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Talking points

Delimitation of bidding zones for electricity markets in Europe and the consideration of internal congestions

The definition of bidding zones to manage congestion

Trading electricity between regions allows to lower the generation costs by dispatching the cheapest power plants, independent of where they are in Europe, and by serving consumers with the highest willingness to pay, regardless of their location. **If trading opportunities were unlimited, this would result in the most efficient allocation of resources and in a uniform electricity price in Europe.**

However, in practice, trading is limited between adjacent regions by the capacity of the interconnecting transmission lines. If interconnector capacity is insufficient, low-cost power plants in one region cannot – via exports – fully displace high-cost power plants in neighbouring regions. As a result, generation costs differ between the regions, as well as electricity prices. Different prices may ultimately alter investment decisions, in particular in plants or storage facilities. **A key element of the current European discussions is therefore the definition and delineation of markets and how they should deal with congestion on transmission lines.**

The solution implemented in Europe lies in the definition of bidding zones. A bidding zone is defined as the largest geographical area in which market players can trade electricity without any restriction due to internal bottlenecks. For instance, France is defined as one bidding zone: from a market point of view, a consumer in the North of France can trade any amount of electricity with any French power plant, independent of its location. **Transmission capacity is assumed to be unlimited within each bidding zone (as if the zone were a copper plate), resulting in the definition of a uniform electricity price.**

Limited transmission capacity is only considered for trades between different bidding zones. For instance, a market participant who wants to trade electricity between France and Spain (two different bidding zones) **has to request a right to use the limited cross-border capacity between both countries, using a process called capacity allocation**. If market participants want to trade more electricity than the maximum capacity of transmission lines between bidding zones, congestions happen which result in different electricity prices in each bidding zone.

In Europe, historically, bidding zones have been mainly defined according to national borders as illustrated in Figure 1. It means that electricity prices tend to be defined on a national level (with Sweden and Italy being the main exceptions, see below) and that congestion is assumed to occur only on cross-border lines.

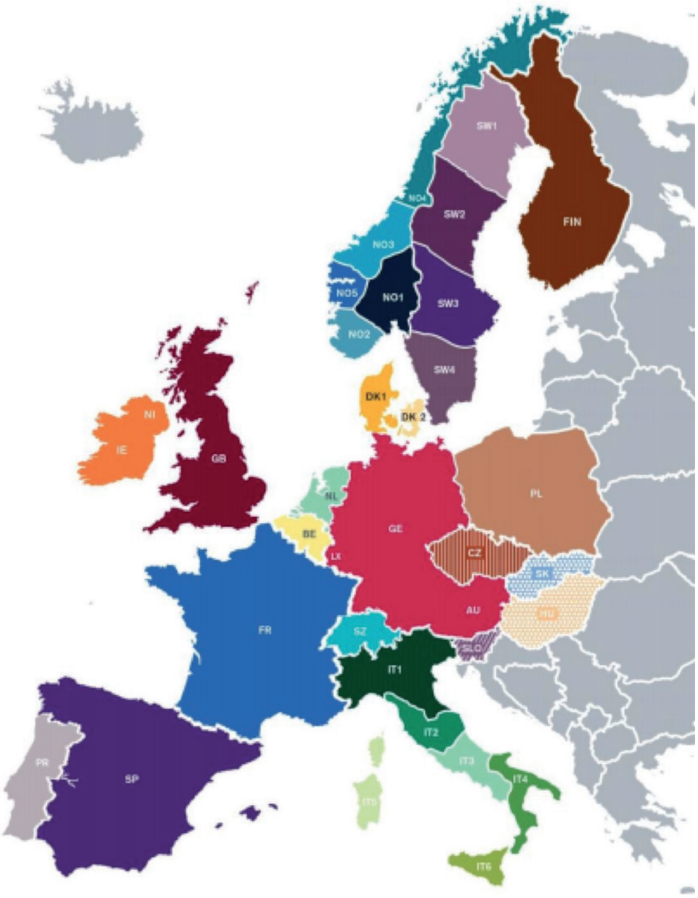

Figure 1 : Bidding zones in Europe (source : OFGEM[1])

Limits of the current definition of bidding zones

To ensure efficiency and proper functioning, the definition of bidding zones usually built on two assumptions:

1) there is **no congestion inside the bidding zone** (trade within the zone is not limited by technical constraints and power can flow without restrictions), and,

2) trade within a bidding zone **does not distort trade outside the bidding zone** (for instance, electricity trade between the North and the South of France is assumed not to modify potential trade in Germany or between Germany and France).

1 ***https://www.ofgem.gov.uk/sites/default/files/docs/2014/10/fta_bidding_zone_configuration_literature_review_1.pdf***

However, the relevance of both assumptions, and more generally the delimitation of bidding zones, are currently being challenged in Europe. The growing output from renewables (wind and solar PV notably), which are often concentrated in areas where weather conditions are most favourable and which are often remote from consumption centres, increases the occurrence and the magnitude of internal congestions. Germany and Austria, which are currently defined as one bidding zone, are a case in point: the bulk of the wind capacity is located in the lowlands of Northern Germany (or increasingly also offshore) while consumption hubs are predominantly in the South and in Austria. During windy days, it results in large power flows from the north to the south and to Austria. This phenomenon is exacerbated by the decommissioning of nuclear plants in the South. **The new and large electricity flows within the same bidding zone challenge both assumptions which characterise an efficient bidding zone**.

First, due to large internal flows and limited internal transmission capacity, congestion does actually occur within the Austro-German bidding zone. In particular, in 2016, the average physical available capacity of the Austrian-German transmission line was about 3200 MW while trade reached up to 7700 MW between both regions[2], due to the absence of capacity restrictions by the market. **Such congestion may jeopardise the security of the system if it is not handled** thanks to another solution which will be described later.

Second, **trading within the bidding zone, between North and South, has impacts on potential trade in neighbouring bidding zones**: the underlying cause is referred to as 'loop flows' and is illustrated in Figure 2 for internal trade between Germany and Austria. The actual flow of electricity through the power grid is determined by the laws of physics and may consequently differ from commercial schedules. In fact, less than half of the internal trade between Austria and Germany physically takes place on the Austro-German interconnection. The remainder flows through neighbouring bidding zones, in particular through Poland and the Czech Republic.

Figure 2 : Distribution of the physical flows of electricity for a commercial trade from Germany to Austria (source: ACER[3])

In dealing with these unscheduled loop flows, transmission system operators (TSO) tend to reduce the cross-border capacity made available to market participants via the capacity allocation process. This consequently reduces potential trade between countries and limits the potential to lower the cost of generation. Moreover, loop flows can jeopardise the security of supply in other countries by creating unscheduled congestions, and thus increasing the risk of blackouts. According to ACER (the European agency of energy regulators), **the reduction of social welfare in Europe due to loop flows is estimated at about 445 millions € in 2015**[4].

Which solutions to reduce the impact of internal congestions and loop flows?

Short-term solutions

1) Redispatching

A major solution used in Europe to alleviate congestion inside the bidding zone is called redispatching i.e. the TSO asks a number of plants on each side of the congested line to modify their output. For instance, when the north-south transmission line in Germany is congested, the TSO asks (and remunerates accordingly) plants in the South to increase their production and plants in the North to reduce theirs. This typically implies that lower cost plants on one side reduce the output while higher cost plants on the other side ramp up. As such, **redispatching can lead to significant costs for the TSO and ultimately for the consumers**. For instance, in Germany, it amounts to 1.2 billion euro in 2017[5].

2) Reduction of the cross border capacity

Another short-term solution lies in the reduction of the cross-border capacity between two bidding zones and which is made available to the market. By limiting import or export from neighbouring bidding zones, a TSO may reduce its internal congestions and then limit the costs it would have borne by resorting to redispatching if these congestions happened. In 2014, 56% of interconnections were voluntarily reduced to solve internal congestions[6].

However, **reducing cross-border capacity to solve internal congestions may be in breach of EU competition rules as an abuse of a dominant market which may distort competition between bidding zones**. For instance, in 2009, the European Commission launched an inquiry to assess whether the Swedish TSO reduced voluntarily exports to Denmark in order to limit the internal bottlenecks[7].

A similar issue is investigated by the European Commission (EC) regarding the German-Danish interconnection. Tennet, a German TSO, is suspected to reduce imports from Nordic countries to avoid worsening existing internal bottlenecks between the north and the south of Germany[8]. It may reduce competition between Nordic producers and German producers as it creates a barrier for Nordic producers to access the German market.

2 ***https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/ANNEXES_CCR_DECISION/Annex%20IV.pdf***
3 Ibid.
4 ***https://acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER%20Market%20Monitoring%20Report%202015%20-%20ELECTRICITY.pdf***
Source: ENTSO-E Transparency Platform
5 ***https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER_Market_Monitoring_Report_2015.pdf***
7 ***https://www.ei.se/Documents/Publikationer/rapporter_och_pm/Rapporter%202015/Ei_R2015_12.pdf***
8 ***http://europa.eu/rapid/press-release_IP-18-2122_en.htm***

Medium-term solutions

The conflict between the reduction of cross-border capacity and antitrust considerations has led to another solution to alleviate internal bottlenecks: a review of the delimitation of bidding zones. **The main idea is to redefine bidding zones so that internal congestion becomes congestion between different bidding zones which can be handled efficiently by the market thanks to cross-border allocation**. Similarly, bidding zones should also be redefined to minimize the size of loop flows in neighbouring bidding zones.

This solution has been implemented in Sweden following an inquiry of the EC in 2009: Sweden has subsequently been split into four different bidding zones. This solution has also been decided for the common bidding zone of Germany and Austria. Due to permanent congestions on the border between both countries as mentioned previously, both countries will be split into two different bidding zones in October 2018[9]. Consequently, trades between these two countries will be constrained by the physical capacity of the cross-border lines and market participants will not be able to trade more than is available, then avoiding congestions and the costs of solving them thanks to redispatching for instance. Some discussions also assess the need to split the German bidding zone into two parts (North/South) to alleviate and consider more accurately the internal congestions between these two regions.

However, splitting bidding zones also has drawbacks. A major consequence of market splitting is the reduction of the market liquidity and the higher risk of market power abuse since two different markets are now created. Several criteria should then be weighted when assessing the need to split bidding zones. ENTSO-E, which have recently released the first edition of the bidding zone review, underline the difficulty as they conclude that their study "does not provide sufficient evidence for a modification of or for maintaining of the current bidding zone configuration"[10].

Moreover, **it should be noted that spitting a market has important redistribution effects**. For instance, the splitting of the German and Austrian bidding zone is expected to raise costs for Austria by 80 million euro per year due to higher electricity prices. On the contrary, Germany is expected to gain about 265 million euros per year. The discussion is then highly political as it is illustrated by the recent decision of the German government to prohibit TSOs from splitting the German bidding zone.

Long-term solutions

Finally, a long-term solution is to build more transmission lines to reduce internal congestions and make bidding zones closer to the copper plate assumption. However, this solution takes several years to be implemented and often encounters local opposition. Moreover, a central question lies in the coordination between TSOs to perform these investments. In particular, since loop flows appear outside the bidding zone which creates them (for instance in Poland whereas they are created by internal congestions in Germany), investment may have to be undertake by the foreign TSO (for instance Poland) to solve an issue caused the German network and the configuration of the German market. Cost sharing mechanisms should then be implemented (such as the Inter-Transmission System Operator Compensation in Europe[11]) and work efficiently to give incentives to TSOs to perform investments.

As a general conclusion, consideration of internal congestions and loop flows is a key topic in current European power systems. Among the different solutions, the redefinition of current bidding zones is currently highly debated in Europe. However, its interest should be weighed against the performances of other solutions, according to different criteria such as the efficiency of price signals but also the risks of reducing the liquidity of power markets. Due to redistribution effects, **public and political acceptability also appears as a major criterion to consider**. Economic theory also suggests another solution to treat efficiently congestion: **nodal pricing**. With this approach, bidding zones are reduced to the smallest area, the nodes of the electricity grid. This solution is currently implemented in most US power markets. However, creating a European nodal pricing system is a complex operation, as this would require significant changes to market making software and operations, and faces considerable political barriers.

Finally, one should keep in mind that the final aim of previously mentioned solutions **is not to eliminate any congestion**. From an economic point of view, congestion is desirable when the costs of solutions to alleviate it exceeds the gains from increased trade. In this case, implemented solutions should aim **at managing congestion in the most efficient way**, in particular by allocating the scarce cross-border capacity to the market participants whose trades will result in the highest social welfare.

9 ***https://af.reuters.com/article/africaTech/idAFL8N1IH3XX***
10 ***https://www.entsoe.eu/Documents/News/bz-review/2018-03_First_Edition_of_the_Bidding_Zone_Review.pdf***
11 ***https://acer.europa.eu/en/Electricity/Infrastructure_and_network%20development/Pages/Inter-TSO-compensation-mechanism-and-transmission-charging.aspx***