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Bidding zones delineation in Europe: Lessons from the past & recommendations for the future

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An EFET Position Paper – September 2019

As the organisation representing the interests of over 100 energy trading companies in Europe, the European Federation of Energy Traders (EFET) very closely follows and participates in discussions on the European zonal model for the organisation of electricity markets.

Over the past decade, significant unscheduled flows occurring on the European grid led to mounting debates among experts and decision makers on the delineation of bidding zones. The size and boundaries of bidding zones were changed in certain countries. And the European TSOs and regulators, via ENTSO-E and ACER, engaged in a review of continental bidding zones borders between 2014 and 2018.

The requirements of the Capacity Allocation and Congestion Management Guideline, which were the basis of the first bidding zone review, have now been upgraded to primary legislation, in the recast Electricity Regulation (2019/943). As a result, a new review of bidding zones delineation may be launched soon.

EFET has taken an active role in the first bidding zones review process, and despite this exercise having been inconclusive in the end, we should learn from the many useful lessons from this first review. EFET members are also keen observers of market in all parts of Europe, which allows us to report on market dynamics following actual changes in bidding zone delineation. As the TSOs are due to present a methodology proposal for the next possible reviews in October 2019, the present paper proposes to look at the experience from the past decade on this sensitive subject, and propose recommendations for the reviews to come.

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1. Basic EFET principles relating to bidding zones delineation

European TSOs and regulators are mandated by the Capacity Allocation and Congestion Management Guideline (CACM GL, EU Regulation 2015/1222) and the recast Electricity Regulation (EU Regulation 2019/943 from the Clean Energy Package) to regularly assess the existing delineation of bidding zones, and possibly initiate its review and reconfiguration.

EFET has taken an active role in the first bidding zones review, with a view that alongside the assessment of current and forecasted congestions on the network, proper attention was needed to improve and safeguard the functioning of the internal electricity market. As a matter of principle, bidding zones should be delineated irrespective of current Member States' borders, along the lines of long-standing structural congestions, and taking due account of market efficiency. Once such appropriate boundaries are found, certainty and long-term stability should also govern the configuration of bidding zones.

Structural congestions are the natural borders of bidding zones and the physical reality cannot be ignored. Managing such structural congestions within bidding zones requires continuous remedial actions by the TSOs, which come at a cost for society. Additionally, the locational signal of market prices would become less effective as congestion costs are not included in the market price.

However, competition and liquidity in all market timeframes, within and across bidding zone borders, are also essential for the overall health of the internal power market. Indeed, liquid wholesale markets are indispensable to manage and reduce risks for market participants, and thus to support timely investments in generation, storage and demand response. By lowering risks and thereby risk premiums, liquid wholesale markets bring down financing costs for investments.

Competition in the wholesale and retail markets pushes market participants to be more cost-efficient and provide goods and services at the lowest cost, to the benefit of end consumers. That reality cannot be ignored either, as illiquid and non-competitive markets also come at a cost for society.

As a result, the optimal bidding zones configuration is the result of a fine balance between reducing the number and magnitude of structural congestions while ensuring the health of the market.

A **stable configuration** of bidding zones is necessary to reduce regulatory uncertainty. Changing the boundaries of bidding zones is a risk that cannot be hedged by market participants. A reconfiguration of bidding zones is sometimes unavoidable, but that should not mean making such an exercise a common occurrence. Bidding zone reconfigurations, if not properly timed and assessed, could effectively nullify contracts that have already been concluded and force market participants to re-arrange hedging strategies at short notice, creating unnecessary welfare losses. Furthermore, stable bidding zones contribute to the emergence of reliable price signals and underpin steady conditions of competition between market participants across all timeframes of the market.

Finally, any assessment and possible review of the delineation of bidding zones, even implicating only one zone, must be **transparently organised and objectively implemented**, as all bidding zones in the internal market are impacted by such as decision. A reconfiguration should be based on a balanced assessment of all relevant factors, including competition and liquidity, at a pan-European level.

2. Assessment of the evolution of congestion and market indicators following past bidding zone splits (Sweden, Germany-Austria)

Looking back at the experience of bidding zones reconfigurations, it is important to analyse all the effects such changes may have had on systems and markets. In this section, we focus on two of the most recent bidding zone splits, namely the split of the Swedish zone into four zones in 2011, and the split of the joint German-Austrian-Luxembourg bidding zone into two separate zones (a German-Luxembourg and an Austrian one) in 2018.

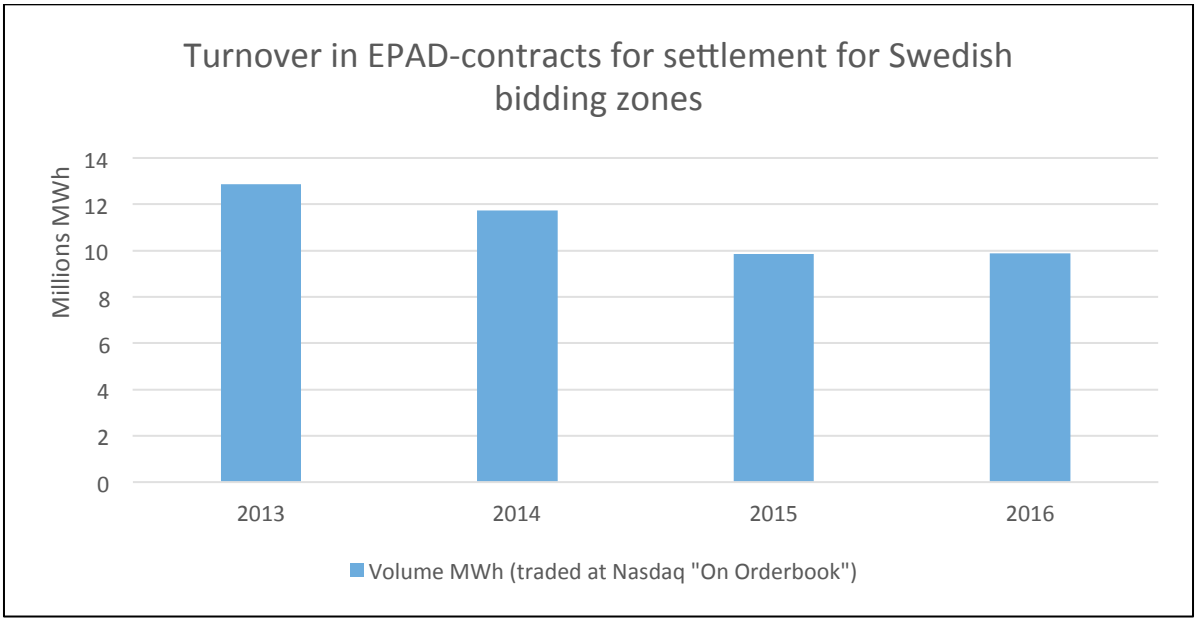
The Swedish bidding zone split

The Swedish model as part of the Nordic system – small bidding zones combined with a system price – is taken as an example to follow by ACER[1], being hailed as solving internal congestion problems with marginal impact on the market.

The split of the Swedish bidding zone into four zones, did indeed result in less restrictions of cross-zonal capacity. Levels of available cross-zonal capacity within Sweden has improved and remained high for a few years now.

At the same time, the 2011 reform in Sweden has been associated with a liquidity loss of the forward market in power[2] – while it increased in all other European markets. As mentioned before, lower liquidity on forward markets increases the price of hedging portfolios (of assets and clients) for market participants, a cost ultimately borne by consumers.

The liquidity of the market in contracts for difference (the Electricity Price Area Differentials or EPADs) used to hedge forward positions against the system price in the Swedish bidding zones dropped as well. This further increased the price of hedging positions for market participants in Sweden, this time across bidding zones.



Source: Energimarknadsinspektionen (Swedish Energy Markets Inspectorate) Evaluation of hedging possibilities in the Swedish electricity market – for consultation according to FCA GL, Annex 1.

[1] See points 121-126 of ACER Opinion 09/2015 of 23 September 2015, available at: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Opinions/Opinions/ACER%20Opinion%2009-2015.pdf

[2] As a dedicated study published by Energimarknadsinspektionen (Swedish Energy Markets Inspectorate) attests in *Annex 1. Evaluation of hedging possibilities in the Swedish electricity market – for consultation according to FCA GL*; available at: https://www.ei.se/Documents/Projekt/Natkoder/FCA/FCA_evaluation_Annex_1.pdf, last page *B1. Statement from SKM regarding the functioning of the bilateral EPAD-market* [in Swedish].

On the side of network congestions, a 2013 report of the Swedish regulator[3] showed that price convergence between the different Swedish zones was very high, especially in the case of SE1, SE2 and SE3. Price convergence on the market indicates the absence of congestion on the network:

Zones/group of zones	Percentage of market time units with price convergence over the 2011-2013 period	Percentage of market time units with price convergence in 2013
SVERIGE	86,4%	92,5%
SE1 och SE2	99,0%	100,0%
SE2 och SE3	96,2%	97,4%
SE3 och SE4	90,2%	94,7%
SE1, SE2 och SE3	95,2%	97,4%
SE2, SE3 och SE4	87,3%	92,5%

Source: Energimarknadsinspektionen and Nord Pool

A THEMA report on the Nordic Bidding Zones commissioned by the Swedish Ministry of Enterprise, Energy and Communications and The Nordic Council of Ministers[4] also dated 2013 even recommended that "***based on the frequency and magnitude of price differences, the most obvious candidates for merger are SE1, SE2 and SE3****, NO3 and NO4 plus NO1 and NO3, and all the northern bidding zones SE1-SE3 and NO3-NO4."*

Despite the negative effects of the 2011 bidding zone split on forward market liquidity and indications of the limited number of market time units where congestions actually occur between the different Swedish zones, there has been no assessment of the welfare benefits or losses of the split, nor any consideration whether a re-merger of at least SE1, SE2 and SE3 would be appropriate.

In summary, the experience of the Swedish bidding zones split shows the potential danger of overweighing the costs of redispatching and/or countertrading without balancing them with the advantages of competition and liquidity[5].

[3] Utvärdering av effekterna av elområdesindelningen, Ei R2014:08, dated March 2014 and available at: https://www.ei.se/Documents/Publikationer/rapporter_och_pm/Rapporter%202014/Ei_R2014_08.pdf.
[4] Nordic bidding zones, a THEMA report, dated October 2013 and available at: https://www.thema.no/wp-content/uploads/2013/10/THEMA-report-2013-27-Nordic_Bidding_Zones_FINAL.pdf.
[5] For more information, see the EFET memo *A reality check on the market impact of splitting bidding zones*, dated June 2016 and available at: https://efet.org/Files/Documents/Electricity%20Market/General%20market%20design%20and%20governance/EFET-memo_Swedish-zones-reform.pdf.

The German-Austrian bidding zone split

On 1 October 2018, the combined German-Austrian-Luxembourg bidding zone was split into two separate bidding zones (a German-Luxembourg and an Austrian one). This decision was made by the German regulator in 2016 in the wake of a decision by ACER on the delineation of Capacity Calculation Regions that foresaw a new bidding zone border between Germany and Austria.

Interestingly, the split of the German-Austrian-Luxembourg zone was also analysed as part of the first bidding zone review initiated by ACER and ENTSO-E according to articles 32 to 34 of the CACM GL. The ENTSO-E analysis of the German-Austrian split considered a number of market efficiency criteria on a qualitative basis (see table below), and compared them with a quantitative analysis of network congestions. In the end, ENTSO-E considered they did not have sufficient elements to justify a recommendation to split the German-Austrian bidding zone (or any of the other scenarios that they analysed)[6].

Bidding Zone Configuration (evaluation compared to current bidding zone configuration)	DE/AT Split	Big Country Split	Big Country Split 2	Small Country Merge
Network security				
Operational security	(+)	(+)	(+)	(-)
Security of Supply (for the entire system, **short-term perspective only**)	(0)	(0)	(0)	(0)
Degree of uncertainty in cross–zonal capacity calculation	(0)	(0)	(0)	(0)
Market efficiency				
Economic efficiency	(0)	(0)	(0)	(0)
Firmness costs[a]	(-)	(-)	(-)	(+)
Market liquidity	(-)	(-)	(-)	(+)
Market concentration and market power	(-)	(-)	(-)	(+)
Effective competition	(0)	(0)	(0)	(0)
Price signals for building infrastructure	(0/+)[b]	(0/+)[b]	(0/+)[b]	(0/-)[b]
Accuracy and robustness of price signals	(0)	(0)	(0)	(0)
Long-term hedging	(-)[c]	(-)[c]	(-)[c]	(+)[c]
Transition and transaction costs	(-)	(-)	(-)	(-)
Infrastructure costs	Reference to investment costs as published in the TYNDP 2016			
Market outcome in comparison to corrective measures	(+)[d]	(+)[d]	(+)[d]	(-)[d]
Adverse effects of internal transactions on other bidding zones	(+)[e]	(+)[e]	(+)[e]	(-)[e]
Impact on the operation and efficiency of the balancing mechanisms and imbalance settlement processes	(0/-)	(-)	(-)	(0/-)
Stability and robustness of bidding zones				
Stability and robustness of bidding zones over time	(0)	(-)[f]	(-)[f]	(0)
Consistency across capacity calculation time frames	(0)	(0)	(0)	(0)
Assignment of generation and load units to bidding zones	(0)	(-)	(-)	(0)
Location and frequency of congestion (market and grid)	(+)	(+)	(+)	(-)

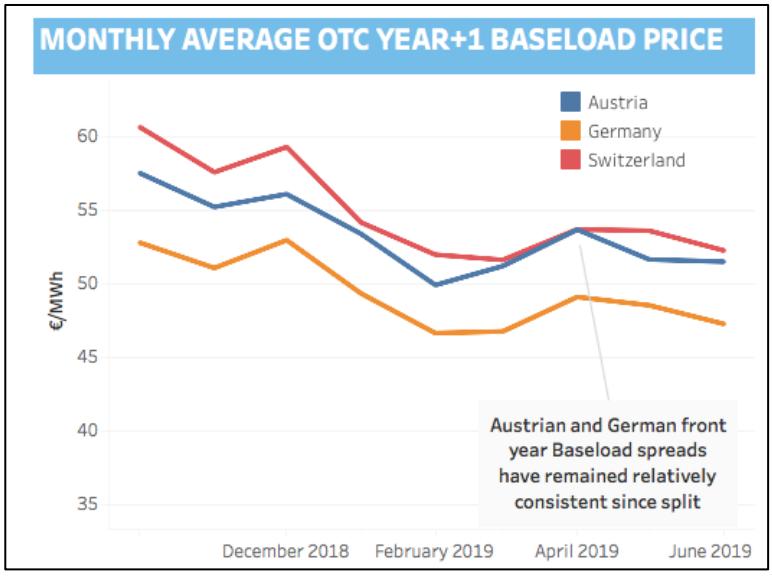
Source: Final ENTSO-E report on the first edition of the biding zones review.

[6] First edition of the biding zones review, ENTSO-E, dated October 2018 and available at: https://docstore.entsoe.eu/Documents/News/bz-review/201803_First_Edition_of_the_Bidding_Zone_Review.pdf

The objective of the split was to reduce so-called unscheduled flows from Germany, chiefly through Poland and the Czech Republic. So far the achievement of this objective does not transpire in the level of available cross-zonal capacity at the concerned borders. More information on this point would help market participants and decision makers to fully assess the efficiency of the measure.

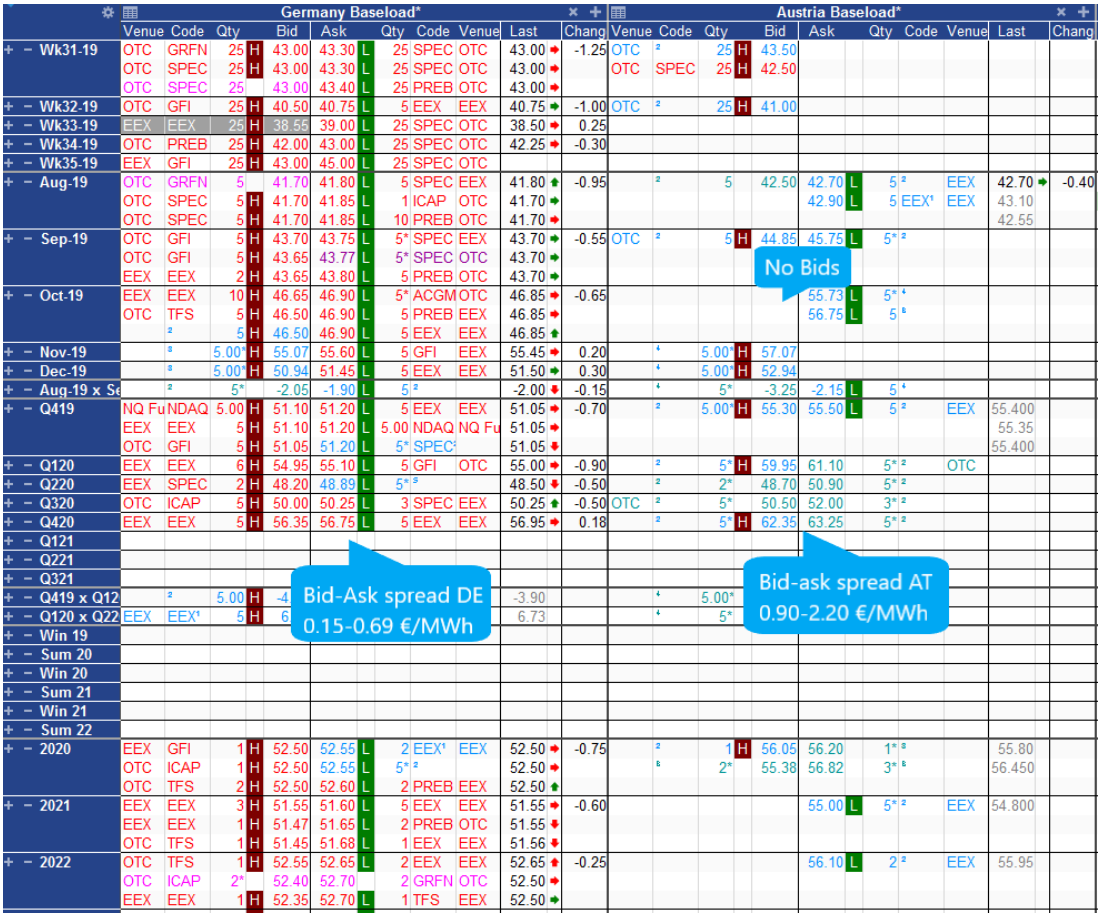
While its potential positive effects on network management and cross-zonal capacity availability have not yet been analysed, the negative impact of the split on the former German-Austrian market were largely ignored by the authors of the decision. All the elements shown below result in increased costs of hedging positions for market participants, within Austria and across the new border. These costs are part of the energy component of the end-consumer's electricity bill.

Hedging positions on the Austrian forward market has shown a steady 5 to 10 EUR/MWh spread on base-load year-ahead products between the two markets that used to have a common price before.



Source: ICIS

In Austria, poor market liquidity led to significant bid-ask spreads – when bids are actually present at all. The snapshot below shows the poor state of liquidity in the Austrian OTC market almost a year after the split.



Source: Screenshot from the Trayport platform for forward OTC transactions, inserts by EFET.

From a timing perspective, the announcement of the split was published **with a two-year lead-time** (on 28 October 2016, effective 1 October 2018), short of the three years EFET considers the minimum lead-time needed to ensure no open interests are affected by a split. Furthermore, the methodology of the splitting was not published until very late in the process[7], some fundamental market design features remaining unknown until three months before the split. This lead market participants scrambling to re-arrange their hedging strategies at very short notice. Market participants' trading activities were left exposed until far too late to the effects of the re-delineation.

While it is yet too early to assess all the effects of the German-Austrian-Luxembourg bidding zone split, we can already deplore that the decision to split was made without properly assessing its effects on system and market efficiency, and without sufficient lead-time[8].

[7] EFET statement on the implementation of the BNetzA decision requesting TSOs to allocate cross-border transmission capacity at the German-Austrian border, dated 11 May 2017 and available at: https://efet.org/Files/Documents/Downloads/EFET_Implementation-DE-AT-BZ-split_11052017.pdf

[8] For more information, see the EFET press release *The implementation of the German-Austrian bidding zone split should be transparent and not before 1 January 2019*, dated 12 May 2017 and available at: https://efet.org/Files/Documents/Press/Statements/EFET-PR110_De-AT-bidding-zone-split.pdf.

3. Analysis of the new article 14 and 15 of the recast Electricity Regulation

The recently approved recast Electricity Regulation 2019/943 gives the legal framework for a possible bidding zone review. Articles 14 and 15 provide the details of this process. There are several routes that can be taken in order to amend the bidding zones, with the shortest duration in which a bidding zone reconfiguration can take place is 6 months. We present in an annex our understanding of the different routes leading to potential reviews and reconfigurations of bidding zones.

Initiated via article 14.3 of the recast Electricity Regulation, a bidding zone review will be carried out regardless, by "*relevant Member States, transmission system operators or regulatory authorities are [of] those Member States, transmission system operators or regulatory authorities*" (Art. 14.4). According to this plan, between 24 and 39 months after the entry into force of the Regulation, a bidding zone reconfiguration could take place.

In the three months following the entry into force of the Regulation, i.e. by 3 October 2019, the TSOs will have to submit a methodology proposal for the review, including an analysis of different configurations. The final part of this paper presents a series of methodological recommendations for the next review.

4. Lessons from the first edition of the bidding zones review and recommendations for the next review

EFET has actively contributed to the first edition of the bidding zones review, and we are ready to offer our expertise for the next edition. We expect the review process to be transparent, with appropriate timing and lead-time, and taking account of network congestions and market efficiency on an equal footing.

The analysis of system efficiency

For the analysis of congestions, the first review relied on a mix of expert-based scenarios – looking at how to split or merge bidding zones, respecting national borders – and model-based scenarios – looking at how to form bidding zones from the ground up using nodal prices. Problems with data input and modelling led ENTSO-E to abandon the model-based scenarios, even though this approach may have represented the most optimal way to delineate bidding zones once crossed with market efficiency data. We believe it would be a mistake to abandon this avenue in the next bidding zones review for the sake of political realism. While we understand

the political difficultly that a recommendation to delineate bidding zones borders without regard for Member States borders may face at a regulatory and political level, we believe it is not the role of ENTSO-E to care for such concerns. Rather, ENTSO-E should deliver a technical analysis with hopefully a strong recommendation for a bidding zones delineation expected to maximise welfare at European level.

For the next review, we recommend going back to the drawing board on the model-based scenarios and making sure that the results from the future clustering exercise, even re-processed and as politically sensitive as they may appear, be analysed according to the welfare maximisation metric like any expert-based scenario.

Modelling the effect of alternative bidding zones delineations also proved one of the major pitfalls of the first edition of the review. The request of NRAs to model flow-based market coupling results proved particularly unhelpful as it dramatically increased the complexity of the analysis while focusing it on the day-ahead timeframe and foregoing the forward, intraday and balancing markets. Modelling was further hindered by the unavailability of the common grid model, differences in the TSOs' current treatment of the various levels of voltage on their network, and the unavailability of transaction data from REMIT.

For the next review, we suggest simplifying the modelling of the effect of alternative bidding zones delineations on the management of networks as well as the functioning of markets. Modelling flow-based in the future also has its significant share of uncertainties (beyond the fact that it solely focuses on DA markets). A reasonably representative modelling of network management and market functioning would simplify the analysis and be more helpful.

The analysis of market efficiency

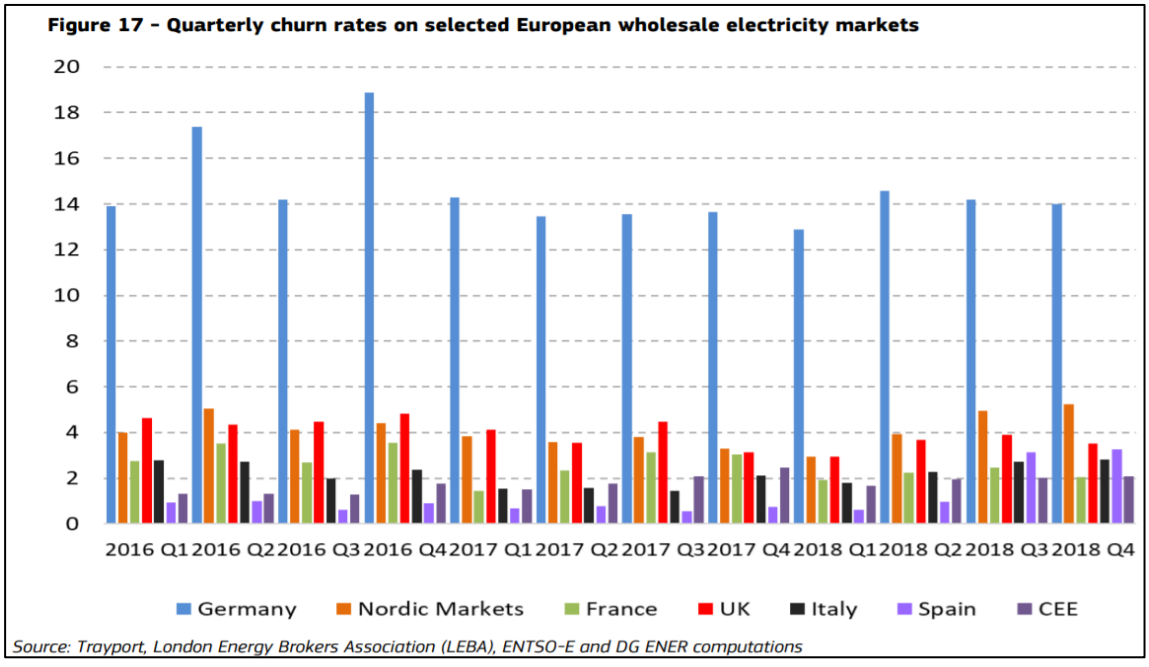
During the first edition of the review, the analysis of the market efficiency of different bidding zones reconfigurations rapidly became a problem. Even after consulting market participants on possible qualitative indicators, ENTSO-E took the decision to limit its assessment of market efficiency to a qualitative analysis.

Any review of bidding zones ought to include a serious and thorough quantitative analysis of market efficiency in different bidding zone configuration scenarios. We insist the analysis of efficiency must extend to study of ***liquidity*** *and* ***competition*** *effects of any re-delineation of bidding zones, alongside the physical elements needed to keep the grid stable. For this purpose, we suggest a list of principles and proposed indicators.*

Liquidity indicators

In a **liquid market**, any amount of energy (coal, gas, power, carbon, oil, etc.) can be bought or sold at any time, for any delivery period, without causing a significant movement in the energy price. Liquid markets allow market participants to manage their market risk in an efficient manner. This in turn increases market efficiency by increasing the ease and security of transacting, and, arguably, the robustness of price signals. In the context of the bidding zone review, churn rate, bid-offer spread, market depth and traded volumes are vital measures:

- **Churn rate:** the number of times electricity is traded before it is consumed. The most liquid electricity market in Europe, Germany, has a churn rate of around 12 for forward markets. This level is considered acceptable, while markets with a churn rate below 4 or 5, i.e. most other European markets, are considered illiquid. The chart below presents the churn rates on selected wholesale electricity markets (exchange-based and OTC markets, spot and futures).

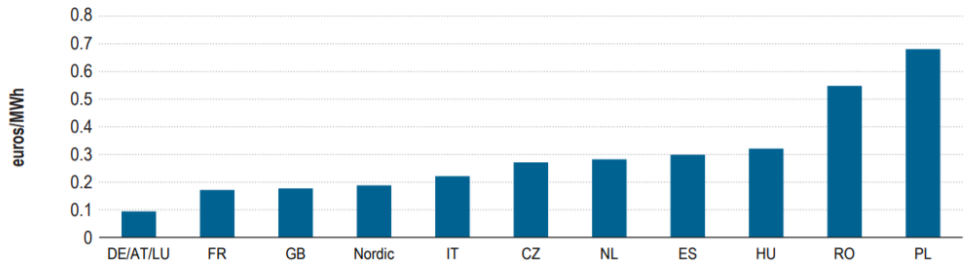


Source: DG ENER, Electricity market reports, Q4 2018; p.18

- **Bid-offer spread**: bid-offer (or bid-ask) spreads represent the cost of getting into or out of a position in the market. The ACER Report notes that "*transaction costs (which are related to the bid-ask spread size) incurred by market participants tend to be lower in bigger markets (when market 'size' is considered to be equivalent to traded volumes)*". In a liquid market, bid-offer spreads should be fairly small in relation to the market price, the lowest in Europe being currently in Germany at 0.1 €/MWh in forward markets.

To understand the importance of this indicator, an increase in the bid-ask spread in Germany of 0,1 EUR/MWh means an additional cost of hedging of EUR 450 million for market participants (based on 2016 forward volumes, all things equal).

Figure 21: Average bid-ask spreads (yearly product, 2019 delivery) in European forward markets – (euros/MWh)



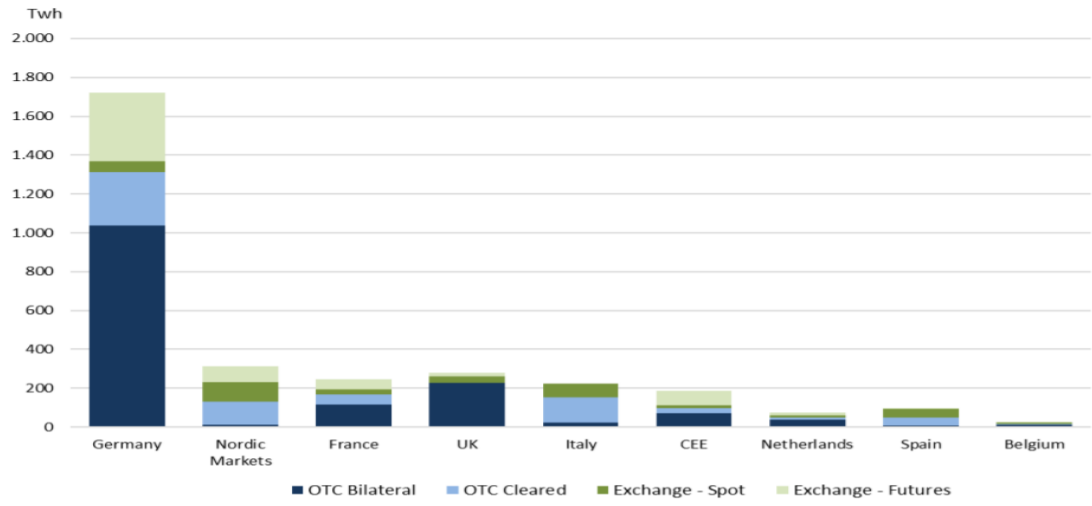
Source: ICIS (2018).
Note: The bid-ask spreads are averaged out throughout the period from July 2017 to June 2018. For Great Britain, the half-yearly (winter and summer 2019) products were used.

Source: ACER annual report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2017 – Electricity Wholesale Markets Volume; p.49

- **Market depth:** the extent to which a market can absorb transaction volumes without having a major impact on the price. Higher market depth shows confidence in the market and reflects the accuracy of the price signals. Such an indicator shows the price sensitivity of each extra MWh purchased.

- **Transaction volumes:** The volumes of MWh traded are an indicator of market liquidity, and with the implementation of REMIT, data is available not only for exchange-based transactions, but also OTC (brokered and bilateral) transactions. The graph below shows a comparison of traded electricity volumes – exchange-based and OTC – in various European countries/regions.

Figure 16 – Comparison of electricity traded volumes in some important day-ahead, forward and OTC markets, fourth quarter of 2018



Source: S&P Global Platts, wholesale power markets, Trayport, London Energy Brokers Association (LEBA) and DG ENER computations

Source: DG ENER, Electricity market reports, Q4 2018; p.17

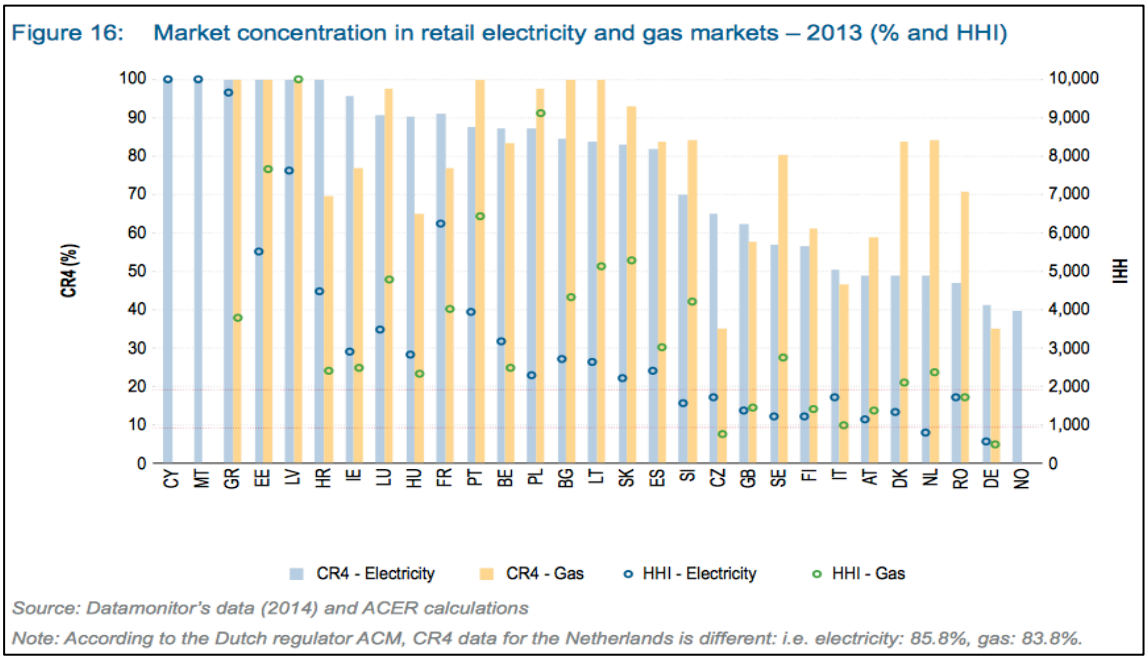
Competition indicators

Well-defined bidding zones should foster **competition in all segments of the market**, *i.e.* in all timeframes of the wholesale market (including across borders), and on the retail market. Here are indicators to assess the degree of competition:

- **Market entry/exit activity**: entry/exit activity shows how easily market participants can take the decision to enter or exit a market based on commercial consideration, and if regulatory and administrative barriers are reasonably low. Note that this indicator is imperfect for comparisons, as newly liberalised markets tend to have a temporarily high entry/exit activity that does not fairly represent the current level of competition in those markets. Nonetheless, it can be a good indicator for its evolution in the future. We regret to see that ACER discontinued this indicator, well analysed in MMR 2015 for example, in recent years.

- **Market concentration:** market concentration indicates the market share of each market participant in a given market (most widely used is the Herfindahl–Hirschman Index, or HHI). In comparison with the previous indicator, it allows not only to see how many market participants there are on a market and how diverse they are, but also how influential they can be. This indicator is mainly applied in antitrust and competition law and mentioned in a study commissioned by ACER measuring the competitiveness of European electricity and gas markets[9].

Figure 16: Market concentration in retail electricity and gas markets – 2013 (% and HHI)



Source: Datamonitor's data (2014) and ACER calculations

Note: According to the Dutch regulator ACM, CR4 data for the Netherlands is different: i.e. electricity: 85.8%, gas: 83.8%.

Source: ACER

[9] IPA Advisory Limited, Ranking the Competitiveness of Retail Electricity and Gas Markets: A proposed methodology, Final Report to ACER, dated 2015 and available at: http://www.acer.europa.eu/en/electricity/market%20monitoring/documents_public/ipa%20final%20report.pdf

- **Number of retail suppliers:** the number of retail suppliers is also a sign of the health of a market. While the development of the retail markets depends on many variables, a high number of retail suppliers shows amongst others how easy it is for suppliers – independent from power generation businesses – to secure energy at an affordable price on the local wholesale market.

Total number of electricity retailers to final consumers, 2003-2017

	2003	2010	2017
Belgium	45	37	60
Bulgaria	8	36	57
Czechia	365	324	399
Denmark	113	33	39
Germany	940	>1 000	1404
Estonia	42	41	46
Ireland	6	8	12
Greece	5	11	19
Spain(')	375	202	291
France	166	177	185
Croatia	1	3	9
Italy	390	268	638
Cyprus	1	1	1
Latvia	1	4	26
Lithuania	8	15	22
Luxembourg	11	11	10
Hungary	12	38	42
Malta	1	1	1
Netherlands	42	36	48
Austria	160	129	171
Poland	175	146	190
Portugal	5	10	27
Romania	8	56	105
Slovenia	8	16	21
Slovakia	18	77	71
Finland	>100	>100	~100
Sweden	127	134	171
United Kingdom	24	22	47
Norway	223	184	197
Montenegro	:	:	5
North Macedonia	1	3	19
Serbia	:	:	19
Turkey	5	466	216
Bosnia and Herzegovina	:	:	26
Kosovo*	:	:	3
Moldova	:	:	4

: data not available
(*) This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo Declaration of Independence.
Detailed table (2003-2017) available in 'Source data for tables and graphs'

Source: Eurostat

A neutral approach to bidding zones delineation

Our third area for lessons learnt and recommendations concerns the overall approach of the review. The first review's different scenarios showed a clear bias towards splitting rather than merging options.

For the next review, we strongly suggest reviewing bidding zones configuration from a neutral perspective, i.e. being open not only to splitting them, but also to maintaining or merging existing bidding zones as well as a combination of splitting and merging. This means:

- **Not pre-judging that congestions and loop flows inherently induce welfare losses without assessing their actual cost on the one hand, and the market benefits of the zone they stem from on the other hand**: physical loop flows and transit flows are an integral part of any zonal model. For example, depending on the bidding zones configuration, the same physical loop flows and transit flows could either become "*loop flows*", "*transit flows*", "*internal flows*" or "*import/export flows*". As such, loop flows and transit flows cannot be considered as "good" or "bad", but just need to be managed and have no preferential treatment. From a welfare perspective, loop flows should be accepted until the cost of their management is higher than the welfare gain associated with more cross-border capacity for cross-border trade. The question is how TSOs coordinate in order to manage loop flows, and ensure economically efficient decision-making. The sole measurement of loop flows and their associated costs does not demonstrate a welfare loss as such and should not be presented in this manner.
- **Not pre-judging that certain market models that work in specific environments can be a solution for the whole of Europe**: leaving aside our observations on the negative effects on market efficiency of the 2011 bidding zone split in Sweden, we harbour deep concerns with the premise that a Nordic-style arrangement of small zones plus exchange-determined system price could just be superimposed on continental Europe, without serious market disruption. The idea to implement a Nordic-style system price schemes in other regions to cope with decreasing levels of liquidity and competition following a bidding zone split fails to recognise that this market design feature is not desired by market participants in other regions; implies the abolition of bidding zone-to-bidding zone hedging opportunities currently available to market participants; and does not provide sufficient hedging tools as the liquidity on the hub is too small.
- **Not casting away inconvenient observations during the review that would go against a "small bidding zones"-centric approach**: for example, the "First edition of the biding zones review"[10] showed some non-intuitive results that were given little consideration at a later stage (p.120): "*A decrease in the number of bidding zones (as in the case of a merge of bidding zones) should increase (or, at least, should not decrease) the number of congestions expected in the system, since generation is restricted in more zones by the market. Yet, this is not the case for the obtained results, where the 'Small Country Merge' configurations [merging the Belgian and Dutch bidding zones] show lower congestions/better performances than the 'Status Quo'.*" The benefits of merging two or more smaller bidding zones into one, or indeed merging one or two smaller bidding zones with part of a larger one, should be considered with the same open mind as that of splitting a bidding zone into two or more smaller zones.

[10] First edition of the biding zones review, ENTSO-E, 2018, available at: https://docstore.entsoe.eu/Documents/News/bz-review/2018-03_First_Edition_of_the_Bidding_Zone_Review.pdf

In summary, we recommend particular attention to the following:

- The zonal model induces a compromise between network management efficiency and market functioning efficiency. **Any assessment of existing bidding zones delineation and possible review of their boundaries should be based on an equally thorough analysis of network congestions and market efficiency**.

- While managing congestions via remedial actions comes at a cost, **redispatch costs do not constitute a welfare loss as such**. Likewise, greater market efficiency brings benefits but **improved liquidity and competition does not constitute a welfare gain as such**. It is the inter-dependence of the two, and their quantitative comparison that can only determine the welfare gain or loss of a certain bidding zones configuration. Hence **both network congestions and market efficiency ought to be properly quantified to ensure trust in the results of any future bidding zones review**.

- **When assessing market efficiency, all segments of the markets should be scrutinised**. In particular, the efficiency of **forward markets** should not be forgotten as they still represent over two third of transactions on the European electricity markets. Effects of bidding zone reconfigurations on **retail markets** should also be analysed as they suffer when the liquidity of wholesale markets reduces. A proper **quantitative analysis of liquidity and competition** on all segments of the market should be carried out, making use of robust indicators already employed for market monitoring purposes.

- If the analysis of network congestions and market efficiency uncovered a welfare loss, various options should be assessed to remedy this situation. The **transition costs linked to the redelineation itself of bidding zones should not be underestimated and properly considered**. Hence, priority must be given to solutions with limited impact on the market, such as improved TSO-TSO (and TSO-DSO) cooperation, (cross-border) redispatch and cost-sharing arrangements and cross-capacity calculation processes**.** Grid expansion can also be a solution in certain cases, as it lowers redispatch costs (but on the other hand increases transmission costs). **A redelineation of bidding zones should only be decided if and when other lower cost, lower impact solutions prove less efficient from a network management and market efficiency perspective**.

- If and when a decision to redefine the boundaries of bidding zones has been taken, decision-makers should be attentive to the following points:

    - The **process of changing bidding zones delineation** takes many years for decision-making and implementation. In the meantime, the grid and the market situations change and the assumptions that were used when reviewing the zones might prove to be wrong. A regular review of the network and market conditions during the bidding zones redelineation implementation is necessary to mitigate the risk of sudden price shocks and incoherent redelineation in the end.

    - We recommend a **lead-time of at least three years for any change in bidding zones configuration to limit negative effects of the redelineation on open interests of market participants**. Most forward contracts have a maturity of maximum three to five years in the current context of electricity markets. It should be noted that the change will nonetheless affect (positively or negatively) existing investments (generation plants, storage assets, demand-response providers) which have a longer amortisation period. Also, the development of long-term power purchase agreements (PPAs) for renewable electricity, often concluded for a period of five to ten years, will be particularly affected by changes in bidding zones delineation.

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ANNEX: Bidding zones review framework in Regulation 2019/943