones to hedge price related risks.
- Market power. The bidding zone configuration does not affect the overall market structure, but it does influence how market participants can trade and compete across larger areas or regions according to the physical limits of the network. Hence, the bidding zone configuration might affect the overall competition and market power, as well as the possibility of market participants to abuse market power.
- Investment incentives. The bidding zone configuration impacts the evolution of wholesale electricity prices in different areas. Under stable investment climate, electricity prices in different areas represent signals for investment in transmission network, as well as for investment in new generation and load units.

The market-related effects of the bidding zone configuration are presented in what follows. Section 2.2 describes how the efficiency of using the network infrastructure is affected by the bidding zone configuration. Liquidity and hedging are discussed in Section 2.3, market power issues in Section 2.4, and investment incentives are discussed in Section 2.5.

2.2 Efficient use of infrastructure (preventive and curative congestion management)

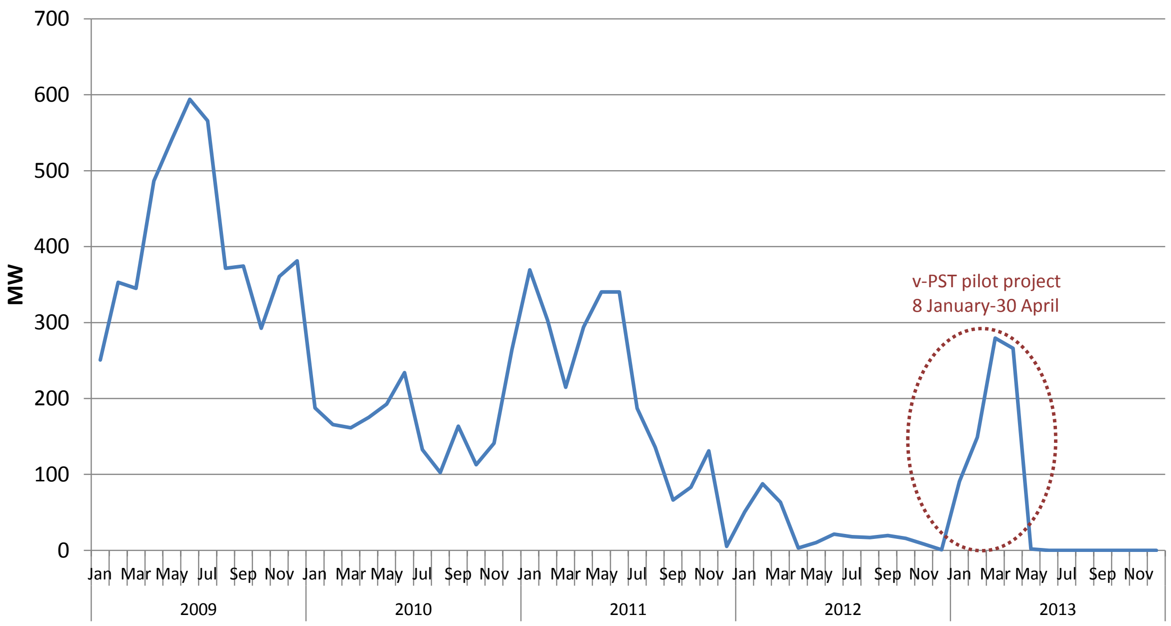
Electricity trading and corresponding exchanges cause flows on electricity infrastructure (i.e. network elements). When these flows exceed operational security limits, TSOs try to impose limits on these exchanges to prevent violation of operational security limits. A common way for TSOs to avoid such violations is to limit *ex ante* trading between zones (as trading inside zones is supposed to be unlimited), by limiting the amount of available cross-zonal capacity.

In the capacity calculation process, TSOs make best forecast of the flows caused by trading inside zones. The remaining available capacities of the network elements are then offered to the cross-zonal market and to the cross-zonal capacity allocation process. In this process, an optimization (e.g. FBMC) ensures that only the exchanges and corresponding flows which maximize social welfare are allowed. This ensures efficient use of the part of the capacity of the infrastructure that is available for cross-zonal trade. In contrast, the efficiency of internal exchanges and corresponding flows are not checked, and all of them are accepted.

Trading inside zones therefore causes flows on network elements (i.e. loop flows and internal flows) that are implicitly prioritised over flows caused by cross-zonal trading. This implies discrimination between internal and cross-zonal exchanges, which is inherent to any zonal congestion management. However, if pushed too far, this discrimination could be detrimental to market efficiency, market integration process, as well as network security. In such a case, TSOs have the responsibility to seek enduring solutions to prevent this "undue discrimination"[5] through, e.g. a reconfiguration of bidding zones.

A badly-designed bidding zone configuration may negatively impact the efficient use of the infrastructure. First, it may lead to a deviation from the optimal generation and load dispatch and impact social welfare. Second, it may have a distributional effect on social welfare among market participants who are located at different geographical points in the network. These two elements are described in the remainder of this section.

The increasing importance of loop flows in the CEE and CWE regions is noted in the ACER 2012 Market Monitoring Report (MMR)[6]. In particular, correlations which may indicate a causality[7], and evidence of the negative effects of loop flows are analysed. For instance, **Error! Reference source not found.** shows a decrease in the Net Transmission Capacity (NTC) values on the Polish-German border between 2009 and 2012, while the temporary increase in 2013 is the result of the implementation of a pilot project on virtual Phase Shifting Transformer (PST)[8].



[5] Point 1.7 of Annex I to Regulation (EC) 714/2009 and draft CACM Network Code.
[6] ACER 2012 MMR, pages 93 to 109, see: http://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER%20Market%20Monitoring%20Report%202013.pdf.
[7] For instance, the MMR shows that the highest correlation of unscheduled flows with wind generation is observed on the borders within the CEE region.
[8] The pilot project on virtual PST lasted from January until April 2013, as can be easily seen in Figure 1. A resumption of the project "virtual PST "in form of the operational phase is foreseen until the commissioning of physical PSTs, planned for 2016.

Figure 1: Monthly average import NTC values on the Polish/German border – 2009 to 2013 (MW) [9]

Loop flows are, however, not the only factor affecting the amount of cross-zonal capacity. For instance, when capacity calculation is not fully coordinated, cross-zonal trading on some borders also causes flows on network elements that reduce the cross-zonal capacity on other borders (unscheduled transit flows).

Potential solutions for the above-mentioned issues need to be analysed separately:

- Transit flows are the physical flows resulting from an electricity exchange between two bidding zones. The unscheduled part of transit flows is the result of the scheduling processes currently applied, where cross-zonal commercial schedules on a given border are not aligned with the transit flows which results in unscheduled transit flows. An efficient capacity calculation and allocation, in particular the implementation of FBMC, helps remove the unscheduled part of transit flows. The FBMC algorithm ensures that all the flows resulting from cross-zonal exchanges (net positions) are compatible with predefined flow margins on the critical network elements and that capacity is allocated where it is most efficient.
- Loop flows are the physical flows resulting from an electricity exchange within one bidding zone occurring in another bidding zone[10]. Loop flows occur as a physical phenomenon – irrespective of the existence of congestion in the grid and of the bidding zone configuration. However, the amount of loop flows depends on the physical properties of the system and on the configuration of bidding zones. Assuming the whole of Europe was one bidding zone, or a nodal system was applied, there would be no loop flows. Loop flows and their effects can be mitigated by investments in the transmission infrastructure (lines, PSTs), remedial actions, and a proper bidding zone configuration.

A recent study on loop flows prepared for the European Commission has assessed the impacts of a set of measures to address efficiently the issue of loop and transit flows with a focus on Germany and its neighbouring Member States. The study concludes "that the prices in the markets do not reflect the limitations in the grid in an efficient way, limiting the efficiency of the price signals provided in the market". It also concludes that "the efficient solution implies that loop and transit flows "compete" for transmission capacity within the market algorithm, i.e. flow-based market coupling with proper representation of the grid across the integrated market area". However, there are important limitations to this study which are explained in the report[11].

A number of respondents to the Public Consultation believe that the impact of loop flows is better tackled through (more coordinated) remedial actions and (potentially) compensation mechanisms, than by means of a reconfiguration of bidding zones[12]. Indeed, the on-going work of the Agency and ENTSO-E task-force on cross-border redispatching and countertrading set-up in 2012, together with regional initiatives (e.g. TSO Security Cooperation – TSC) should contribute, among others, to finding an appropriate framework for sharing the redispatching costs and addressing the loss of social welfare due to decreased cross-border capacities. In that respect, it is also worth mentioning the joint initiative between 50Hertz and PSE S.A. (virtual Phase Shifting Transformers) on the German-Polish border. This initiative seeks an agreement on remedial actions to be taken by the two TSOs to ensure a certain level of cross-border capacity to Poland.

[9] Source: ENTSO-E (2013) and ACER calculations. Note: Monthly average values were calculated on the basis of hourly data.
[10] In contrast Internal Flows are the physical flows resulting from an electricity exchange within one bidding zone occurring in the same bidding zone.
[11] Thema, Loop flows, final advice, prepared for the European Commission, September 2013.
[12] See Annex II, summary of public consultation responses, question 1.

The initiatives mentioned above may address the distributional effects caused by loop flows. However, they cannot address the problem of achieving an optimal dispatch of generation and load.

Remedial actions are measures activated by TSOs to relieve congestions on either cross-border or internal lines. Some remedial actions do not result in significant costs (e.g. changing of grid topology), but others do come at a significant cost such as countertrading and redispatching.

According to the definitions in Commission Regulation (EU) No 543/2013 of 14 June 2013 on submission and publication of data in electricity markets:

- Countertrading means a cross-zonal exchange initiated by system operators between two bidding zones to relieve physical congestion; and
- Redispatching means a measure activated by one or several system operators by altering the generation and/or load pattern in order to change physical flows in the transmission system and relieve a physical congestion.

Assessing the impact of remedial actions on the efficient use of infrastructure and efficient operation of the market is not straightforward. Some respondents pointed out in the Public Consultation that the overall costs of generation dispatch after countertrading and redispatching may be equal to the optimal dispatch[13].

Although a detailed assessment of the efficiency of remedial actions is not the subject of this report, their efficiency depends on the following influencing factors, which are usually not met in practice:

1. It assumes equal technical flexibility of power plants in day-ahead and real-time operation. However, due to the time lag between the day-ahead (or intraday) operations and redispatching, the latter is subject to more technical constraints (e.g. changing generation output in short notice), which has two main effects. First, it reduces the set of available generators for TSOs to apply remedial actions (e.g. redispatching or countertrading). Second, it affects bidding behaviour of generators, who offer their energy at a higher price than at the day-ahead timeframe and sometimes request reservation payments. As a consequence, the resulting costs of countertrading or redispatching may be higher than resolving congestions through day-ahead (and intraday) market coupling/splitting, where all generators can compete.

2. It assumes load participation in remedial actions, whereas in practice TSOs resort only to generation when applying redispatching or countertrading. This reduces efficiency compared to market coupling/splitting where both generation and load intervene to resolve congestion.

3. It assumes a high level of coordination among TSOs when using remedial actions, which requires several TSOs to be involved. While there is certainly significant scope for improving coordination among TSOs, the enhancements may not reach the level of efficiency achieved within day-ahead (and intraday) market coupling in optimising a large (generation and load) portfolio of market players.

[13] See Annex II, summary of public consultation responses, question 1.

4. It also assumes the same economic incentives as provided by the day-ahead (and intraday) market coupling/splitting. However, the price signals sent by countertrading or redispatching are not as strong as the ones provided by the day-ahead (and intraday) market coupling/splitting. While the latter send efficient economic signals to all individual market players, the economic incentive of countertrading and redispatching is limited due to the following reasons: first, because only the generators involved in those remedial actions are financially affected by countertrading and redispatching, and second, more importantly, because the overall cost of those actions is often socialised through network tariffs.

Hence, improving redispatching and countertrading will enhance the dispatch efficiency, though the optimal solution is unlikely to be reached and attained. The aim of the review process shall therefore be to verify if handling frequent congestions in the day-ahead and intraday markets is more cost efficient than handling them via redispatching or countertrading.

Most respondents to the Public Consultation agreed that in the zonal model there will always be a demand for remedial actions, because it would be inefficient to remove all internal (within zones) congestions through network investments. Some respondents argued that the completion of the internal market should be pursued by creating larger geographical price zones.

The Agency believes that the impact of the existing remedial actions on efficiency needs to be assessed. In general, the larger the zone, the larger the proportion of congestions managed by redispatching, which, as explained above, affects the overall costs of dispatching. However, this also depends on the strength of the network within a zone. An accurate assessment of those costs can only be performed by comparing different scenarios of bidding zone configuration.

In addition, transparency on the cost of remedial actions, as well as on the limiting constraints of the network affecting the level of cross-border capacities needs to be increased. For instance, not all TSOs provide sufficiently detailed information when reporting on redispatching and countertrading costs. However the Commission Regulation (EU) 543/2013 (‘Transparency Regulation’) is expected to increase the transparency with regard to remedial actions applied by the TSOs and with regard to the limiting constraints of the network.

In conclusion, a new bidding zone configuration may be an appropriate method, among others, to address efficiently the loss of efficiency and social welfare due to loop flows. It may also help mitigate the potential discrimination between network users in different zones caused by the reduced cross-zonal capacity due to those flows. Moreover, this assessment and the review should also aim to evaluate the impact of different bidding zone configurations on the costs of remedial actions, and more generally on the efficient dispatch of generation and load. Finally, it may allow for more transparency on costs for redispatching and countertrading as well as on the limiting constraints affecting the level of cross-border capacities.

2.3 Liquidity and hedging

In this report we consider liquidity as the ability of market participants to have constantly available trading partners with which they can enter into contractual positions, and also reverse out of them through further trades with the same and other participants, and to do so without their individual trades significantly upsetting the level of market prices. The liquidity of electricity market can be seen from the perspective of the short-term market (day-ahead and intraday) and the forward market. Practically, the liquidity of the day-ahead market does not appear to be influenced by the size or configuration of bidding zones as far as traded volumes are concerned.

The configuration of bidding zones determines how the underlying physical limitations of the network are imposed on market participants when trading across large areas or regions. On one hand, given that the underlying network capabilities do not change with different configurations of bidding zones, defining larger bidding zones creates large areas within which trading is unlimited, but with possibly significantly reduced volume of capacities between these areas (due to reliability margins and internal congestion shifted to the zone borders). On the other hand, smaller bidding zones may create rather small areas without internal limitations to trade, but with possibly larger volumes of cross-zonal capacities between these areas (lower reliability margins, less internal congestions).

While it is difficult to assess which bidding zone configuration has more a positive impact on the overall limitations to trade electricity across areas and regions, the experience from different markets in Europe does not show a clear link between the size of the zones and the liquidity of the day-ahead market. This is because physical limitations to trade are just one of the many factors influencing liquidity of the day-ahead market. One can therefore conclude that the liquidity in the day-ahead market is more influenced by the market structure, market design (e.g. obligatory participation on power exchanges) and market concentration, rather than by the configuration of bidding zones.

Spot market liquidity and number of market participant active on the power exchanges

To illustrate the level of liquidity in the various national markets, **Error! Reference source not found.** below shows the share of electricity traded through the spot exchange; countries are ordered by the total consumption in 2012. **Error! Reference source not found.** depicts the number of market participants active on the power exchanges in the concerned member states.

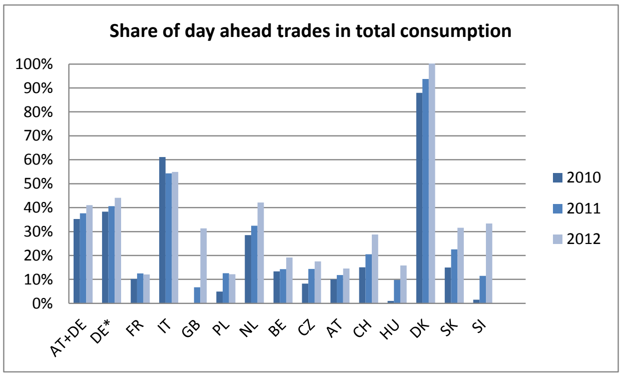


Figure 2: Share of day ahead trades in total consumption; source CEER internal database, own calculation[14]

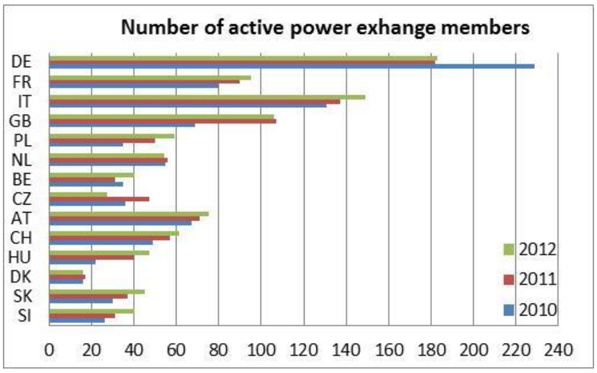


Figure 3: Number of active power exchange members; source: CEER internal database[15]

The conclusion for the influence of bidding zone configuration on the liquidity of the day-ahead market cannot, however, be generalised to the forward market. The forward electricity market serves the purpose of ensuring stability of cash flows to market participants. For this reason, the forward electricity market is often considered as a hedging market, where market participants are incentivized to hedge against the uncertainty of prices in the short term. Some markets or

[14] The data for Austria represent trading at EXAA and do not include trading on EPEXSPOT (also covering the joint German-Austrian price zone). (*) German data includes Luxembourg, which lacks a spot market for electricity though Luxembourgish market players can participate in the German power exchange.
[15] The data for Austria represent trading at EXAA and do not include trading on EPEXSPOT (also covering the joint German-Austrian price zone). (*) German data includes Luxembourg, which lacks a spot market for electricity though Luxembourgish market players can participate in the German power exchange.

regions in Europe have good competition and liquidity enabling market participants to hedge the short-term price risks sufficiently well. A variety of forwards, futures, options, swaps, contracts for differences, etc., have been developed and are traded on various platforms.

In Europe, two designs of the forward market have emerged. The first design is based on the concept that for each bidding zone there is a set of hedging contracts linked to the day-ahead clearing price of the bidding zone (a single-zone hub). The second design, which is implemented in the Nordic countries and in Italy, presents hedging contracts created for a group of bidding zones and these contracts are linked to a hub price, which represents some sort of average day-ahead price within this group of zones (a multi-zone hub).

In a single-zone hub design, the liquidity of hedging products tends to depend, among others, on the size of the bidding zones. While large bidding zones have fairly good liquidity, the liquidity of hedging products in many small bidding zones is not satisfactory and here, the transmission rights (TR) issued by TSOs play an important role. TRs may serve as a bridge between the highly liquid financial electricity markets (Market A) and the adjacent poorly liquid markets (Market B). Market participants can therefore lock the price of electricity in Market A and lock the difference between the price in Market A and Market B. This effectively creates an alternative way to lock the price of electricity in Market B.

In a multi-zone hub design, the liquidity of hedging products linked to a hub price is usually good, whereas the difference between the hub price and the day-ahead price of individual zones can either be hedged with contracts that provide the hedge for the difference between the zonal price and the hub price (Contracts for Differences) or do not need to be hedged at all, when the correlation between the hub price and the zonal price is high.

In response to the Public Consultation document, many stakeholders, especially those concerned with trading, argued that churn rates are an appropriate metric of market liquidity. Churn rate represents the ratio between the volume of all trades in all timeframes executed in a given market and its total demand[16]. It could be considered as a number showing how many times a megawatt hour is traded before it is delivered to the final consumer. Opinions vary on what level of churn rate indicates a truly liquid market. Nevertheless, some stakeholders consider a churn rate of at least 3 to be a minimum value. The most liquid market in Europe, Germany, reaches on average a churn of 8.5[17], and the most liquid European gas hubs reach churn rates at times as high as 25[18].

The calculation of exact churn rates is challenging in the context of an almost continent-wide study. The total volume of traded electricity comes from several categories of trades, falling into a short-term (day-ahead and intraday) and a forward timeframe and executed either on power exchanges or over the counter (OTC). While the volume of electricity traded on power exchanges is easily accessible, the opposite is true for OTC trading. Market data on OTC trading are not yet available, either in the public domain[19] or to regulatory authorities, and traded volumes are generally derived from information reported voluntarily to price reporting agencies by market participants.

[16] Please note that churn ratios can be defined in many different ways and thus any reported values should be treated with caution.
[17] The average for years 2010-2012 based on European Power Trading 2013 report by Prospex Research. For details on the methodology please refer to Annex I.
[18] ACER/CEER Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2012, p. 186.
[19] This is to change as REMIT is implemented. As more accurate market data concerning the volume of trade will be available in the future, this task should become less challenging and the results more reliable.

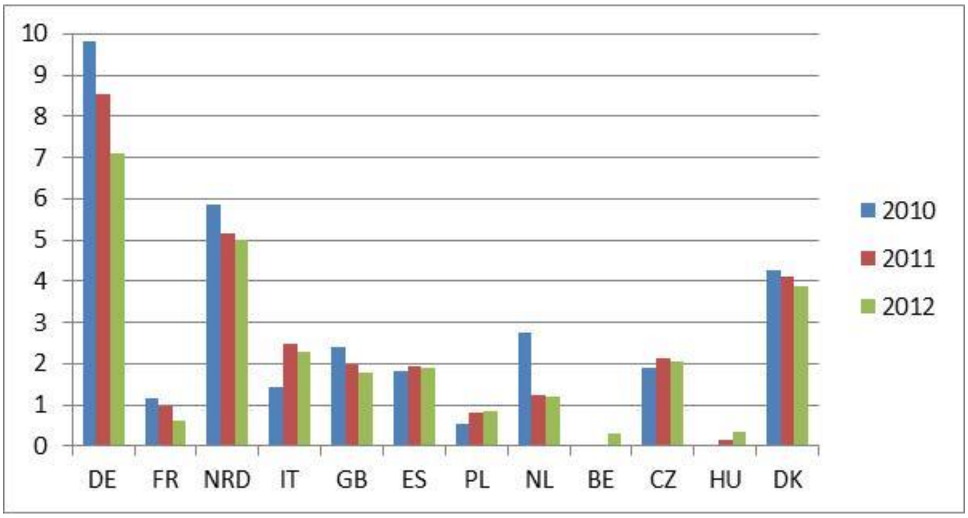


Figure 4: Churn rates of several European markets[20]

Figure 4 shows that the alleged relationship between the size of a market (in total demand) and its churn rate, as a proxy for liquidity, is not straightforward. Based on the level of churn rate, Germany is by far the most liquid market at least in Continental Europe. The Nordic market (NRD) also exhibits high levels of churn rates despite the generally small size of the bidding zones. The size does not appear to have a strong bearing on liquidity of other markets. This suggests there are other factors affecting the level of liquidity. More specifically, the market design and the overall maturity of a given market, including market concentration, are likely to be more important. Additionally, the results show that over the past three years liquidity has decreased in most analysed markets.

The Agency believes that an analysis of the liquidity, especially through the level of churn rate and possibly through other more sophisticated methods (such as bid-ask spread), should form an integral part of any future bidding zone efficiency assessment. It is assumed that less market activity (expressed in terms of churn rate) results in higher bid-ask spreads. Bid-ask spread indicators may be considered as a more direct measure of liquidity, as defined at the beginning of this sub-section, because they show the extent of transaction costs resulting from an instantaneous change in a market participant's contractual position. Higher transaction costs incurred in markets with high bid-ask spreads are likely to be passed on to final customers.

In conclusion, the liquidity of hedging products in small bidding zones within the current bidding zone configuration tends not to be satisfactory, which results in less competition and market efficiency. However, in large bidding zones the liquidity tends to be satisfactory, partly also because market participants from small bidding zones need to use the contracts from large bidding zones in combination with Transmission Rights to hedge themselves. This hedging strategy is less efficient and more costly, and therefore may contribute to a non-level playing field for competition within the EU internal electricity market. From this perspective it is essential that any bidding zone reconfiguration is complemented with a forward market design providing market participants in all bidding zones with sufficiently good possibilities to hedge their price risks at competitive costs. Such design might include implementing a multi-zone hub design or Transmission Rights also between non-neighbouring bidding zones. This in turn may decrease the negative impacts, which the bidding zone reconfiguration could have on the forward market.

[20] For a detailed description of the methodology applied see Annex I.

2.4 Market power

Market power is defined as the ability of a firm to profitably increase market price above the competitive level, by reducing its output or directly raising its price. Market structure and limitations to trade imposed by the transmission network, which affect the definition of the relevant market, are two key elements for the appraisal of competition in electricity. When assessing market power, the definition of the relevant market is especially challenging for interconnected markets. The relevant market may vary from the zonal or national market, if the transmission capacity is not taken into account, up to the whole EU market, if there was infinite cross-zonal capacity. In addition, market power may vary across different time horizons (e.g. day-ahead vs. balancing timeframe).

In this section we tackle general market power, when some market players are dominant in a market to the degree that they alone can influence prices, and locational market power when certain generators or loads are located very close to network elements that are frequently congested and are often needed to solve congestions.

The relationship between market power and the size of bidding zones is not straightforward. On one hand, it may be argued that the larger the bidding zone, the lower the market power of a market player in the day-ahead market due to the increased number of competitors and the increased liquidity in the bidding zone. On the other hand, it may also be argued that the reduction of bidding zone size allows for an increase of competition by an increase of the relevant market[21], because a better appraisal of network congestions allows security margins to be decreased in the capacity calculation process which can induce an overall increase in the possibilities to trade.

Redispatching is very often organised in a non-market based way such that the costs of redispatching represent the costs for assuring availability of generators and the costs that reflect the loss of opportunities. Where market-based redispatching is applied, the competition is usually weaker in redispatching than in the day-ahead market coupling. Therefore, with an increase of redispatching linked to zone size, it needs to be assessed whether a decrease of market power of a given market player in a large zone is counterbalanced by the increase of locational market power in redispatching.

Locational market power is inherently present in the electricity market, regardless of the zonal or nodal design. This is because some generators and loads are inherently more suitable to solve congestion in specific locations in the network. Nevertheless, locational market power can be mitigated to some degree. In the case of smaller zones or nodal pricing, *ex-ante* remedial actions are more likely replaced by market mechanisms, solving congestion based on bids from all generators in, for example, the day-ahead market. This way, the generator with locational market power is faced with more competition in solving the congestion.

When considering the impact of market power on prices, costs and efficiency, the overall impact needs to be taken into account. Prices influenced by market power, for example in the day-ahead market, affect directly the costs for all consumers. However, prices influenced by market power in redispatching may affect a smaller portion of costs, because redispatching prices are not used as a reference for a number of different prices.

When reviewing bidding zones, market power should be assessed with the indicators generally used to assess market concentration and the indicators aimed to assess the pivotal position of market participants within a market. In general, such an assessment is within the realm of regulators or, where applicable, with competition authorities.

Beyond the calculation of these indicators, it is challenging to directly measure market power, let alone to establish whether market power has been abused. To measure market power,

[21] Scott M. Harvey and William W. Hogan, Nodal and Zonal Congestion Management and the Exercise of Market Power, January 10, 2000

sophisticated methods involving detailed transaction and cost data are required, which go beyond the scope of this report. As market concentration is one of the preconditions for market power, the Agency considers that market concentration indicators can provide first insights into the static relationship between market power and the size of bidding zones.

There are a number of methods to measure market concentration. In this report, the Agency relied on the CR3 concentration ratios reported annually by NRAs in the database maintained by the Council of European Energy Regulators (CEER).. The indicators are described in Annex I along with caveats related to them. In Figures 5 to 8, countries are ordered by the total installed capacity and generated volume in 2012.

The Agency acknowledges the limits of the CR3 indicators and points out that, given the limitations of the data available to the Agency, it is impossible to conduct a rigorous statistical analysis. Nevertheless, the Agency notes the lack of any consistent pattern between the size of a bidding zone and the level of market concentration and therefore cannot confirm the alleged relationship between the two.

Furthermore, the Agency is of the opinion that the level of market concentration is also strongly affected by other factors in play in a given market, namely the market design and historical circumstances such as national generation structures before liberalisation started.

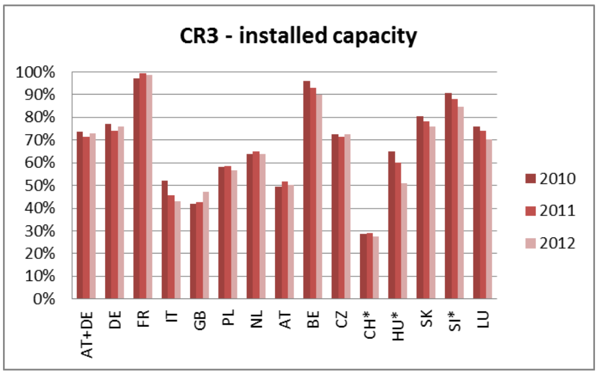


Figure 5: Installed capacity; source: CEER internal database *) countries where only data per individual companies were provided

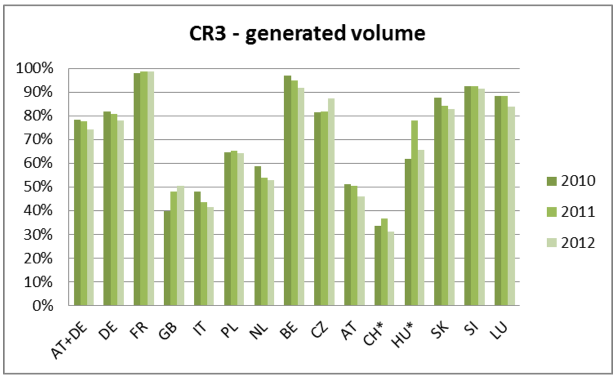


Figure 6: CR3 - generated volume; source: CEER internal database *) countries where only data per individual companies were provided

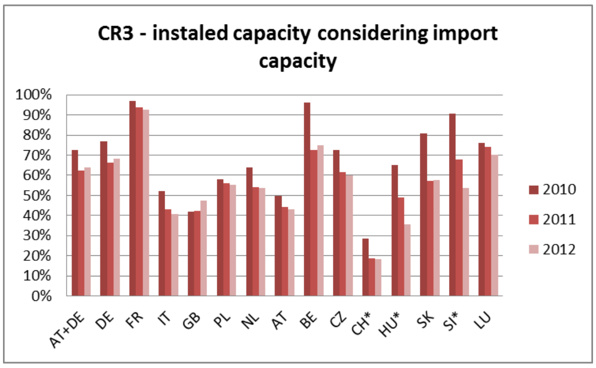


Figure 7: CR3 - installed capacity considering import capacity; source: CEER internal database, own calculation *) countries where only data per individual companies were provided

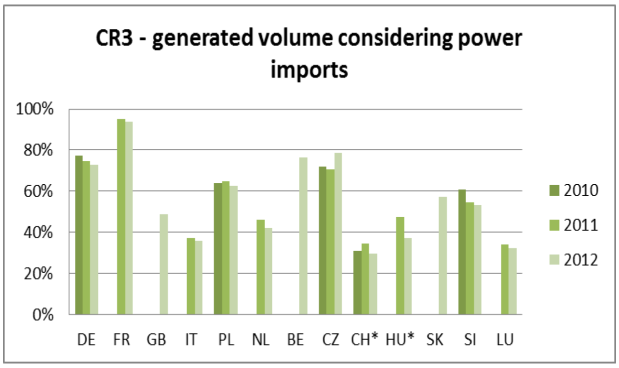


Figure 8: CR3 - generated volume considering power imports; source: CEER internal database, own calculation *) countries where only data per individual companies were provided

In conclusion, the Agency believes that the issue of market power is best addressed by dedicated tools that are already or will be available to the regulatory authorities under the existing European and national legislation. It follows that the review of bidding zones should not be primarily guided by possible impacts on market power. However, the Agency invites ENTSO-E to provide indicative values of market concentration indicators and potential impacts of market concentration under the various possible bidding zone configurations.

2.5 Investment incentives

It is often perceived that the most efficient market is the one where no congestion exists and where the network is developed to the degree that, for example, the whole of Europe is one bidding zone. While this is certainly true with respect to the efficiency of the market, the overall efficiency of electricity delivery is not just about efficient competition between generators and loads and efficient price formation, but it is also efficient operation and development of the networks.

Hence, the network should only be strengthened to the point where the marginal costs of network development, maintenance and operation are equal to the marginal benefits of further market integration and price convergence. The picture below illustrates that a full copper plate in Europe would not be efficient as this would entail investments costs, which would far exceed the benefits of price convergence.

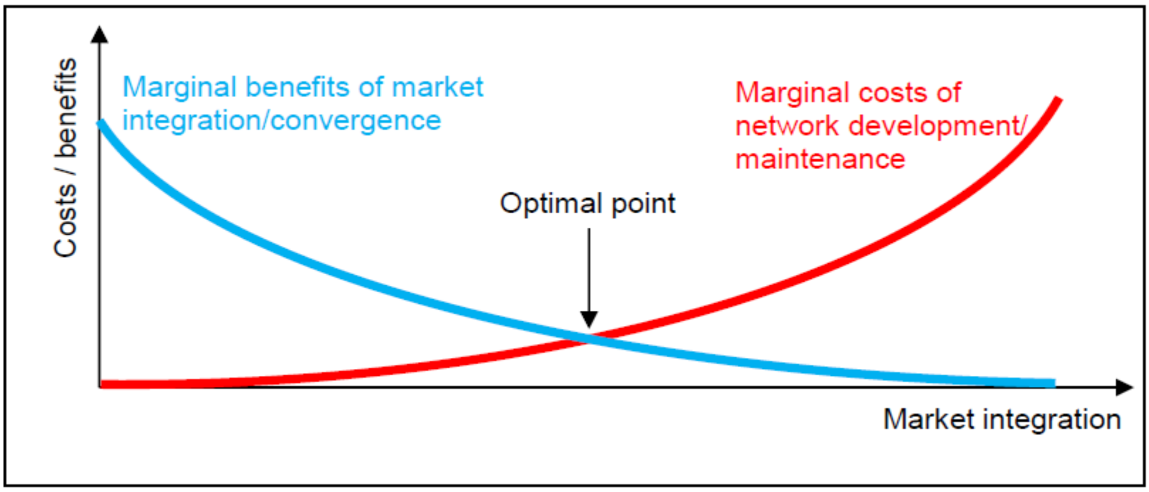


Figure 8: Optimal network development

The views of stakeholders are somewhat divided in respect of the influence of bidding zone configuration on incentives and adequate price signals for investment. The majority of stakeholders recognise that a well-designed and a stable bidding zone configuration could influence incentives and price signals for investment. Well-designed means that configuration bidding zone configuration respects the technical constraints of the network, both internally and cross-border, and that it provides efficient market signals (prices) and opportunities (liquidity, hedging). Stable means that a bidding zone configuration should not be changed frequently and only if it is sufficiently justified. Stakeholders also note that the current regulatory regime (permitting procedure, support schemes) drives investment decisions, both in transmission and generation, more than locational signals created by the market.

The Agency fully agrees with stakeholders that the stability of the bidding zone configuration is an essential component of a stable regulatory framework and to promote long-term investments. A biding zone reconfiguration may impact the evolution of electricity prices with prices potentially decreasing in some areas and increasing in others. As emphasised by many respondents to the

Public Consultation, reconfigurations create an uncertainty whose impact has to be minimised. This uncertainty implies that 1) the overall process leading to the decision to eventually change the bidding zone configuration should be as efficient as possible; and 2) a biding zone configuration should not be changed too frequently. In that respect, the network investments with high certainty of completion within or closely following the timeframe for the change of configuration need to be taken into account in the review.

The Agency acknowledges with regret that investment decisions are currently not always driven by market signals but other influencing factors such as RES support schemes. However, the Agency also believes that a well-designed bidding zone configuration (i.e. a bidding zone configuration that better reflects the physical network constraints) may contribute to providing more efficient price signals and a more favourable investment climate both at transmission and generation level. Therefore, the Agency encourages ENTSO-E, when reviewing the bidding zone configuration, to consider the likely impact of each bidding zone configuration scenario on the future investment decisions, both in the transmission and generation sector.

3 Review of the bidding zone configuration: recommendations to ENTSO-E

The review of the bidding zone configuration (Activity 4) is the final, most important and difficult step in the assessment and review process. The draft CACM NC provides a solid framework for this process. In particular, Article 38 provides criteria for the review, which encompass elements from market efficiency, network security, stability and robustness of bidding zones. To Agency's understanding, the review process involves creation of different future scenarios of the European network situation (generation, load and network topology) and different scenarios of the bidding zone configuration. Each scenario should be evaluated against the criteria set out in the CACM NC. While the Agency acknowledges the complexity of this task, as well as the novelty of the process, the framework set out in the draft CACM NC should be the main driving element for this activity. Nevertheless, some additional elements not included in the draft CACM NC, but arising from responses and expectations from stakeholders, as well as from the Agency's understanding, are also considered by the Agency to be important and to be considered by ENTSO-E in undertaking the review.

The fundamental element of the review process appears to be the creation of realistic scenarios of future generation load and network topology and creation of bidding zone scenarios that reflect the frequent physical congestions in the network. Different time horizons should be considered for scenarios, however all scenarios should consider the time required to change the bidding zone configuration and to enable market participants to adapt. In addition, the scenarios should include future investments in the network and a full cost-benefit analysis should be undertaken encompassing all the expected costs and benefits of expanding and using the network. When it comes to the usage of the network, the creation of realistic scenarios should allow ENTSO-E to compare the overall costs of dispatching for the existing and alternative bidding zone configurations. The comparison should, at least, be able to differentiate between the costs of dispatching at the day-ahead and intraday market and the costs incurred due to remedial actions applied by TSOs. This task should also implicitly address the elements such as uncertainties and reliability margins in capacity calculation, the amount of cross-zonal capacities, the emergence of unscheduled flows, and possibly more coordinated and optimised remedial actions. As difficulties in the implementation of the Target Model were the driving element behind the initiative for the whole assessment, the Agency recommends that the review process also focuses on the efficiency and ease of the implementation of the Target Model, by comparing the existing and alternative bidding zone configurations within the analysed geographical scope.

With respect to short term market liquidity, it is recommended to investigate how alternative bidding zone configurations impact the liquidity of the day-ahead and intraday market. With respect to the forward market, there is a general expectation that an alternative bidding zone configuration will have a significant impact on the forward electricity markets which are based on a single-hub design. As such, the Agency recommends to ENTSO-E to investigate whether an alternative forward market design could mitigate this problem. For example, multi-hub design or transmission rights between non-neighbouring bidding zones could address the negative impact of smaller bidding zones on the forward market.

In addition to the recommendations above, the Agency also outlines the following recommendations to ENTSO-E:

1. The comparison of different bidding zone configurations should also consider the influence on transaction costs for market participants.
2. The review should consider the extent to which bidding zone configurations induce, in the analysed geographical scope, an "undue discrimination" between internal and cross-zonal exchanges (considering the criteria from Art. 39 draft CACM NC) and to which extent different bidding zone configurations could mitigate this discrimination. ENTSO-E is also invited to develop a measure of such "undue discrimination".

3. When comparing alternative bidding zone configurations with the existing one, ENTSO-E should also take into account the time needed and the (one-off) transitional costs of a possible bidding zone reconfiguration.
4. ENTSO-E is invited to assess the likely impact of each bidding zone configuration scenario on the future investment decisions, both in the transmission and generation sector.
5. ENTSO-E is also invited to analyse market power and market concentration indicators and potential impacts of market concentration under the different bidding zone configurations.
6. As bidding zone configuration may impact the retail market competition, these aspects should in principle also be analysed for each configuration. Nevertheless, the Agency recognises the difficulties to perform such analyses.

Finally, one of the most important recommendations to ENTSO-E is to provide full transparency of the review process, as well as the factors influencing the decisions. First, stakeholders should be involved throughout the process, in particular during the definition of the problem, definition of the methodology and criteria, and during the creation of scenarios and assumptions. With respect to the criteria defined in the draft CACM NC, some stakeholders expressed doubts about the relevance of some criteria and recommended caution when using them. Stakeholders emphasised the need for published scenarios, assumptions, and methodology. More transparency is also required for the hidden information related to congestion management, such as location and frequency of congestions and the true costs of managing these congestions.

4 Conclusions

An adequate configuration of bidding zones in EU electricity markets is one of the key elements for an effective implementation of the Electricity Target Model and for the overall efficient market performance[22]. Currently, further implementation of the Electricity Target Model (i.e. implementation of market coupling) is hampered in the CEE and the CWE regions. This is partly due to the discrepancies in the perception of stakeholders about what an adequate bidding zone configuration should be. A review of bidding zones, performed by ENTSO-E, should cast light on this by assessing the impact of a bidding zone reconfiguration (comparing existing and alternative bidding zone configurations) on market efficiency, network security as well as on network and generation development.

This report is based on the Agency's assessment and stakeholders' feedback received in the Public Consultation. As such, it analyses the main effects of the existing bidding zone configuration on the electricity markets of the CEE and the CWE regions, Denmark West, Switzerland and Italy, and concludes that the existing bidding zone configuration is currently affecting:

1. The efficient dispatch of generation and social welfare, which are both affected by preventive congestion management (cross-zonal capacity calculation and allocation) and curative congestion management (remedial actions);
2. The distribution of social welfare due to the potential discrimination of market participants located at different geographical points in the network;
3. The signals and incentives to invest in both transmission and generation; and
4. The liquidity, possibly in the day-ahead but in particular in the forward markets, where larger bidding zones offer more hedging opportunities than small bidding zones creating non-level playing field.

The review of bidding zones to be performed by ENTSO-E should include, as a minimum, an assessment of the effects of different bidding zone configuration scenarios on the above-mentioned market-related aspects. Other elements such as market power are currently perceived as less relevant for a bidding zone review in the CEE and the CWE regions, Denmark West, Switzerland and Italy. Market power is considered to be inherently present in the electricity market regardless of the market design recognising, however, that a precise analysis on the relevance of market power in this context has not been made in this report.

Additional remarks were provided by stakeholders in the Public Consultation undertaken in the context of this report. First, stability of the bidding zone configuration is very important for market participants, who recommend that reviews of bidding zone configuration should not take place too often. Second, stakeholders request the utmost transparency when ENTSO-E and the Agency perform, respectively, the technical and market report within the assessment of bidding zone configuration.

[22] The review of bidding zones becomes more relevant in the context of growing intermittent generation since it often contributes to the problem of loop and transit flows, as presented in section 2. Although RES policies are expected to be more coordinated in the future, the presence of non-harmonised technology-oriented support instruments for RES-based generation will still continue to impact the efficient functioning of the markets.

Annex I: Indicators for market power and liquidity

Given the limited timeframe and resources available, the Agency opted for data that are readily available in the database collected by the CEER; these data are supplied by national regulatory authorities. Namely, the present Report contains the concentration ratios of the three largest companies in the market (CR3), supplemented by statistics on the number of active power exchange members.

Concentration ratios

The concentration ratio is the ratio of the sum of market shares of a given number (three in this case) of the largest firms to the total size of the market. The CR3 indicators are reported in two separate variations reflecting two possible definitions of relevant market size, namely the total installed capacity and total generated volume. Two indicators, taking into account only domestic installed capacity and generated volume, were sourced directly from the CEER database[23]. In addition, the Agency has construed two synthetic indicators which try to capture the influence of cross-border transmission capacity and actual power imports. The first of them was arrived at by increasing the size of the relevant market – installed capacity, by the average import NTCs. For the second one, the total generated volume was increased by the total power imports.

However, it needs to be emphasised that some regulators reported data per individual company. The Agency deems it more relevant, from a market power analysis perspective, to report the concentration ratios of business groups. A business group is a grouping of generating companies where one person exercises effective control over the remaining persons in the group. By means of an example, it can take the form of a holding company that owns no generating assets but has majority rights in individual power plants or companies directly owning generation assets. It is reasonable to expect such a conglomerate to act as a single company and thus exercise market power, given that its combined market share is large enough. When market shares (i.e. share of installed capacity and generated volume) of only individual companies are taken into account, the level of market concentration as reported by the CR3 figures may be understated.[24]

Furthermore, a data consistency check revealed that the data supplied by the regulators are not fully consistent. Perhaps most importantly, while most NRAs reported values based on total installed capacity and total generated volume, other NRAs[25] take account of the size and/or intermittency of generators. In these cases, the reference market typically excludes intermittent or renewable generation and smaller generating units. The agency deems that, in principle, the latter approach may better reflect the underlying potential for market power abuse. As a result, the CR3 values for those countries compared to the other member states may be to some extent overstated.

Churn rates

The reported churn rates come from different sources. The Agency notes the limited explanatory value of the resulting values especially in terms of comparability. The most reliable values are those for major European markets, namely Germany, France, Nordic, Italy, the UK, and the Netherlands. The churn rates for 2012 were taken directly from the European Power Trading

[23] The CR3 values for Denmark could not be obtained.
[24] For example in the Czech Republic, the installed capacity CR3 was 61% when only individual comapnies were reported as opposed to 71% when business groups were taken into account.
[25] GB, FR, NL, and DE

2013 report by Prospex Research.[26] The churn rates for 2010 and 2011 were calculated from Trading Volumes provided by Prospex[27] and demand data from the CEER database.

Finally, the values for the remaining markets were calculated based on traded volume and demand data from the CEER database. Traded volume in these markets (except Czech Republic) only includes day-ahead, futures and power exchange-cleared OTC trades.[28] As such the resulting traded volumes are likely to be underestimated as not all OTC trades are cleared through a power exchange. Furthermore, intraday volumes are not included at all. The value of churn rate in these countries is therefore likely to be understated. The size of this discrepancy is impossible to exactly determine. A comparison of churn reported by Prospex and the results based on the CEER database indicate that the real churn rates (i.e. including all OTC trades) can be twice as high.

For the Czech Republic the traded volume includes bilateral trades reported to the market operator in place of power-exchanged OTC trades. As a result some physically-settled futures may be double-counted but overall very close to the real churn rates and possibly slightly overstated.

		Source of data		
Market	Abrv.	Churn	Trading volume	demand
Germany	DE	2012 Prospex 2011 n.a. 2011 n.a.	2012 n.a. 2011 prospex 2010 prospex	2012 n.a. 2011 CEER 2010 CEER
France	FR	2012 Prospex 2011 n.a. 2011 n.a.	2012 n.a. 2011 prospex 2010 prospex	2012 n.a. 2011 CEER 2010 CEER
Nordic	NRD	2012 Prospex 2011 n.a. 2011 n.a.	2012 n.a. 2011 prospex 2010 prospex	2012 n.a. 2011 CEER 2010 CEER
Italy	IT	2012 Prospex 2011 n.a. 2011 n.a.	2012 n.a. 2011 prospex 2010 prospex	2012 n.a. 2011 CEER 2010 CEER
Great Britain	GB	2012 Prospex 2011 n.a. 2011 n.a.	2012 n.a. 2011 prospex 2010 prospex	2012 n.a. 2011 CEER 2010 CEER
Spain	ES	2012 Prospex 2011 n.a. 2011 n.a.	2012 n.a. 2011 prospex 2010 prospex	2012 n.a. 2011 CEER 2010 CEER
Poland	PL	n.a.	CEER	CEER
Netherlands	NL	2012 Prospex	2012 n.a.	2012 n.a.

[26] European Power Trading 2013, chart 41
[27] European Power Trading 2013, table 14.
[28] For the Czech Republic the traded volume includes bilateral trades.

		2011 n.a. 2011 n.a.	2011 prospex 2010 prospex	2011 CEER 2010 CEER
Belgium	BE	n.a.	CEER	CEER
Czech Republic	CZ	n.a.	CEER	CEER
Hungary	HU	n.a.	CEER	CEER
Denmark	DK	n.a.	CEER	CEER

Table 1: Overview of data employed for calculation of churn rates

Annex II: Summary of the responses to the Public Consultation

1) How appropriate do you consider the measure of redefining zones compared to other measures, such as, continued or possibly increased application of redispatching actions or increased investment in transmission infrastructure to deal with congestion management and/or loop flows related issues? What is the trade-off between these choices and how should the costs attached to each (e.g. redispatching costs) be distributed and recovered?

According to the majority of respondents (market players and their associations, market operators and their associations), investments in transmission infrastructure is the long-lasting solution to deal with loop flows and congestion management. In addition, coordination between TSOs should be enforced and, in particular, flow based capacity calculation and redispatching (also cross border redispatching) measures are considered more efficient than the redefinition of bidding zones. Redispatching costs should be shared between TSOs and recovered through grid tariffs. In general, costs of redispatching and procurement methodologies lack in transparency.

The minority of respondents (grid operator and association of market players) argue that redefinition of bidding zones should be considered in parallel to redispatching measures and grid investments. Bidding zones lead to a feasible dispatch while redispatching is considered not efficient (if available). Cost sharing should reflect the polluter pays principle.

The respondents did not provide any quantitative justifications.

2) Do you perceive the existing bidding zone configuration to be efficient with respect to overall market efficiency (efficient dispatch of generation and load, liquidity, market power, redispatching costs, etc.) or do you consider that the bidding zone configuration can be improved? Which advantages or disadvantages do you see in having bidding zones of similar size or different size?

According to the majority of the respondents (market players and their associations, market operators and their associations), current bidding zones should gradually be merged. The current configuration may be considered appropriate from a political perspective even if some small zones should be merged to benefit from greater liquidity. The review process should not underestimate the jurisdictional issue (e.g. one bidding zone overlapping more than one TSO control area). Efficiency of the current configuration is hard to define. Comparison between alternative bidding zone configuration is not possible because of the lack of information on redispatching volumes and costs. Transition costs should not be underestimated. It is not obvious whether bidding zones should be of similar size or not.

The minority of respondents (grid operator and association of market players) argue that large zones may be not sustainable as far as they do not represent the limits of the transmission network. Structural bottlenecks are the drivers to define alternative configurations. Transparency of internal and cross border redispatching and countertrading costs to relieve congestions shall be part of ENTSOE technical report.

3) Do you deem that the current bidding zone configuration allows for an optimal use of existing transmission infrastructure or do you think that existing transmission infrastructure could be used more efficiently and how? Additionally, do you think that the configuration of bidding zones influences the effectiveness of flow-based capacity calculation and allocation?

Most respondents believe that bidding zone configuration is not too relevant for an optimal use of the infrastructure. However, most of them believe that this will be better achieved by implementing FBMC. Indeed, they think that FBMC is still in a learning stage and that a highly detailed flow-based capacity calculation will contribute to a more efficient use of infrastructure. In addition, some other factors are considered as essential to improve efficiency. In particular, most respondents stressed the need to improve the level of transparency concerning TSOs' practices, e.g. when reporting on remedial actions (redispatching, countertrading, etc.). Other important elements are reliability margins and the impact of internal -within zones- congestions on cross-border capacity made available to the market.

In general, most respondents think that the existing bidding zone configuration should not negatively affect the effectiveness of FBMC, or at least that it is too early (still in a learning stage) to reach that conclusion.

Only a few respondents stressed the importance of bidding zone configuration for an efficient use of the infrastructure, by means of a better allocation of congestions costs.

4) How are you impacted by the current structure of bidding zones, especially in terms of potential discrimination (e.g. between internal and cross-zonal exchanges, among different categories of market participants, among market participants in different member states, etc.)? In particular, does the bidding zone configuration limit cross-border capacity to be offered for allocation? Does this have an impact on you?

Most respondents believe that bidding zone configuration does not cause any discrimination among market participants. Some stakeholders believe that discrimination may occur when cross-border capacity is limited by not managing congestion where it occurs, i.e. “moving it to the border”. Only one stakeholder does see problems caused by bidding zone configuration, in particular in the neighbouring areas of the German-Austria bidding zone. Those problems relate to reduction of cross-zonal capacities, discrimination between producers and the need of additional reserves for unpredictable flows. Another stakeholder thinks that the ENTSO-E Technical Report is crucial to determine potential discrimination between “TSO’s internal customers and cross-zonal customers as current congestion management practices are currently hidden”. Finally, some stakeholders commented on the discriminatory effects of smaller bidding zones due to its negative impact on market liquidity and the isolation effect of some market participants.

Regarding the impact of bidding zone configuration on cross-border capacity, the answers are similarly split. Most respondents think that cross-border capacity is affected primarily by lack of infrastructure, insufficient TSO coordination or absence of transparency in capacity calculation rather than by the configuration of bidding zones. One stakeholder believes that the unlimited internal capacity within Germany-Austria leads to reduction of cross-zonal capacities in the remaining borders.

5) Would a reconfiguration of bidding zones in the presence of EU-wide market coupling significantly influence the liquidity within the day-ahead and intraday market and in which way? What would be the impact on forward market liquidity and what are the available options to ensure or achieve liquidity in the forward market?

The responses to the consultation – mainly from market participants - do overall underline the importance of liquidity, size of forward markets, and the consistency of the geographical dimension of the forward market with the day-ahead and intraday market. It is argued that smaller zones tend to reduce the number of market parties in forward markets and thus the liquidity and competition.

A reduced number of market parties and thus reduced liquidity in smaller bidding zones has, from the market parties’ view, consequences as it will reduce the depth of the forward markets. This in turn increases bid/ask spreads and reduces the possibilities for generators and consumers to hedge their positions efficiently.

On the other hand some respondents (e.g. from Scandinavia) note that a configuration with smaller zones would tend to shift trading volumes towards the day-ahead markets provided that these are coupled via implicit auctions and that hedging is possible with proper instruments such as CfDs.

Consultation participants also frequently point to the transition costs of a reconfiguration process and the impact on on-going market integration processes.

Some respondents underline that liquidity comes from both trade within the zone as well as from cross-border trade, so the lowered liquidity in the smaller zones may be compensated by cross-border trade with implicit auctions.

6) Are there sufficient possibilities to hedge electricity prices in the long term in the bidding zones you are active in? If not, what changes would be needed to ensure sufficient hedging opportunities? Are the transaction costs related to hedging significant or too high and how could they be reduced?

Examples given for areas with sufficient liquidity are the German-Austrian zone, the Netherlands and UK. Spain was quoted as an area with limited or too small liquidity.

The majority of respondents highlight the link between hedging possibilities and liquidity of the market and bidding zones stability over the time. The best hedging possibilities are attributed to the zones with highest liquidity (currently Germany-Austria-Luxembourg), covering the period of up to two three years. It is noted that even though the hedging possibilities in Nordic market relating to system price are sufficient (high liquidity of instrument), the CfD themselves are not liquid enough as they refer to the liquidity in the price zones.

7) Do you think that the current bidding zone configuration provides adequate price signals for investment in transmission and generation/consumption? Can you provide any concrete example or experience where price signals were/are inappropriate/appropriate for investment?

Almost half of the comments received during the consultation consider that the current bidding zone configuration gives adequate signals for investment in transmission infrastructure. Other stakeholders highlight that redispatching costs can also give economic signals to boost grid investment.

However, several stakeholders do not consider bidding zone configuration as a good economic signal for grid investment. According to comments of the respondents the regulatory framework, hidden congestion cost, long permitting processes also influence decisions to invest in new grid infrastructure. A few comments suggest that keeping or increasing the level of congestion rent even gives negative incentive for TSOs to invest into cross-border transmission capacities.

Some stakeholders highlighted that reductions of capacity on certain interconnectors by moving congestions to borders is a market interference that creates distorted price signals and inappropriate investment signals.

In the view of several stakeholders some flows in CEE region are preferentially treated and not subject to market allocation. These flows are not internalized in the current electricity market, so the current price signals might not fully reflect real needs. There are no incentives for the countries which are causing unplanned power flows to invest in internal transmission lines.

The large majority of respondents think that problems caused by current bidding zone configuration could be solved by investment in transmission capacities.

Changing the configuration of bidding zones can modify the existing balance of generation/consumption creating surplus and deficit areas (zones) that might give unnecessary or perverse incentives in generation/load capacity.

According to stakeholder views renewables support schemes, heat demand for CHP, reliable forward prices, locational signals like local grid tariffs or balancing/redispatching costs, subsidies and long permitting processes can distort or heavily modify the price signals and give distorted incentives for investors.

Some stakeholders also emphasize that the reliability and stability of the bidding zones are very important for long terms investments like investment into generation or transmission capacity. Dynamic zones or continuous reconfiguration of zones could be an obstacle of new investments.

Small bidding zones increase investment risks compared to larger ones which means splitting zones could lead to deter incentives for investors.

8) Is market power an important issue in the bidding zones you are active in? If so, how is it reflected and what are the consequences? What would need to be done to mitigate the market power in these zones? Which indicator would you suggest to measure market power taking into account that markets are interconnected[29]?

All Respondents active in the German/Austrian market in general indicate that there is not an issue with market power within this bidding zone and that the report by the German Competition Authority shows that market concentration and thus the possibility to abuse market power has significantly declined between 2007-2008 and 2012.

Respondents active in the Nordic Power market indicate that the Nordic power market is a well-functioning and competitive market in which market power currently is not an issue and that due to integration of spot and balancing markets competition is promoted irrespective of the size of bidding zones.

Respondents active in several other power markets indicate that market power is sometimes an issue. This is caused mainly due to insufficient transmission capacity inside the country and it is thus related to locational market power. Other respondents indicate that market power is currently not an issue.

On the question what would be needed to mitigate market power in those zones where it is an issue:

- In general most responses related to the fact that a larger bidding zones would result in lower market concentration and less market power and that splitting a zone would do the opposite. A larger zone would reduce the opportunity to abuse of a dominant position. Others highlighted that market power is not related to the size of the bidding zone.
- Some respondents highlighted that when configuring the bidding zones the regulators would have to focus on the market power issue to avoid new bidding zones that can facilitate market abuse.
- In order to limit the effects of market power, respondents answered that higher available volumes of interconnector capacities to neighbouring bidding zones would reduce market power by increasing the Generation Capacity in the local Market and that the wide use of bidding areas as congestion management has moved more quantities into the day-ahead market, thus increasing the transparency in the price formation. Other respondents highlighted also that it is very disputable to think that smaller bidding zones will have beneficial effects in terms of volumes of transmission capacity being offered by TSOs due to other externalities such as uncertainty about RES-production.
- With regard to measures to mitigate market power respondents highlighted that if market power does exist, specific and targeted regulatory measures to mitigate the impact of that market power may be more effective at addressing the problem than redefining bidding zones. Others said that mitigating market power is an issue of transparency and monitoring and that transparency on all costs incurred in congestion management is essential in this respect. Grid reinforcement/development, stability (of bidding areas) and access to liquid hedging are also key to improving market power issues. Several legal instruments al-ready exist for this purpose (e.g. REMIT, transparency guidelines, competition authorities, etc.).

[29] This information would be primarily useful for ENTSO-E when performing the bidding zone review process (Activity 4)

With regards to which indicator would be suggested to measure market power taking into account that markets are interconnected most respondents answered that indicators such as HHI index, PSI and RSI would be preferred to measure levels over market concentration and assess the pivotal position of market participants within a specific market.

Others indicated that no single indicator is sufficient to measure the level of competition and that no new indicator needs to be invented. Others said that indicators should not only focus on spot markets but also on derivative and retail markets.

More general comments related to the fact that a study on these indicators should be within the realm of the regulators or where applicable the competition authority and not with ENTSO-E.

9) As the reporting process (Activity 1 and Activity 2) will be followed by a review of bidding zones (Activity 4), stakeholders are also invited to provide some expectations about this process. Specifically, which parameters and assumptions should ENTSO-E consider in the review of bidding zones when defining scenarios (e.g. generation pattern, electricity prices) or alternative bidding zone configurations? Are there other aspects not explicitly considered in the draft CACM NC that should be taken into account and if so how to quantify their influence in terms of costs and benefits?

Several respondent indicate that TSOs (and very often NRAs, see question 10 below) should take into account the impact of bidding zone configuration on market efficiency and in particular on liquidity, competition, transparency, transaction costs and redispatching costs. Respondents also indicate that future investment decisions in the transmission network (TYNDP) have to be taken into account when reviewing bidding zones and in particular when assessing future network performance, that CBA analysis have to be performed for several market scenarios, that market players should be given enough time to adapt before new bidding zones can be implemented, that bidding zone delimitation is a political issue and that bidding zones should be robust over time. An explicit reference to a study made by Consentec and Frontier economics is also made.

10) In the process for redefining bidding zone configuration, what do you think are the most important factors that NRAs should consider? Do you have any other comments related to the questions raised or considerations provided in this consultation document?

Several respondents showed that parameters (question 9) to be used by ENTSO-E when comparing different bidding zones delimitations correspond to important factors to be considered by NRAs and/or refer to their answer to question 10 (see above). In addition to these comments, respondents refer to the issue of the congruity of balancing zones and bidding zones, the need of an increased transparency of congestion methods applied on some borders and to the need of an optimisation of remedial actions,

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